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NURTURING NATURE IN VIRTUAL REALITY: A PRELIMINARY STUDY OF PRO-ENVIRONMENTAL PUBLIC SERVICE EXPERIENCES

A Preliminary Study of Pro-Environmental Public Service Experiences

CHRISTOPHER BALL

Extended Abstract

The effects of human intervention on the environment are numerous and increasingly devastating. The proliferation of fossil fuel based vehicles and factories have led to wide-spread environmental threats, such as global warming and powerful superstorms. Further still, many species of animals have become endangered due to such environmental changes and an encroachment on their natural habitats. For example, humpback whales were once hunted to the point of extinction but now face new threats related to ecosystem pollution. Likewise, certain species of elephants, such as African Elephants, are under constant threat due to environmental encroachment and ivory poaching. Unfortunately, research indicates that it can be difficult to keep people informed and actively engaged with environmental issues.

Environmental issues can sometimes be difficult for people to engage with in a meaningful way for a number of reasons. First, environmental issues are usually not immediately observable (Ahn et al., 2016; Kollmuss & Agyeman, 2002; Preuss, 1991). Second, there is usually a temporal gap between the cause and effect of environmental issues (Ahn et al., 2016; Ahn, Fox, Dale, & Avant, 2015). In the U.S., a common method to keep the public informed and engaged with environmental issues are public service announcements (PSAs). However, research indicates that PSAs may not be as effective in a modern day multi-media landscape (Boyle et al., 2014; Fishbein, Hall-Jamieson, Zimmer, von Haeften, & Nabi, 2002; Paek, Hove, Ju Jeong, & Kim, 2011; Walther, DeAndrea, Kim, & Anthony, 2010). Therefore, we must continue to explore new means and methods for engaging the public with increasingly important environmental issues.

The present in progress research explores new ways, using the immersive and interactive affordances of virtual reality (VR), to disseminate novel pro-environmental experiences to young adult audiences. In the past, "Public Service Announcements" (PSAs) were a common method for engaging the public with pro-environmental information (Cialdini, 2003). More recently, pro-environmental VR-based experiences have been shown to increase participants involvement with nature, the perception of environmental risk, pro-environmental behavioral intentions, and environmental efficacy (Ahn, Bailenson, & Park, 2014; Ahn et al., 2016). The repurposing of VR to convey pro-social experiential messages to the public has been recently referred to as "Public Service Experiences" (PSEs)(Ball, 2018). PSEs specifically, have been shown to have positive indirect effects on pro-environmental attitudes and behavioral intentions (such as support for conservational policies) via the mediating roles of spatial presence and narrative engagement (Ball, 2018).

However, there are still lingering questions regarding the mechanism behind the impacts of VR-based pro-social experiences such as PSEs (Ahn, Fox, Dale, & Avant, 2015). In particular, there is a need to better understand the dimensions and roles of narrative and interactivity in PSE effects (Ahn et al., 2014; Ahn et al., 2015; Christy & Fox, 2016; Peng, Lee, & Heeter, 2010). Specifically, PSEs, unlike PSAs, may provide ideal contexts to create and disseminate interactive narratives which may result in more engaging and influential experiences (Green & Jenkins, 2014). Furthermore, there is a need in the literature to explore granular differences in immersive affordances in order to draw more precise conclusions regarding the nature of PSE effects (Cummings, Bailenson, & Fidler, 2012).

The present in progress study seeks to build and expand upon the PSE literature by continuing to explore possible mechanisms, and their relation to one another, which may account for any potential PSE effects. Therefore, this research builds on previous literature by testing a new conceptual framework that might help explain PSE effects. Specially, this study consults the literature surrounding immersion, presence, narrative transportation, narrative interactivity, and natural mapping. Furthermore, this study seeks to fill a particular gap in the literature related to gradient manipulations of immersive factors. Many studies related to technological immersion only compare "high vs low" conditions, ignoring potentially important and subtle differences in immersive factors (Ball, 2018). Therefore, this study tests the impact of granular differences in immersion factors, specifically, gradations in naturally mapped movement in virtual reality. Finally, based on spreading activation theory, this study seeks to explore the possibility that pro-environmental PSE's might have the ability to activate other associated environmental attitudes.

In order to explore the above questions, an experiment is currently being conducted which tests the potential impacts of narrative interactivity and naturally mapped movement in a PSE. The experiment is a between-subjects factorial design. Specifically, the experiment is a 2 (high and low narrative interactivity) X 3 (low, medium, and high natural mapping) factorial design. Upon completion, the total participants for this study will consist of 180 undergraduate college students obtained from a large mid-western university. The experiment involves exposing participants to a 10-15 minute virtual experience/environment which includes endangered wildlife such as elephants. The selected stimulus for this study is *Nature Treks VR* (Carline, 2017). *Nature Treks VR* is a nature-based VR experience which was created for the HTC Vive. *Nature Treks VR* is an experience in which players select from a diverse selection of natural environments to explore. Players are then encouraged to freely wander the environments, "relax and immerse" themselves in nature and interact with the various kinds of wildlife (Steam, 2017). In this study, the "Savannah" environment was chosen, which includes endangered animals such as elephants. The results should provide contributions to the literature surrounding VR effects, environmental communication, PSEs, technological immersion, narrative persuasion, and spatial presence.

References

Ahn, S. J., Bostick, J., Ogle, E., Nowak, K. L., McGillicuddy, K. T., & Bailenson, J. N. (2016). Experiencing Nature: Embodying Animals in Immersive Virtual Environments Increases Inclusion of Nature in Self and Involvement With Nature. *Journal of Computer-Mediated Communication*. doi: 10.1111/jcc4.12173

Ahn, S. J., Fox, J., Dale, K. R., & Avant, J. A. (2015). Framing Virtual Experiences: Effects on Environmental Efficacy and Behavior Over Time. *Communication Research, 42*(6), 839-863. doi: 10.1177/0093650214534973

Boyle, L., Cordahi, G., Grabenstein, K., Madi, M., Miller, E., & Silberman, P. (2014). Effectiveness of Safety and Public Service Announcement (PSA) Messages on Dynamic Message Signs (DMS): Federal Highway Administration.

Carline, J. (2017). Nature Treks VR: Greener Games.

Fishbein, M., Hall-Jamieson, K., Zimmer, E., von Haeften, I., & Nabi, R. (2002). Avoiding the Boomerang: Testing the Relative Effectiveness of Antidrug Public Service Announcements Before a National Campaign. *American Journal of Public Health, 92*(2), 238-245.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental education research, 8*(3), 239-260.

Paek, H.-J., Hove, T., Ju Jeong, H., & Kim, M. (2011). Peer or expert? The persuasive impact of YouTube public service announcement producers. *International Journal of Advertising, 30*(1), 161-188.

Preuss, S. (1991). *Umweltkatastrophe Mensch: Über unsere Grenzen und Möglichkeiten, ökologisch bewusst zu handeln*: Asanger.

Steam. (2017). Nature Treks VR.

Walther, J. B., DeAndrea, D., Kim, J., & Anthony, J. C. (2010). The influence of online comments on perceptions of antimarijuana public service announcements on YouTube. *Human communication research, 36*(4), 469-492.

PLAYING INCREMENTAL GAMES AT WORK AS RELIEF? MAYBE NOT

YU-HAO LEE

Abstract

Incremental game is a popular genre of games characterized by incremental progress with or without player input. Incremental games are often thought of as the perfect games to play at work since it does not interrupt work. Using an online survey of 466 incremental game players that have full-time jobs, this study seeks to examine to what extent does work-related stress predict incremental game playing behavior during work and outside of work. Moreover, does playing incremental games during work facilitate recovery from work-related stress? The findings showed that recovery needs predicted incremental game-playing during work, but not outside of work. However, playing incremental games during work was negatively associated with recovery experience.

Introduction

Playing digital games during work time is generally viewed as a form of "cyberslacking," defined as the use of internet and technology during work time for personal purposes (Vitak, Crouse, & LaRose, 2011). Studies estimate that the average American workers spend between two to three hours of their work time on activities including online shopping, checking personal emails, blogging, watching online videos, and playing digital games (Blanchard and Henle, 2008; Greenfield and Davis, 2002; Madden and Jones, 2008). With increased ease of access to the internet, many workers in developed countries are found playing casual games during work. A survey conducted by PopCap Games found that 24% of the surveyed white-collared workers play games during work including 35% of the surveyed senior executives (Gameindustry.biz, 2007). Cyberslacking is often perceived as a threat to work productivity because the activities distract workers from their work (Lim, 2002). However, some scholars argue that personal activities during work can serve as coping strategies that relieve work-related stress and add variety to routine work (Henle and Blanchard, 2008; Lim and Chen, 2012; Oravec, 2002). Taking a break during work time by engaging in personal activities may even help workers re-focus on work-related tasks (Lim and Chen, 2012).

Recent studies support the idea that playing digital games can help workers recuperate from work-related anxiety, stress, and cognitive exhaustion (Collins and Cox, 2014; Reinecke, 2009a; Reinecke, Klatt, & Krämer, 2011). Scholars argue that digital games' recovery potential is due to its high absorption potential from interactivity and immersion. As an interactive media, digital games provide players with a sense of control and agency (Grodal, 2000), requiring players' attention to process the continuous input-feedback loops (Klimmt and Hartmann, 2006). Digital games can also immerse players in virtual worlds and play different roles, allowing players to briefly escape their mundane work (Sherry, Lucas, Greenberg, & Lachlan, 2006). However, different types of digital games vary in their level of cognitive demand and immersion. The types of digital games that workers play during work are less likely to be games that are highly immersive and takes multiple hours to complete, such as massively-multiplayer online games or first-person shooter games. Instead, the games played during work are more likely to be casual games that have simple mechanics and can be played at short durations. One type of casual game that is of interest to this study is incremental games that require minimal player inputs and can sometimes play by itself in the background. Unlike immersive games that support work recovery through its absorption potential, incremental games may act as short mental breaks. Will work-related stress predict more incremental gameplay during work or outside of work? Can playing incremental games during work support recovery from work-related stress?

Incremental games, also known as idle games or clicker games, is a genre of digital games defined by its focus on minimal player interaction and incremental resource growth. In an incremental game, players acquire resources by performing simple actions such as clicking on the screen or making simple decisions. Even when the player is not interacting with the game, many incremental games have mechanics that allow incremental resource growth. For example, in the popular game *Cookie Clicker*, players earn cookies by clicking on a cookie repeatedly or by leaving the game to play in the background of the browser. The cookies earned can be spent to purchase items that speed up the automatic accumulation of cookies. The game's goal is simple, to accumulate more cookies, indefinitely, with no win-lose scenario or an end. Incremental games such as *Clicker Heros*, *Tap Titans*, and *AdVenture Capitalist* are regularly among the top played games on mobile phones and Valve's gaming platform Steam. Through an online survey of workers who play incremental games, this study examines the relationship between work-related stress and playing incremental games, as well as the recovery potential of playing incremental games during work and outside work time.

Related Literature

Cyberslacking

Cyberslacking is prevalent among workers around the world who have access to computers during work. National surveys showed that 80% of workers in the United States reported using the internet for personal purpose during work, while cyberslacking is not limited to workers of specific professions, it is especially prevalent among workers with higher status and autonomy, younger workers, and male (Garrett and Danziger, 2008a; Vitak, et al., 2011). Similarly, Lim and Chen (2012) examined workers in Singapore and found that the average worker spends 51 minutes of work time on personal use of the internet. Cyberslacking is a concern to companies and organizations because it can distract workers from work-related tasks and lead to production loss (Anandarajan, Devine, & Simmers, 2004; Blanchard and Henle, 2008; Lim, 2002). Some estimates that cyberslacking activities cost companies in the UK roughly £300million (~USD 600million) in productivity annually (Taylor, 2007).

Workers may be especially tempted to engage in cyberslacking activities because they are less observable than other physical breaks to their workers or supervisors. Checking one's private email, chatting on instant messenger, or browsing one's social media page can provide quick gratifications and discontinued immediately at will. However, the motivations behind cyberslacking are mixed. While some studies show that perceived injustice in the organization (i.e., that the company is not fair to workers), or lack of control over one's work predicts minor cyberslacking activities (Blanchard and Henle, 2008; Lim, 2002). Other studies found that disaffection towards the company does not predict cyberslacking behaviors. Instead, the behaviors are mostly driven by perceived utility of the internet and psychological benefits of the technology (Garrett and Danziger, 2008a). Many workers reported positive gains from the personal use of the internet during work such as helping them boost their emotions, or learning new skills that can support their work (Lim and Chen, 2012).

The conflicting findings may be due to the different cyberslacking activities examined in previous studies. While some studies included all internet use during work without distinguishing activities(Lavoie and Pychyl, 2001), other studies focused on a few specific activities such as checking email or browsing the web (Garrett and Danziger, 2008a; Lim, 2002). Some scholars have attempted to differentiate different types of cyberslacking by its cause or effects. For example, Lim (2002) argued that cyberslacking activities can be categorized into two categories: browsing and emailing. Browsing consists passive use of the internet, such as reading online news, watching sports, checking the stock market, and visiting adult websites. Emailing involves more interactive communication, such as checking and sending personal emails. Based on research in workplace deviance, Blanchard and Henle (2008) made a distinction between minor and serious cyberslacking activities. Minor cyberslacking refers to common use of the internet including browsing websites and sending emails; it is considered minor as it resembles commonly tolerated but inappropriate behaviors at work, such as reading the morning newspaper or making personal phone calls. In comparison to minor cyberslacking, serious cyberslacking consists of behaviors that are disruptive and potentially illegal, such as visiting adult websites, downloading videos, and online gambling. Similarly, Anandarajan, et al. (2004) identified three types of cyberslacking behavior. Recreational activities include browsing online shopping websites and checking emails. Personal learning activities include checking the news or professional forums. Disruptive activities are the behaviors that organizations should be worried about, such as visiting adult websites, online gambling, downloading illegal music, and playing video games. According to these typologies of cyberslacking, playing digital games during work is viewed as a severe disruption to work that can have negative consequences. However, few studies have examined the cause the effects of playing games during work, and the few studies that have examined the effects (e.g., Reinecke, 2009b) do not differentiate between different types of games played at work. Just as it is problematic to examine internet use as a monolithic experience, different types of games consist of varying degrees of attention, immersion, and disruption, which may lead to different outcomes.

Work recovery experience

One potential motivation for playing digital game during and after work is to recovery from work-related fatigue. Working for long hours can be mentally, physically, and emotionally straining, which can lead to stress, burnouts, productivity loss, and decreased well-being. To replenish energy and restore one's mood, individuals may engage in activities that help them recover. *Recovery* is the opposite of stress and fatigue and can be viewed as a process that helps "unwind" one's functional systems to its pre-stressed states (Sonnentag and Fritz, 2007). Summarizing previous studies on work recovery, Sonnentag and Fritz (2007) identified four types of recovery experience:

Psychological detachment. Some workers can detach themselves from work physically when they leave the workplace, but physical detachment from work may not be available to all workers (e.g., workers who work from home or workers who are on call), nor is it sufficient for recovery. With the increased adoption of communication technology such as mobile phones and email in organizations, many workers are expected to respond to work demands even after they leave the workplace. Work-related stress can spillover to one's life and have detrimental effects on one's mood, sleep quality and well-being. Therefore, recovery requires psychological detachment, the ability to mentally detach oneself from work. Psychological detachment can take many forms, while one person may choose to take a walk in the forest, another person may choose to watch a movie or read a book to remove one's thoughts away from work. Studies have shown that successful psychological detachment from work is related to positive affect and well-being (Newman, Tay, & Diener, 2014; Reinecke, 2009a; Sonnentag, Binnewies, & Mojza, 2008).

Relaxation. Work stress is often caused by the high physical and psychological demands at work; relaxation is reducing these demands to allow the body and mind to replenish. Activities that support relaxation is often characterized by low activation, increased positive affect, and not challenging, such as meditation, yoga, or listening to music (Stone, Kennedy-Moore, & Neale, 1995). Relaxation can facilitate recovery by reducing the strains from prolonged activation at work, and also by offsetting negative emotions (Sonnentag and Fritz, 2007).

Mastery experience. In comparison to relaxation, individuals can also recover from work by engaging in challenging activities that boost their competence and self-efficacy. Examples include playing sports, learning a new language, or volunteering during the weekend (Sonnentag and Fritz, 2007). A study by Rook and Zijlstra (2006) used diary method to examine the relationship between recovery activities, sleep quality, and recovery. Their study found that low-effort and social activities did not predict recovery, but the challenging physical activities supported recovery. While the challenging activities can place additional physical or psychological demands on the individuals, they can also build up the individuals' skills, competency, and self-efficacy that can help them cope with stress from work.

Control. Autonomy has been identified as an intrinsic human need and motivation (Deci and Ryan, 2010). A major source of work-related fatigue comes from the feeling that one has no control over the work schedule or the outcome (Laschinger, Finegan, Shamian, & Wilk, 2004; Organ and Greene, 1974). Engaging in activities voluntarily, and activities that offer individuals control over their pace, progress, and outcomes support individuals' autonomy needs and can promote well-being.

Entertainment media offers many recovery potentials and is a convenient option in modern society. Research in mood management theory has consistently found that people's media choices are often motivated by the need to boost their mood and arousal (Knobloch-Westerwick, 2006; Zillmann, Hezel, & Medoff, 1980). Watching television is a common way for people to relax and escape from the stress of life (Henning and Vorderer, 2001), and watching familiar television shows helps restore sense of self-control (Derrick, 2013). Recent studies show that video games can support all four types of recovery (Collins and Cox, 2014; Reinecke, 2009a; Reinecke, et al., 2011).

Recovery potential of digital games

Video games have potential to support recovery through psychological detachment, relaxation, mastery experience, and control. Many games are designed to immerse players in their game mechanic, virtual worlds, and rich characters, which can help players detach from their work-related thoughts and stress. Some games such as casual games are designed to support relaxation by reducing the physical or cognitive demands on players. As an interactive media, most video games require active player input to progress, and players are directly responsible for the process and outcomes of the game. The interactive features and choices afford mastery experience and sense of control (Grodal, 2000; Klimmt, Hartmann, & Frey, 2007; Tamborini, Bowman, Eden, Grizzard, & Organ, 2010). Reinecke et al. (2012) found that games that can support competence and autonomy were most effective in helping people repair their mood. Rieger, Frischlich, Wulf, Bente, & Kneer (2015) directly compared the mood recovery potential of digital games against non-interactive media and found playing digital games to be most effective in supporting mood repair due to its higher task demand and arousal.

Very few studies have directly examined the recovery potential of playing video games during work and outside of work. Using a national survey of video game players, Reinecke (2009a) showed that video games could support all four types of recovery. In a similar study, Reinecke (2009b) found that workers with higher work-related fatigue were more likely to play video games during work than workers with less fatigue. Workers with less social support during work were also more likely to play games during work. The study also found that playing games during work was effective in supporting recovery experience. While these two studies support the recovery potential of video games, the studies did not distinguish between different types of games or examined the underlying mechanisms for supporting recovery experiences. Collins and Cox (2014) found that gamers reported lower need for recovery than non-gamers, which may support the idea that games are effective recovery means. Their study also compared different game genres and found that first-person shooter games, which was the genre that the respondents played the most, was the strongest predictor of recovery. However, different genres of games predicted different types of recovery experience. For example, playing role-playing games predict relaxation. Playing massively multiplayer online games positively predicted mastery experience, while playing sports games negatively predicted mastery experience.

Overall, these findings suggest that to understand the recovery potentials of digital games, we must consider the context of game-playing behaviors. It is also important to break down the different types of games so that we may understand the underlying mechanism that drives people to play digital games during work and outside of work and its recovery potentials.

Incremental games and its recovery potential

Most literature argues that digital games' recovery potentials are based on their immersive and absorptive affordances. However, this study is particularly interested in examining a popular type of digital game that is designed to minimize player input and often pitched as games that can be played at work without interrupting work (Bohn, 2016). This type of digital games has been called incremental games, clicker games, idle games, background games, or waiting games (Alharthi, Alsaedi, Toups, Tanenbaum, & Hammer, 2018; Keogh and Richardson, 2017). While these terms are used interchangeably, they refer to different game mechanics that, only when combined, can define these games. Incremental games describe games in which the main goal is to accumulate resources incrementally. Clicker games describe the simple controls, which often involve clicking on the screen or a few keys repeatedly. Idle games, background games, or waiting games focuses on the automated game mechanics that allow the game to progress without player input. Taken individually, none of these features are unique to this genre of games. For example, traditional role-playing games like *Final Fantasy* or sandbox simulators such as *Minecraft* also focus on incremental accumulation of resources. Platform action games or early games such as *Pong* also have simple controls. Many massively-multiplayer online games or social network games also progress when the players are not actively playing (Wohn, Lee, Sung, & Bjornrud, 2010). However, when taken as a whole, these characteristics create a unique genre of games.

This study adopts the term *incremental games* to emphasize that incremental accumulation of resources is both the means and the goal of these games. This study defines incremental games as *games in which the player accumulates resources through simple inputs or wait for the resource to accumulate automatically*. These characteristics afford temporal flexibility to the players, so that players can play the games when they wish to, with little to no penalties from the games. Few incremental games are designed to be played in long stretches; most incremental games are designed to be played within a flexible and short period of time, allowing them to be played intermittently in between daily activities, including during work.

Many early incremental games were designed to be parodies of popular game mechanics. For example, Ian Bogost's *Cow Clicker* was intended to parody the wait-to-click game mechanics of social network games such as *Farmville*. In *Cow Clicker*, the only action available to the player was to click on a cow and receive a "Moo!" and then the player waits six hours to click on the cow again and receive another "Moo!" (Tanz, 2011). The game *Progress War* aimed to criticize the monotony of grinding and leveling-up involved in many role-playing games, the players create a character, and then the game plays by itself, the character kills endless monsters so that it can level up to improve its ability in killing more monsters. In the game *Universal Paperclips*, the player takes on the role of an artificial intelligence to perform an arbitrary task of manufacturing paperclips. The game attracted more than 450,000 players in the first week of launch, and most players completed the game, which ends in the destruction of the world when everything is sacrificed to make paperclips (Rogers, 2017). For many academics and critics, incremental games are not considered games due to its lack of interactivity (Purkiss and Khaliq, 2015). Many incremental games can play by itself in the background and do not require player input. However, other scholars argue that while incremental games started as boundary-drawing parodies aimed as criticizing existing games, overtime, the players and the industry has solidified its status as a unique genre that focuses on optimization of gains (Deterding, 2016). A study of over 220,000 incremental game players found that most of the players were not casual game players, but core game players (Yee, 2016). Yee (2016) argues that incremental games "cleanly isolate the power progression and accumulation mechanics from the typical trappings of AAA RPGs" and thus attracts "gamers who enjoy the leveling up and power accumulation in RPGs, but less interested in big-action combat or elaborate fantasy settings." In other words, incremental games can afford comparable experiences as more elaborate games but place less burden on the players regarding time commitments and efforts.

Since incremental games can be played intermittently between work-related tasks and do not penalize players for not playing, the nature of incremental games makes them ideal games to play during work as a stress reliever or a short break. As literature suggest that work stress is associated with more cyberslacking behavior (Henle and Blanchard, 2008), we posit that work-related stress will be positively associated with more incremental game-playing during work.

H1. Need for recovery will positively predict incremental game-playing during work.

Incremental games may be the game of choice when it comes to cyberslacking due to its temporal flexibility, but players may seek more immersive or absorptive games for recovery after work. Thus we pose a research question about incremental game-playing outside of work:

RQ1. Will need for recovery be associated with incremental game-playing outside of work?

Previous studies have found that digital games can support all four dimensions of recovery potentially through its interactive nature and immersion (Collins and Cox, 2014; Reinecke, 2009a). As a genre of games characterized by minimal interactivity and requires low player commitments, can incremental games facilitate recovery? Recent studies on work attention and productivity suggest that taking brief mental breaks may help workers refocus their attention and improve productivity (Ariga and Lleras, 2011). The activities that provide the biggest boost to work performance are those that are performed voluntarily and do not require many cognitive resources, such as playing simple games. Indeed, many workers believe that playing casual games during work helps them unwind and concentrate (Gameindustry.biz, 2007; Lim and Chen, 2012). In other words, while incremental games do not have the affordances of more immersive digital games, they may support recovery is played briefly as a short break, but frequent gameplay can also distract from work. Thus, we pose the following research questions:

RQ2. To what extent is incremental game-playing during work associated with recovery?

RQ3. To what extent is incremental game-playing outside of work associated with recovery?

Based on the hypothesis and research questions, we propose the following path diagram for the relationship between the key variables.

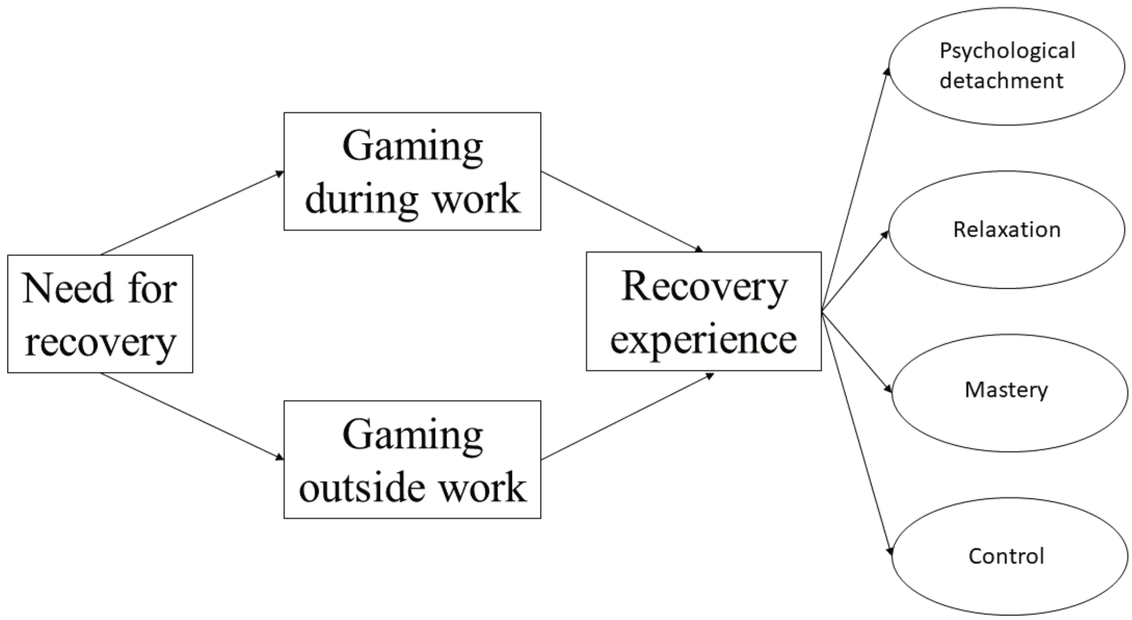

Figure 1

Methods

Participants

We recruited participants from Amazon's Mechanical Turk who resides in the United States. Each participant was paid USD 1.00 for their voluntary participation. The sample was selected because they are more diverse and representative of the general population compared to convenience samples such as undergraduate students (Buhrmester, Kwang, & Gosling, 2011). More importantly, the sample consists of diverse workers with different backgrounds and varying degrees of income status (Mason and Suri, 2012). A total of 522 participants were recruited for this study. The majority of the participants are working and identified as a paid employee (*n*=399, 76.4%), followed by self-employment (*n*=67, 12.8%), then unemployed or retired (*n*=47, 9.1%), nine participants did not disclose their work status (1.7%). The participants that were not working (unemployed, retired) or did not disclose were excluded from the analysis since a focus of this study is on playing incremental games during work. As a result, 466 participants were included for the analysis. Of the 466 participants, the mean age was 31.63 (*SD*=8.58) ranging from 18 to 80 with a median age of 30.00. There were more male (*n*=277, 59.40%) than female (*n*=185, 39.70%), two participants chose others and two did not disclose their gender. More than half (57.2%) of the participants received a bachelor's degree or higher.

Measures

Incremental game frequency. Participant were asked how many times do they play incremental games on an average day, the measure ranged from 0 (none) to more than 10 times a day. The mean score was 4.20 (*SD*=2.61).

Incremental game frequency during work and outside of work. Participants were asked how many times they played incremental game *during work*, the measure ranged from 0 (none) to more than 10 times a day. The mean score was 2.82 times during work (*SD*=2.57). Non-worktime gaming was calculated by subtracting worktime gaming from incremental game frequency. The average non-worktime gaming frequency was 2.36 times (*SD*=2.43).

Need for recovery. The Need for Recovery Scale (Van Veldhoven and Broersen, 2003) was used to measure fatigue from work. The scale consisted of 11 items about the severity and duration of work-related fatigue. For example, "By the end of the working day, I feel worn out," and "Often, after a day's work I feel so tired that I cannot get involved in other activities." The participants responded on a 7-point scale with 1=strongly disagree and 7-strongly agree, *M*=3.79, *SD*=1.22. The scale was reliable with a Cronbach's α = .89.

Recovery effects of incremental games. Recovery effects of incremental games was measured using the recovery experience questionnaire by Sonnentag and Fritz (2007). The scale included 16 items that measures the four subdimension of recovery including: psychological detachment (e.g., "I forget about work," Cronbach's α=.88), relaxation (e.g., "I use the time to relax," α=.88), mastery (e.g., "I do things that challenge me," α=.90) and control (e.g., "I feel like I can decide for myself what to do," α=.85).

Procedure

Participants from Amazon Mechanical Turk voluntarily signed up to participate in the study. They were given a brief definition of incremental games and indicated whether they are currently playing any incremental games. Then they were instructed to list one incremental game that they are currently playing and respond to questions regarding that game. Afterward, they responded to a questionnaire measuring their incremental game frequency (total and during work), incremental game time, work satisfaction, need for recovery, recovery effects of incremental game games, satisfaction with life, game enjoyment, and demographics including age, gender, and employment status. After completion, they were paid $1 from Amazon Mechanical Turk.

Results

Pearson product-moment correlation coefficients were calculated using SPSS 25. The hypothesis and research questions were tested with a structural equation model using AMOS 25. The 11 items of the Need for Recovery scale were used to estimate the latent variable of work-related fatigue. Recovery experience was modeled as a latent variable based on the four sub-scales of the recovery experience questionnaire.

Pearson's correlations among the independent and dependent variables are shown in Table 1.

Table 1. Correlation between variables

	1	2	3	4	5	6	7
1. Need for recovery	--						
2. Gaming during work	.16**	--					
3. Gaming outside work	.05	.42***	--				
4. Psychological detachment	-.06	-.16***	-.08	--			
5. Relaxation	-.18***	-.21***	-.06	.56***	--		
6. Mastery	-.05	.07	.03	.18***	.24***	--	
7. Control	-.14**	-.21***	-.10*	.43***	.59***	.39***	--

*p<.05, **p<.01, ***p<.001

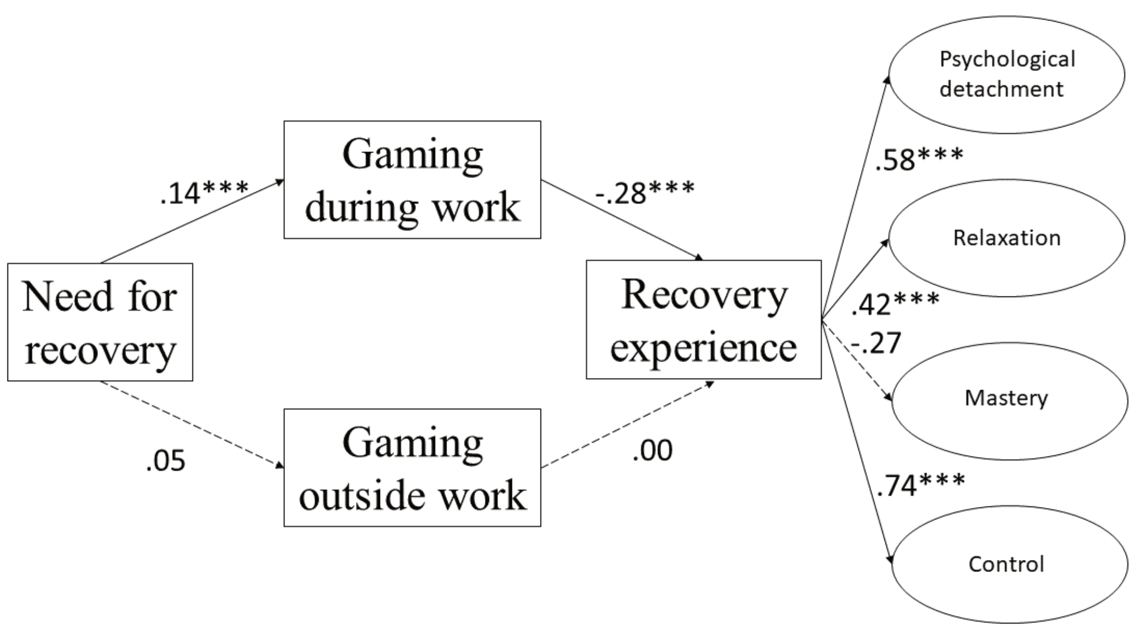

Figure 2

Three model fit indices were used to assess model fit (. The model was a good fit, =13.7, p=.057, CFI=.988, RMSEA=.045 (Hu and Bentler, 1999).

Three of the four sub-dimensions of recovery experience loaded well into the latent variable of recovery experience: psychological detachment (β=.58, p<.001), relaxation (β=.73, p<.001), and control

(β=.74, p<.001). Surprisingly, mastery was negatively associated with recovery experience but was not statistically significant, β=-.27, p=.175.

Hypothesis 1 posited that need for recovery would positively predict the frequency of incremental game playing during work. The results showed that need for recovery positively predicted higher frequency of incremental game playing at work, β=.14, p<.001. The data was consistent with hypothesis 1.

Research question 1 asked whether the need for recovery would be associated with incremental game playing outside of work. The results showed that the relationship was not significant, β=.05, p=.269. In other words, work-related stress did not predict higher incremental game frequency outside of work.

Research question 2 and 3 asked to what extent does incremental game playing during work and outside of work predict self-reported recovery experience. The results showed that playing incremental games during work was negatively associated with recovery experience, β=.28, p<.001. However, there was no significant relationship between playing incremental games outside of work and recovery, β=-.004, p=.936. The findings suggest that playing incremental games during work did not facilitate recovery experience, but may instead, reduce sense of recovery. Playing incremental games outside of work was not associated with recovery experience.

Discussion

This study has two goals: The first goal was to investigate to what extent is work-related stress associated with frequency of playing incremental games during work and outside of work. The second goal was to examine to what extent is playing incremental games during work and outside of work associated with self-reported recovery experience composed of four sub-dimensions including psychological detachment, relaxation, mastery, and control. The results indicated that participants who reported higher work-related stress were more likely to play incremental games during work, but not outside of work. However, playing incremental games during work was not associated with more recovery. Instead, it reduced recovery experience. In other words, playing more incremental games during work made people feel less recovered.

Our findings were consistent previous studies that found cyberslacking was partially motivated by stress and fatigue from work (Blanchard and Henle, 2008; Lim and Chen, 2012). However, contrary to the findings from Reinecke (2009b)'s study that did not specify game genres, our study found that playing incremental games during work was negatively associated with recovery experience. One potential explanation is that prolonged gameplay or high frequency of incremental game playing during work can also be exhausting. However, this is less likely because most incremental games are not designed for extended sessions and often have game mechanics that promote waiting instead of playing (Alharthi, et al., 2018). Our data also shows that while the participants in our study play incremental games, on average, 4.20 times (*SD*=2.61) times a day, the majority (70.6%) of our participants spends less than 60 minutes per day playing incremental games. A more possible explanation is that playing incremental games during work led to a negative appraisal of one's game-playing experience. This explanation is consistent with previous studies. For example, Reinecke, Hartmann, & Eden (2014) found that people who experienced ego-depletion were more prone to select media as a means of recovery. However, they were also more likely to have a negative appraisal of their media experience, perceiving their media use as procrastination, which leads to guilt and diminishes the recovery effects. Playing digital games during work often conflicts with workplace norms and can further increase work-related stress and guilt. Kubey and Csikszentmihalyi (2013) also found that people often experienced less relaxed and satisfied after media use because "it distracts and removes us from stress and the demands of reality only temporarily" (p.146). In other words, while people who are stressed or suffer fatigue from work are more likely to play incremental games during work, playing incremental games during work negatively affects their appraisal of their game-playing experience and its recovery effects.

Different media affords different recovery potentials (Reinecke, et al., 2011; Rieger, et al., 2015). Consistent with findings from Collins and Cox (2014), when the different game genres are examined independently, the different game mechanics affords different types of recovery experience. The results from our study showed that incremental games were most effective in offering people a sense of control, some psychological detachment and relaxation, but not mastery experience. As a genre of games designed to facilitate temporal flexibility, incremental games' greatest recovery affordance lies in its ability to provide a sense of control. Regardless of the players' commitment level, the games will progress incrementally. This type of design reduces the burden and stress of having to commit and collaborate with other players that many popular multiplayer games entails. Therefore, incremental games offer a sense of control over one's schedule and game progress, and a sense of security knowing that there will be little to no punishment involved with not playing for a while. The low commitment requirements afford relaxation, allowing people to unwind, or a chance to temporarily detach from work-related thoughts. However, incremental games do not support mastery experience because they typically do not involve complex skills or challenging game mechanics. Mastery experience requires overcoming challenges to boost one's self-efficacy. Many incremental games can play by itself or require very little player input to progress. While the accumulation of resources can provide achievement or gratification for some players, the most challenging aspect of many incremental games is waiting for the resources to accumulate in the background (Keogh and Richardson, 2017).

Limitations

This study has several limitations. First, while the panelists are more representative than convenient sample of undergraduate students. They are nevertheless, not representative of all workers. For example, studies have shown that higher status workers in the workplace are more likely to engage in cyberslacking including playing games (Garrett and Danziger, 2008b; Vitak, et al., 2011). However, higher status workers are perhaps less likely to voluntarily participate in studies for $1. Second, the recovery experience is measured through self-report, and thus may or may not reflect actual recovery. A worker may report feeling recovered, but unconsciously still suffer from work-related fatigue. Therefore, the results should be interpreted as a perception of recovery rather than actual recovery. Playing incremental games during work is associated with lower perceptions of recovery, future studies should also include measures of actual recovery effects to assess the recovery potentials of incremental games as a short break during work.

Conclusion

Overall, this study explores whether stress from work leads to increased cyberslacking through playing incremental games? Moreover, does playing incremental games help workers recover from their work-related stress? The results showed that work-related stress is positively associated with more incremental game-playing behaviors during work. However, playing incremental games during work does not make workers feel recovered. When examining how incremental games contribute to the four sub-dimensions of recovery, we found that incremental games support psychological detachment, relaxation, and control, but not mastery experience. These findings highlight the importance of not treating all gameplay as a homogeneous experience. Different game elements afford different effects, as do the context of gameplay. While stress from work motivates people to play incremental games during work, playing games during work lead to negative appraisal of their behavior and the recovery effects.

Reference

Alharthi, S. A., Alsaedi, O., Toups, Z. O., Tanenbaum, J., & Hammer, J. (2018). *Playing to Wait: A Taxonomy of Idle Games.* Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, Montreal, QC, Canada.

Anandarajan, M., Devine, P., & Simmers, C. A. (2004). *A multidimensional scaling approach to personal web usage in the workplace* Hershey, PA.: Information Science Publishing.

Ariga, A., & Lleras, A. (2011). Brief and rare mental "breaks" keep you focused: Deactivation and reactivation of task goals preempt vigilance decrements. *Cognition, 118*(3), pp. 439-443. doi:10.1016/j.cognition.2010.12.007

Blanchard, A. L., & Henle, C. A. (2008). Correlates of different forms of cyberloafing: The role of norms and external locus of control. *Computers in Human Behavior, 24*(3), pp. 1067-1084. doi:10.1016/j.chb.2007.03.008

Bohn, D. (2016). Spaceplan is the perfect game to leave on a browser tab at work. Retrieved Date Accessed, 2018 from https://www.theverge.com/2016/8/12/12459466/spaceplan-game-browser-clicker.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on psychological science, 6*(1), pp. 3-5. doi:10.1177/1745691610393980

Collins, E., & Cox, A. L. (2014). Switch on to games: Can digital games aid post-work recovery? *International Journal of Human-Computer Studies, 72*(8-9), pp. 654-662. doi:10.1016/j.ijhcs.2013.12.006

Deci, E. L., & Ryan, R. M. (2010). *Self-determination*: Wiley Online Library.

Derrick, J. L. (2013). Energized by television: Familiar fictional worlds restore self-control. *Social Psychological and Personality Science, 4*(3), pp. 299-307. doi:10.1177/1948550612454889

Deterding, S. (2016, August 1-6). *Progress Wars: Idle Games and the Demarcation of "Real" Games.* 1st International Joint Conference of DiGRA and FDG 2016, Dundee, Scotland, UK.

Gameindustry.biz. (2007). Survey: Tens of Millions of "White Collar" Workers Play "Casual" Video

Games – One in Four Play at Work, And Senior Execs Play Even More. Retrieved Date Accessed, 2018 from https://www.gamesindustry.biz/articles/survey-tens-of-millions-of-white-collar-workers-play-casual-video-games-one-in-four-play-at-work-and-senior-execs-play-even-more.

Garrett, R. K., & Danziger, J. N. (2008a). Disaffection or expected outcomes: Understanding personal Internet use during work. *Journal of Computer-Mediated Communication, 13*(4), pp. 937-958. doi:10.1111/j.1083-6101.2008.00425.x

Garrett, R. K., & Danziger, J. N. (2008b). On cyberslacking: Workplace status and personal Internet use at work. *Cyberpsychology & Behavior, 11*(3), pp. 287-292. doi:10.1089/cpb.2007.0146

Greenfield, D. N., & Davis, R. A. (2002). Lost in cyberspace: The web@ work. *Cyberpsychology & Behavior, 5*(4), pp. 347-353. doi:10.1089/109493102760275590

Grodal, T. (2000). Video games and the pleasures of control. In D. Zillmann & P. Vorderer (Eds.), *Media entertainment: The psychology of its appeal* (pp. 197-213). Mahwah, NJ: Lawrence Erlbaum.

Henle, C. A., & Blanchard, A. L. (2008). The interaction of work stressors and organizational sanctions on cyberloafing. *Journal of Managerial Issues, 20*(3), pp. 383-400.

Henning, B., & Vorderer, P. (2001). Psychological escapism: Predicting the amount of television viewing by need for cognition. *Journal of Communication, 51*(1), pp. 100-120.

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal, 6*(1), pp. 1-55. doi:10.1080/10705519909540118

Keogh, B., & Richardson, I. (2017). Waiting to play: The labour of background games. *European Journal of Cultural Studies*, pp. 13-25. doi:10.1177/1367549417705603

Klimmt, C., & Hartmann, T. (2006). Effectance, Self-Efficacy, and the Motivation to Play Video Games. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 133-145). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Klimmt, C., Hartmann, T., & Frey, A. (2007). Effectance and control as determinants of video game enjoyment. *Cyberpsychology & Behavior, 10*(6), pp. 845-848. doi:10.1089/cpb.2007.9942

Knobloch-Westerwick, S. (2006). Mood management: Theory, evidence, and advancements. In J. Bryant & P. Vorderer (Eds.), *Psychology of entertainment* (pp. 239-254). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Kubey, R., & Csikszentmihalyi, M. (2013). *Television and the quality of life: How viewing shapes everyday experience*: Routledge.

Laschinger, H. K. S., Finegan, J. E., Shamian, J., & Wilk, P. (2004). A longitudinal analysis of the impact of workplace empowerment on work satisfaction. *Journal of Organizational Behavior, 25*(4), pp. 527-545. doi:10.1002/job.256

Lavoie, J. A., & Pychyl, T. A. (2001). Cyberslacking and the procrastination superhighway: A web-based survey of online procrastination, attitudes, and emotion. *Social Science Computer Review, 19*(4), pp. 431-444. doi:10.1177/089443930101900403

Lim, V. K. (2002). The IT way of loafing on the job: Cyberloafing, neutralizing and organizational justice. *Journal of Organizational Behavior, 23*(5), pp. 675-694. doi:10.1002/job.161

Lim, V. K., & Chen, D. J. (2012). Cyberloafing at the workplace: gain or drain on work? *Behaviour & Information Technology, 31*(4), pp. 343-353. doi:10.1080/01449290903353054

Madden, M., & Jones, S. (2008). Networked workers. *Pew Internet & American Life Project*

Mason, W., & Suri, S. (2012). Conducting behavioral research on Amazon's Mechanical Turk. *Behavior research methods, 44*(1), pp. 1-23. doi:10.3758/s13428-011-0124-6

Newman, D. B., Tay, L., & Diener, E. (2014). Leisure and subjective well-being: A model of psychological mechanisms as mediating factors. *Journal of Happiness Studies, 15*(3), pp. 555-578. doi:10.1007/s10902-013-9435-x

Oravec, J. A. (2002). Constructive approaches to Internet recreation in the workplace. *Communications of the ACM, 45*(1), pp. 60-63. doi:10.1145/502269.502298

Organ, D. W., & Greene, C. N. (1974). Role ambiguity, locus of control, and work satisfaction. *Journal of Applied Psychology, 59*(1), pp. 101-102. doi:10.1037/h0035826

Purkiss, B., & Khaliq, I. (2015, October 14-16). *A study of interaction in idle games & perceptions on the definition of a game.* Games Entertainment Media Conference (GEM), 2015 IEEE, Toronto, Canada.

Reinecke, L. (2009a). Games and recovery: The use of video and computer games to recuperate from stress and strain. *Journal of Media Psychology: Theories, Methods, and Applications, 21*(3), pp. 126-142. doi:10.1027/1864-1105.21.3.126

Reinecke, L. (2009b). Games at work: The recreational use of computer games during working hours. *Cyberpsychology & Behavior, 12*(4), pp. 461-465. doi:10.1089/cpb.2009.0010

Reinecke, L., Hartmann, T., & Eden, A. (2014). The guilty couch potato: The role of ego depletion in reducing recovery through media use. *Journal of Communication, 64*(4), pp. 569-589. doi:10.1111/jcom.12107

Reinecke, L., Klatt, J., & Krämer, N. C. (2011). Entertaining media use and the satisfaction of recovery needs: Recovery outcomes associated with the use of interactive and noninteractive entertaining media. *Media Psychology, 14*(2), pp. 192-215. doi:10.1080/15213269.2011.573466

Reinecke, L., Tamborini, R., Grizzard, M., Lewis, R., Eden, A., & David Bowman, N. (2012). Characterizing mood management as need satisfaction: The effects of intrinsic needs on selective exposure and mood repair. *Journal of Communication, 62*(3), pp. 437-453. doi:10.1111/j.1460-2466.2012.01649.x

Rieger, D., Frischlich, L., Wulf, T., Bente, G., & Kneer, J. (2015). Eating ghosts: The underlying mechanisms of mood repair via interactive and noninteractive media. *Psychology of Popular Media Culture, 4*(2), pp. 138-154. doi:10.1037/ppm0000018

Rogers, A. (2017, October 21). The way the world ends: Not with a bang but a paperclip. *Wired*.

Rook, J. W., & Zijlstra, F. R. (2006). The contribution of various types of activities to recovery. *European journal of work and organizational psychology, 15*(2), pp. 218-240. doi:10.1080/13594320500513962

Sherry, J. L., Lucas, K., Greenberg, B. S., & Lachlan, K. (2006). Video game uses and gratifications as predictors of use and game preference. *Playing video games: Motives, responses, and consequences*, pp. 213-224.

Sonnentag, S., Binnewies, C., & Mojza, E. J. (2008). "Did you have a nice evening?" A day-level study on recovery experiences, sleep, and affect. *Journal of Applied Psychology, 93*(3), pp. 674-684. doi:10.1037/0021-9010.93.3.674

Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: development and validation of a measure for assessing recuperation and unwinding from work. *Journal of occupational health psychology, 12*(3), pp. 204-221. doi:10.1037/1076-8998.12.3.204

Stone, A. A., Kennedy-Moore, E., & Neale, J. M. (1995). Association between daily coping and end-of-day mood. *Health psychology, 14*(4), pp. 341-349. doi:10.1037/0278-6133.14.4.341

Tamborini, R., Bowman, N. D., Eden, A., Grizzard, M., & Organ, A. (2010). Defining media enjoyment as the satisfaction of intrinsic needs. *Journal of Communication, 60*(4), pp. 758-777. doi:10.1111/j.1460-2466.2010.01513.x

Tanz, J. (2011, December 20). The curse of Cow Clicker: How a cheeky satire became a videogame hit. Wired. *Wired*.

Taylor, A. (2007). Gambling at work "costs employers 300M a year. *Financial Times,* p. 4.

Van Veldhoven, M., & Broersen, S. (2003). Measurement quality and validity of the "need for recovery scale". *Occupational and environmental medicine, 60*(suppl 1), pp. i3-i9.

Vitak, J., Crouse, J., & LaRose, R. (2011). Personal Internet use at work: Understanding cyberslacking. *Computers in Human Behavior, 27*(5), pp. 1751-1759.

Wohn, D., Lee, Y.-H., Sung, J., & Bjornrud, T. (2010). *Building common ground and reciprocity through social network games.* CHI'10 Extended Abstracts on Human Factors in Computing Systems.

Yee, N. (2016, July 6). The Surprising Profile of Idle Clicker Gamers. Retrieved from https://quanticfoundry.com/2016/07/06/idle-clickers/

Zillmann, D., Hezel, R. T., & Medoff, N. J. (1980). The effect of affective states on selective exposure to televised entertainment fare. *Journal of Applied Social Psychology, 10*(4), pp. 323-339. doi:10.1111/j.1559-1816.1980.tb00713.x

DESIGNING AN INCLUSIVE PLAYTESTING PROCESS USING COGNITIVE LOAD THEORY

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Abstract

Designing transformational games requires a keen understanding of player-specific needs and preferences, informed both top-down by learning theories and instructional design practices and bottom-up by extensive playtesting with learners from diverse demographic groups. When not all players are included in these processes, then the final game risks being impactful for only a subset of players. Too often this means that marginalized and other underrepresented groups (based on factors such as socioeconomic status, race, and gender) are excluded. Through an iterative playtesting process at two sites with different demographic characteristics, we identified playtest design issues to consider that may affect players with high levels of cognitive load, which prior work has shown disproportionately affects players from marginalized groups. We explore how cognitive load issues can arise when making decisions about prototype fidelity, game theming, and replayability. Through this case study of our playtesting process and its impact on our iterative design decisions, we propose methods for how these issues can be mitigated in both playtest design and game design.

Designing an Inclusive Playtesting Process Using Cognitive Load Theory

Games can provide students with a safe, informal space in which to adopt and practice new skills, take on new identities and perspectives, and embrace experimentation and failure (e.g., Akilli, 2007; Gee, 2003; Hayes & Games, 2008; Ke, 2009; Papastergiou, 2009; Squire, 2008). However, if designers hope to make these benefits available to all players, it is imperative that they avoid "one-size-fits-all" solutions and, instead, account for and address the unique needs of all players. This is particularly crucial for players from low socio-economic status (SES) households and other marginalized identity groups such as women or racial minorities, whose orientation toward education can be profoundly influenced by their experience of stigmatization and under-representation.

Some educational game designers are already working to take the needs of specific populations into account by including content that is relevant for players of different cultures (e.g., Khaled, 2008; Thompson, 2014) and grounding their designs in a knowledge of the cognitive development of particular learner groups, including low-SES children (e.g., Wilson, 2009). At the same time, such considerations are still far from the norm, as persisting issues of inclusion and diversity in game design continue to result in games that insufficiently address the perspectives and desires of minority groups (Fron, Fullerton, Morie, & Pearce, 2007).

Cognitive load, which can be a barrier to processing information in a multimedia learning context (Van Merrienboer, 2003), is relevant to inclusive educational game design. Mitigating cognitive load in educational contexts can benefit all learners, but can have a particularly significant impact on low-SES and other marginalized groups, for whom cognitive load is often exacerbated by their unique psychosocial experiences (Molzhon 2016).

Prior work has produced models and frameworks for integrating instructional design principles in games (e.g., Enfield 2012; Westera, 2008), as well as case studies demonstrating the detection and management of cognitive load in games (Kalyuga & Plass, 2009). With few exceptions (Wilson, 2009), however, this research has not detailed how playtesting with target learner groups (and low-SES and marginalized groups in particular) informed iterative design decisions.

The present work addresses this gap by detailing the playtesting and iterative design of *Outbreak*, a transformational board game intended to support players, particularly those from low-SES populations, in developing socio-emotional (SEL) skills around curiosity (To et al., 2016; To, Fath, et al., 2017). These skills include formulating questions about an unknown situation, and being willing to admit ignorance in front of a group (To, Holmes, et al., 2017). We iteratively prototyped and playtested the game with students from both low-SES and high-SES communities over 16 sessions. At each session, we observed gameplay, recorded detailed field notes, conducted post-game interviews following play, and administered post-game measures of players' emotional responses to the game to inform our future designs.

During our iterative design process, we discovered that cognitive load theory explained many challenges in playtesting with low-SES players, and that redesigning both the playtest process and the game with cognitive load in mind improved their experience. We do not claim that cognitive load theory is the only possible explanation for what we observed, nor do we aim to exclude other factors. For example, we recognize that differing cultural frameworks also impact the playtesting process (DiSalvo, Guzdial, Bruckman, & McKlin, 2017). Rather than discount these other perspectives, we hope to show that using cognitive load theory principles as a lens explained observed phenomena and improved our playtesting process.

In this paper, we describe and illustrate our discoveries using artifacts from our game design process, field notes and observations, and other qualitative data from our playtests. It is our hope that through this case study, we might help codify practices of embodying instructional design in game design, using playtesting with learners from key demographic groups to observe the impact of design decisions.

Related Work

In the following section we describe the role of playtesting in the game design process, and examine cognitive load through the lens of game design.

Playtesting and Inclusion

Playtesting is a critical part of the iterative game design process, during which players engage with game materials and provide feedback to the designers about the player experience (Choi et al., 2016). Game design educators recommend that playtesting be integrated into the entire design process, including early playtesting, and playtest results are meant to drive game design decisions (Fullerton 2014). Some game design methods, such as the Tandem Transformational Game Design process, explicitly tie playtest results to the development of theory and the identification of new goals for the game (To et al., 2016). In industry, games user research methods and game metrics are used during playtesting to inform the redesign of game levels and other elements (Ambinder 2011; El-Nasr, Drachen, & Canossa, 2016.). In other words, *who* is included in playtesting influences *how* the game evolves.

Marginalized groups, including low-SES learners, racial minority groups, and women, are often unintentionally left out of the discussion of game design (Fron, Fullerton, Morie, & Pearce, 2007). Although playtesting is central to game design, access to one's intended audience may be limited or absent entirely (Fron et al,, 2007). Some methods for inclusive playtesting exist. For example, Vasalou, Khaled, Gooch, & Benton, 2014 explored how to deal with issues of cultural appropriation in game design through co-design activities (Vasalou et al., 2014), while Gerling & Masuch examine inclusion for the "frail elderly" (2011). However, more typically, games that are designed for marginalized populations report on their outcomes rather than their methods.

One challenge around playtesting is that games can be very different from one another, and designers may have very different goals. A single-player augmented reality game meant to improve physical fitness will have different playtest needs and procedures, compared to a multiplayer entertainment-focused strategic board game. Rather than hard-and-fast methods, designers need to be able to identify the *purpose* of a playtest, match that purpose to appropriate methods, and apply the data to game iteration (Choi et al., 2016). For this reason, *theory-driven* approaches to designing inclusive playtests are needed, so that individual design teams can apply them to their games. In this paper, we explore the value of cognitive load theory to explain challenges faced during inclusive playtesting, and identify ways that it can provide solutions when applied to a particular game context.

Cognitive Load Theory and Games

Cognitive load theory describes the limited reserve of cognitive resources available to working memory for the encoding and processing of new, incoming information (Baddeley 1992, Sweller, Van Merrienboer, & Paas, 1998). According to this framework, during experiences that require active and deliberate information processing, cognition may become "overloaded" with irrelevant, ill-timed, or excessive information, detracting from our ability to attend to and satisfy one's current cognitive goals (Kalyuga, 2009). Cognitive load occurs when information enters working memory from too many channels at once, or at too rapid a pace, or when irrelevant incoming information or simultaneous cognitive tasks deplete resources required for effortful cognition, or even when familiar information is introduced in a new context (Moreno & Mayer, 1999; Paas, Renkl, & Sweller, 2004).

In addition to these context-specific variables, a number of learner-specific factors have been shown to influence the experience of cognitive load. For example, research on stereotype threat has revealed that for students from marginalized groups, the activation of stereotypes about one's identity group creates a state of cognitive load that detracts from available for working memory and interferes with optimal problem solving and decision making in learning contexts (Schmader & Johns, 2003). Repeated experiences with stereotype threat can result in perpetually higher levels of cognitive load, ultimately resulting in challenges to performance, persistence, and identification with learning contexts (e.g., Woodcock, Hernandez, Estrada, & Schultz, 2012). Additionally, recent research suggests that students from low-SES backgrounds may be living with a heavier-than-typical level of cognitive load from the daily realities of dealing with poverty, stress, or trauma (Mani, Mullainathan, Shafir, & Zhao, 2013; Sirin 2005).

In a games context, the "information" that might contribute to cognitive load includes everything that encompasses the play experience – from the rules and mechanics to the game materials to the interpersonal and intrapersonal dynamics of play. Games can be understood as complex multimedia experiences, and, as such, position learning the game and learning *from* the game as tasks that both require the deployment of cognitive resources (Mayer & Moreno, 2003). In this context, learners run the risk of attending more to figuring out the game than to learning the content. This is particularly important for groups already experiencing high cognitive load, as noted above.

Games present challenges around cognitive load because many principles of game design run directly counter to recommendations from cognitive load theory, For example, in the pursuit of increasing player engagement, designers typically employ methods such as adding extraneous elements (e.g., striking visual aesthetics and interesting "flavor text" in rule books and game materials). Moreover, it is common practice for designers to purposefully make relevant information difficult to obtain, partially hidden, or initially ambiguous, with the assumption that uncertainty sustains player interest (Costikyan, 2013). In contrast, a cognitive load approach might suggest that rich mechanics and visuals may be deeply engaging but potentially misaligned to the learning goal of the game, especially when treated as two distinct and separate parts of the game experience (Aleven, Myers, Easterday, & Ogan, 2010). Perhaps not surprisingly, game design frameworks that that have used instructional design principles such as cognitive strategies have revealed challenges in creating engaging educational game experiences (Enfield, 2012).

In this paper, we present our attempt to grapple with these challenges using a game design case study approach. In our design process, we utilized cognitive load theory to identify and streamline mechanics that were making the game less engaging or that were distracting from the game's core learning goal. As described below, our playtesting revealed that these design iterations resulted in higher engagement levels, faster playthroughs, and more strategy use directly tied to our learning goals by our players. The change in outcomes was most drastically observed in playtesters where we might expect the higher amounts of cognitive load.

Outbreak Game Design

Outbreak was designed as a part of the SCIPR project, which aims to design and study transformational games to encourage and increase curiosity through play – particularly for adolescents from marginalized or underrepresented groups in STEM. *Outbreak* was designed using Tandem Transformational Game Design which emphasizes iterations of the game alongside theoretical understanding of its transformational goals (To et al., 2016).

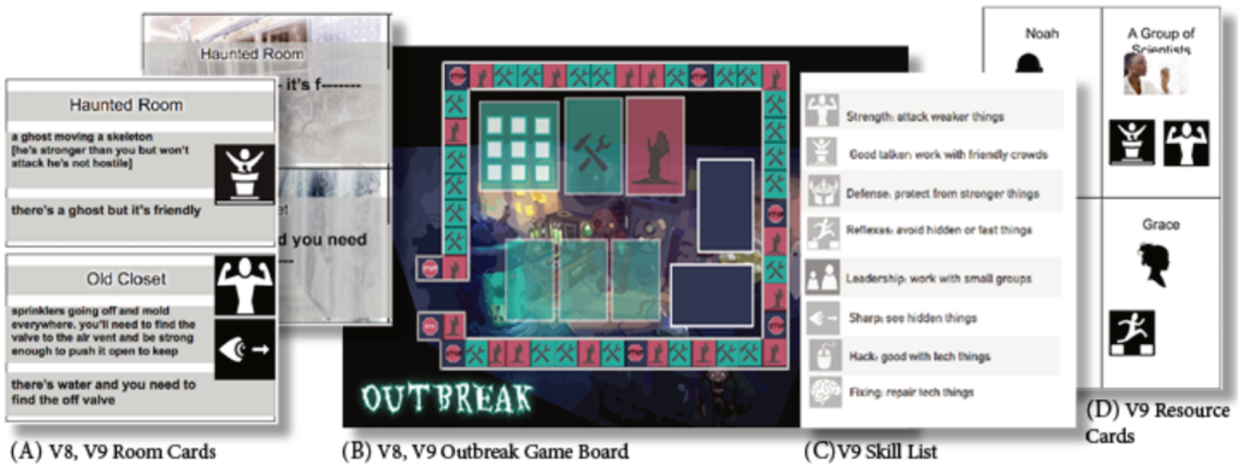

Figure 1. Outbreak game with components from V9 including (A) room cards, (B) the game board, (C) the list of skills, and (D) resource cards. Image from (To, Fath, et al., 2017)

Outbreak is a cooperative question-asking game for two to five players, in which the group must collect sufficient antidotes to cure a disease before the game ends. To do this, players search a different room inside the scientist's haunted house each round of gameplay. Most players assume the role of scientific investigators, while one player takes the role of their robot assistant. The robot can safely enter any room, which equates in the game to reading a secret description of the room, including what is necessary to neutralize any threats (e.g, Figure 1A). However, the robot cannot describe what it sees. It can only respond to questions put forward by the investigator players during the timed question-asking phase. Players then use the answers to these questions to decide which of their limited resources (Figure 1D) with related skills (Figure 1C) they will use to overcome the challenge in the room to win the antidotes they need. For example, an angry mob might be calmed by a card that has someone who is friendly, while a card with good defense might neutralize a room with dangerous electrical wiring.

Methods

This paper presents a case study of the playtest and iterative design process for the cooperative tabletop game *Outbreak*, in which we draw themes from the specifics of a given situation (Lazar, Feng, & Hochheiser, 2017). Over the course of seven weeks, we conducted 16 playtests of *Outbreak* with 9-14 year old players at two field sites in Pittsburgh, PA, USA. During this time, the game was iterated to help achieve its transformational outcomes (for further details, see (To, Fath, et al., 2017)). Over the seven weeks, seven versions of the game were prototyped – four of which were deployed in the official playtests detailed in this paper. The playtest methods and game materials were also iterated in order to include the maximum number of players across two very different sites.

Field site one (referred to as the community center) was a summer day camp located in a community center designed to provide local neighborhood youth a safe and enriching environment for campers to enjoy healthy, developmentally-appropriate learning experiences and activities. The camp enrollment is from mid-June to mid-August and students must pay and register to attend. The camp focuses on building self-esteem, social skills, and includes a maker space for STEM learning. Attendees of the camp come primarily from the Homewood neighborhood in Pittsburgh, PA which is a predominantly African American neighborhood (98.3% African American as of 2000 census) and historically has a lower income per capita than both the Pittsburgh city and Pennsylvania state average and a higher unemployment rate.

Field site two (referred to as the science center) was a post-care program for a wide variety of summer science camps located at a local science center. Summer camps at the center tend to only be a week long but some campers enroll in multiple camps. The post-care program is an additional paid program for parents who want to pick up their children from 4:30-6pm when the camps have already completed their activities for the day. The post-care program offers supervised, unstructured play. While the site does not collect demographic information about attendees, a single week of camp (with post-care) costs twice as much as the community center's program cost for the entire summer. We therefore conclude that these families are relatively affluent. Our observations suggest that the racial demographics of the campers are more similar to the overall demographics of Pittsburgh, PA than at the community center (Bureau, 2010).

At both sites players had varying relationships and familiarity with each other. Players were randomly assigned to groups and playtests were scheduled as part of the regular activities of the program (To, Fath, et al., 2017).

In all playtests, we tested the same version of the game at both sites on the same day, which gave us access to qualitative field notes that we could use to cross-compare the same gameplay experience across two groups. Participants played *Outbreak* in groups of three to five, with a researcher taking the role of the robot player. This researcher also obtained consent and taught the rules of the game. An additional researcher was present in the space to take notes. Participants played until they won, they lost, or 40 minutes had passed.

To capture data about participant inclusion in the playtest process, we relied primarily on observation and post-game focus group interviews. Due to the limitations of our field sites, we were unable to record audio or video, as children who had not consented to participate in the study were regularly present. We therefore developed a field notes template that allowed researchers to capture visible emotional responses to the game, unusual player behavior, and the gist of side conversations between players. When possible, researchers noted the game outcome, whether players succeeded in a particular room, and other observations related to playability and balance (To et al., 2016). To study the game's transformational outcomes, we also captured questions asked by players and used a customized valence-arousal measure to connect player emotional reactions to specific moments of the game (To, Holmes, et al., 2017). In the focus group interview, participants were told that their feedback would be helpful in aiding the game designers working on the game to change the game and make it better. They were asked what they liked most about the game, what they would wish to change about the game, and for any other additional feedback they'd like to share. While other elements of the playtests changed in response to our observations about player inclusion (see below), these elements were held constant across the entire study period.

The data captured represents a diverse range of playtests. Some participants played the game only once, while some played multiple times over several weeks; playtests occurred in a range of physical locations from a formal lab setting to a cafeteria in a science center; and some players played multiple versions of the game. Although we had quantitative data, for example in the valence-arousal maps, we felt it was inappropriate to perform formal statistical analyses across groups. Instead, we used qualitative methods to understand participant behavior.

Following each playtest, the entire team (i.e., playtesters, game designers, researchers) met to discuss common themes and look together at the data in an exploratory and informal manner. Cognitive load was identified early in the design process as a promising and relevant theory, but only as it broadly might pertain to the design of educational materials. After our second playtest, we identified cognitive load during a post-play debrief as being relevant to the specific design of game materials such as length and complexity of text on game cards. From that point forward we added analyzing cognitive load of the game to our observations and post-play debrief sessions, including examining play speed, rules comprehension, changes in the self-report measures, and the use of "better" (i.e., more strategically helpful) questions during the question-asking phase of game play.

Using those themes and informal data discussion, the team then also participated in an open brainstorm session for changes that might improve the game. Finally, the game designers would generate a master changelist from this brainstorm and start prioritizing potential changes based on their ability to increase playability for our target audience, the relative ease of implementing the change, and which specific overarching design goal the change would address.

Results and Discussion

Based on our qualitative field notes, as well as learning and engagement measures from playtesting, we believe that cognitive load theory can meaningfully inform the playtest process. We observed that using cognitive load theory when designing playtests and interpreting playtest data can be more inclusive of children from a range of backgrounds, particularly those who may struggle with increased cognitive load. In the following section we discuss three areas of consideration: prototype fidelity, theming, and replayability. Table 1 summarizes what sort of playtesting feedback may be tied to each of these three areas, along with the related Cognitive Load principles discussed for each.

Table 1
Examples of playtest feedback that teams may receive, and which Cognitive Load Theory Principles may help address and resolve that feedback.

Playtest Feedback	Potential Area of Focus	Cognitive Load Principle(s)
Sporadic levels of interest that differ widely between players. Voiced frustrations about game material quality or organization. Random rather than strategic choices made during gameplay.	Prototype Fidelity	Essential & Incidental Processing (Mayer & Moreno, 2003) Coherence and Signaling Principles (Mayer & Moreno, 2003) Strategic Choice and Mental Processing Resources in Games (Kalyuga, 2007)
Players discussing game theme/story in unexpected ways or not at all. Players discussing rules in incorrect ways that relate to the story. Players focusing on irrelevant information as though it mattered.	Theming	Extraneous Information (Mayer & Moreno, 2003) Information Channels (Moreno & Mayer, 1999; Paas, Renkl, & Sweller, 2004)
Players who have played once before can play much more quickly. Players who play the game multiple times rate it more highly than first-time players.	Replayability	The Pre-Training Principle (Mayer & Moreno, 2003; Kalyuga, 2009) Segmenting Principle (Mayer & Moreno, 2003) Working vs Long-Term Memory (Baddeley 1992)

Prototype Fidelity

A key principle of iterative game design is to get prototypes into testing as early as possible, and to iterate many times during the design process (Fullerton 2014). These early, rapid prototypes usually focus on mechanics and gameplay rather than visual design or production quality. High-quality materials can detract from players' ability to rate gameplay on its own merits, and so are often left for later stages (Martin & Hanington, 2012, Schell, 2014). However, we found that low-fidelity prototypes come with their own set of challenges around engagement, learning, and even the ability to play the game – but only for some players.

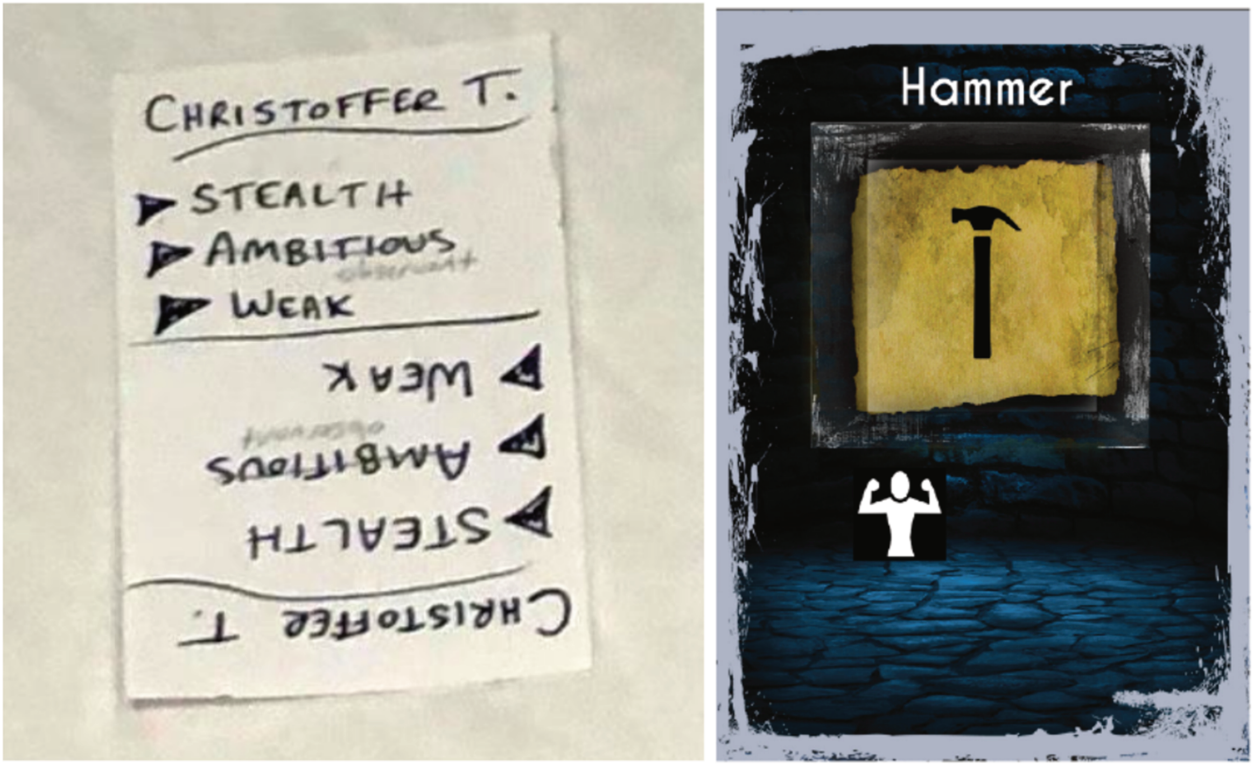

Figure 2. Initial resource card prototypes written on white card stock with black permanent marker [left] and final resource cards printed on playing cards in color [right] from Outbreak.

We deployed the same early prototypes at both research sites: black-and-white printouts, accompanied by hand-drawn cards (Figure 2). At the science center, players rated early playtests more positively in the post-game measures, asked more strategic questions during gameplay, and completed the game more quickly (on average, 20 minutes vs. 1 hour) than their peers at the community center. For example, most players at the science center ranked 9-10 of the 11 key game moments as having been positive, joyful, or "gripping" (i.e., afraid but interested), while responses from players at the community center were more distributed and sporadic. Most community center player responses were ranked in the "bored" area while others put a disproportionate number as "gripping," with few positive responses. In other words, science center players were more consistently interested and interested in the same things as their fellow players, compared to their counterparts at the community center who were generally more disinterested or reported more negative emotions.

Because the problems appeared in player interactions with mechanics, our first hypothesis for explaining this difference was that the game mechanics were cognitively taxing for our community center players. This would imply that the *essential processing*, or the basic work required to make sense of game activities, was too high. For example, in *Outbreak*, essential processing includes taking turns, drawing cards, asking questions, and eliminating choices. However, our observations did not align with this hypothesis. Rather than critiquing the game *activities* during play or in post-game interviews, players criticized the game *materials*. Our field notes report, for example, that community center players were "frustrated by the fidelity of the game" and "bothered about cards and board low-fi."

If the problem was the fidelity of the materials, we could investigate this possibility by improving the quality of our prototype. We removed our paper-printout board (Figure 3 [left]), backed all materials with cardstock or cardboard, (Figure 3 [right]), and printed everything in color. We made no changes to game mechanics or core interactions. After deploying the new version at both sites, we observed that players at the science center did not change their play behavior. However, players at the community center played in ways that were similar to science center players, rather than similar to our previous community center playtests. They completed game loops more quickly, and asked more directed, productive, and strategic questions.

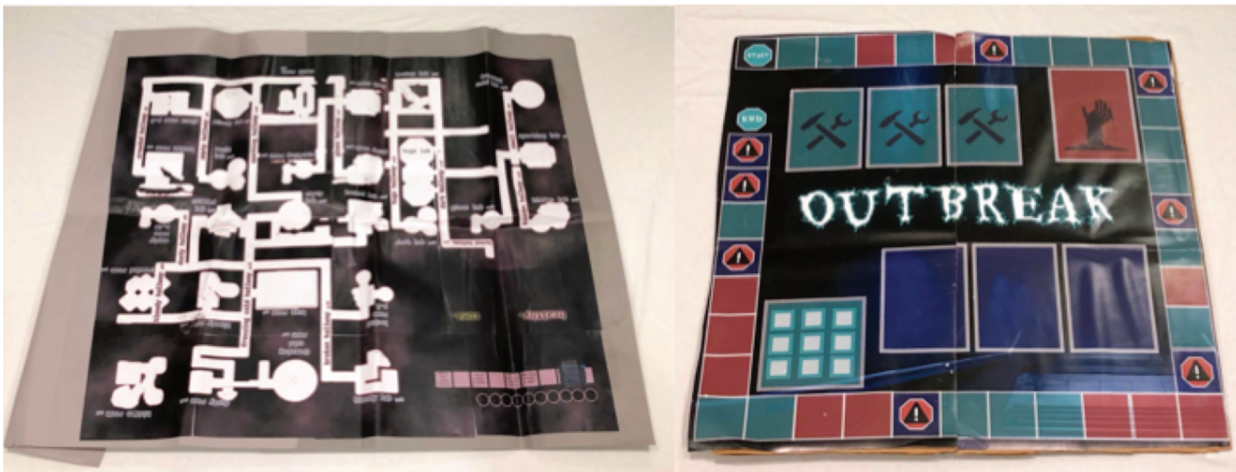

Figure 3. A low-fi game board primarily printed in black and white on construction paper with a fixed map of rooms [left] and a later more high-fi colorful game board with a track backed with cardboard [right].

Players' difficulties completing game loops can be explained by the concept of incidental processing (Mayer & Moreno, 2003). Incidental processing is what happens when non-essential media material requires cognitive processing, such as when music plays during the narration of a video. Many games make use of this idea to increase the challenge level. Nintendo's *Mario Party* minigames, for example, often work on the concept of distraction. They draw the eye with distracting "red herring" movement of non-essential game components. However, in this case, the additional processing required by our less polished game materials impaired players' ability to play the game at all. Particularly for players who may already experience high cognitive load for out-of-game reasons, low-fidelity prototypes may cause an incidental processing "tipping point." At this moment, players are no longer able to interact with the core of the game and the game materials feel overwhelming.

This theory also explains why we observed lower-quality questions at the community center with our lower-fidelity prototypes. Cognitive load theory predicts that cognitive overload leads to random search behaviors, as strategic choice is too complex for the mental processing resources available (Kalyuga, 2007). We witnessed random search behavior at the community center with our low-fidelity materials. At the time, it seemed unrelated to board fidelity: "[players] want to ask open-ended, storytelling questions, not to optimize skill quality questions ('do we need to be fearless?', 'Would I be scared?')." However, the issue was resolved by improving the fidelity of the material, which we hypothesize freed up cognitive resources for asking strategic questions.

Creating higher-fidelity prototypes has its own risks. They are more expensive and time-consuming to produce. The added time slows the iterative design process. Game materials that are too high-fidelity will also throw up false positive feedback. Players want to please the interviewer about a game that is perceived as closer to done (Schell, 2014). There are also known psychological effects related to materials fidelity. Users will rate good-looking screens as better, even if the content is identical (Martin & Hanington, 2012). But audiences with heavier-than-average cognitive load burdens may need high-fidelity materials to provide useful playtest data. Comparing data from a low- and high-fidelity prototypes of the same version of a game may help identify whether the issues are from core mechanics or incidental processing of game materials.

Theming

Game theming is a central narrative concept that ties the entire game together, which can be conveyed through imagery, text, or other materials (Schell, 2014). Theming invokes *schemas*, or sets of related ideas that provide meaning and structure to game activities. For example, in a game about pirates, players might expect loot, exploration, or double-crossing. While each person may not come to the game with the exact same expectations, theming can help players understand mechanics (Rosewater, 2012).

At the same time, cognitive load theory tells designers to reduce "extraneous" information. Extraneous information is information that is interesting but irrelevant (Mayer & Moreno, 2003). For example, in a video about lightning, a designer might remove interesting images of objects damaged by lightning that have no pedagogical value. While it may be relatively easy to tell what is extraneous information in an educational video, it is less easy to understand what is extraneous in a game. For example, flashing lights and a shower of stars might tell players they have obtained a reward. Is this core to the game experience, creating a "juicy" user interaction (Swink 2009), or is it extraneous to the core interactions of the game?

We discovered the challenges of theming early in our design process. We identified key concepts we wanted to signal with our choice of theme, such as cooperative play, expectations of failure, and exploring the unknown. We originally selected a zombie theme because it involves small groups of survivors exploring an unknown environment, at great risk to themselves, under pressure from the zombie hordes. However, when we brought this version of the game to our players, we found that players at the community center were disengaged from the theme. Players at this site did not talk about the story during the game or interviews, except using words that were directly in the instructions. Confusion about zombie horror tropes was also revealed in questions such as "Would zombies be good?" If community center players struggled with the theme, we suspected that it might function as extraneous cognitive load for them, rather than as a cognitive scaffold. By contrast, science center players seemed familiar enough with zombie tropes that they were correctly strategizing to theme (e.g., we have to save people quickly before they succumb to infection or attack).

Figure 4. A collection of the codesign materials used to identify which aesthetics seemed mature, creepy, and fun. Description words were placed on about 20 pictures with different color filters.

To understand why we were seeing this effect, we turned to culturally relevant pedagogy (Irvine, 2010), which encourages designers to think about how a learner's pre-existing cognitive schema might differ from their own. Game designers are not exempt from this challenge, as the design principles of games have emerged from a limited market and are hardly immutable (Fron, Fullerton, Morie, & Pearce, 2007). In our case, we turned to the literature and discovered that zombie survival stories are primarily white middle-class fantasies that allow them to imagine what "roughing it" would be like (Preston 2010), and the players at the community center would likely have much less exposure to this genre. We cross-checked this by interviewing our own players and found corroborating results. While players at both sites knew about zombies, we found differences between the sites when asked to describe a zombie apocalypse. The stories of participants at the science center were richer, more detailed, and more descriptive than those collected at the community center.

Figure 5. Image of a codesign activity to identify scary stories our target audience was familiar with. "A girl like Bloody Mary who is trapped here until she can find friends to help her out of the room"

To develop a theme that would connect better with players, we turned to co-design (Sanders & Stappers). We retained our core concepts of cooperation, failure, exploration, and the unknown, but worked with participants to identify a theme that would better evoke those concepts. We asked players to place adjectives onto different pictures describing their opinion of them (e.g., Figure 4) We also asked players to create an artifact about a spooky story, after a short discussion of spooky stories and urban legends they'd heard (e.g., Figure 5).

We decided to re-theme the game to "haunted house" after hearing that concept come up the most frequently when discussing failure, exploration, and the unknown. We then ran another session where we collected a list of the threats players expected to see inside of a haunted house: body horror (disembodied hands), haunted dolls, monsters, angry animals, and ghosts. These elements were then incorporated into the game.

We observed that the new theme was successful at both sites. Players spent time talking about the haunted-house themed flavor text, talking about the characters and what they were like, and talking about the game scenario as it related to the skills on the cards. However, this came at a price. We noted players would often read an entire card out loud, including flavor text, and then become confused as to what was relevant versus irrelevant information. We also observed players extrapolating solutions from the flavor text or imagery when in fact the text was there for humor only. This effect was more pronounced at the community center, to the point where it significantly affected gameplay. For example, we observed the strongest readers often adopted the role of the board manager, managing the essential processing that the other players were unable to handle, such as keeping track of turn-taking or of hidden information. We hypothesized that we might be seeing a channel mismatch. The core activities of our game included reading and speaking (e.g., asking questions); putting flavor information into text would conflict with these core activities, and the effects of the additional cognitive load would become visible for the players where reading itself provided a substantial challenge.

To address this issue, we experimented with removing much of the non-essential textual descriptions, and simplifying the images down to icons (Figure 6). We were concerned that these choices would lead to player disengagement, because we would no longer be conveying our theme effectively. However, we found that the simpler materials produced higher engagement from the table as a whole and faster turns. Players were also more likely to succeed at the game (i.e., completing rooms and receiving antidotes). Player engagement with the narrative remained, driven largely by channels such as the detailed box art (which situated the game inside of a haunted house) and the introductory story, which was now more aligned to a story most participants were familiar with.

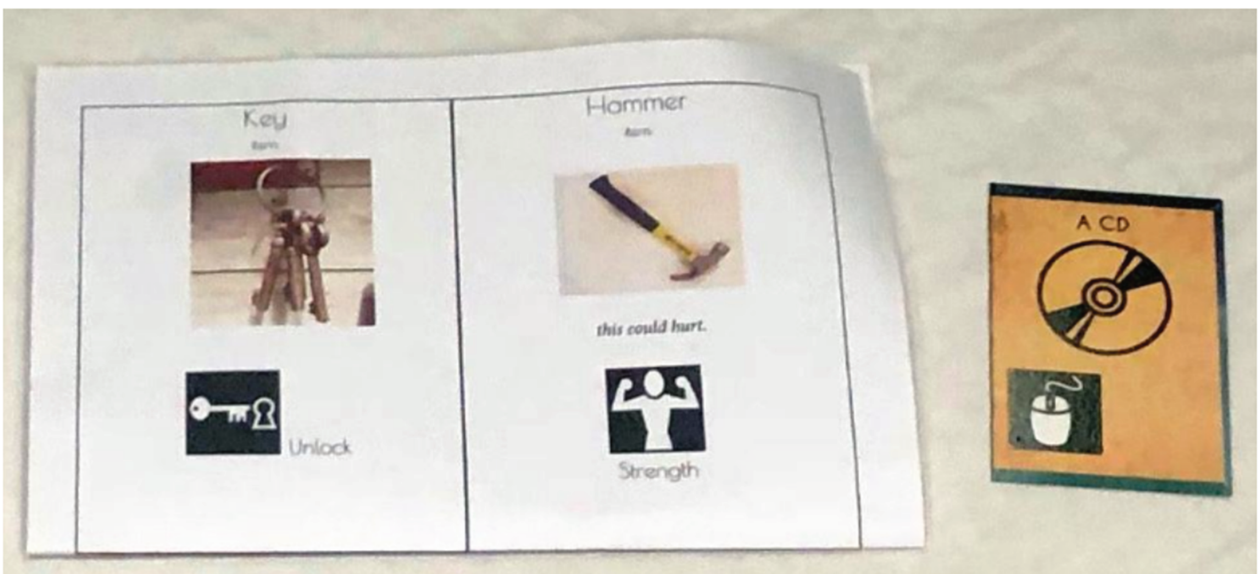

Figure 6. Resource cards with flavor text and complex imagery [left] and simplified resource cards with fewer words [right].

While theming and relying on schemas can be a useful tool to reduce cognitive load in players, the risks in this approach are twofold: over-generalization of audiences and variance in players' pre-existing knowledge. In just a handful of interviews it can become easy to quickly overgeneralize for a given audience. To mitigate this risk, when designing for audiences whose prior knowledge and experiences differs from the designers', story should likely not carry the torch. If it does, test the story early and often. To mitigate the risk of variable audience prior knowledge, it can be helpful to create an "assumption map" of what the game design team's expectations are (regarding theme and story) before a playtest in order to explicitly test those assumptions (for more on assumption maps, see Martin & Hanington, 2012.

Replayability

Game designers approach replayability in games in a variety of ways, such as procedural generation, randomness, or emergence. The board game *Settlers of Catan*, for example, relies on a randomly-created tile map for different gameplay each time. Replayability can also come from players making different choices in different playthroughs, as in *Dragon Age*'s romances, or from players repurposing and revisioning the game, as in speedrunning.

Replayability in games creates challenges for playtesting. On the one hand, it is important to diversify the number of players who are testing a game, to avoid over-fitting the game's design to the preferences or needs of a specific group. On the other hand, cognitive load theory argues that playing a game multiple times frees up cognitive resources because some of the information has been committed to working memory, also called the pre-training effect (Kalyuga, 2009).

In our playtest process, we addressed this issue by having some players return from previous playtest sessions, playing alongside new players. This simulates a typical board game play situation where at least one player has read the rules beforehand, or has previously played. This also allowed us to have some players reflect on the differences between game versions, while still learning about the effects of new versions on new players.

Early versions of *Outbreak* used a fixed map with a limited number of rooms (Figure 3). We found that this created issues with replayability. For example, players would learn how to game the system. Once it became clear to the players that some questions were particularly useful for successfully clearing a room, they began to ask the same questions over and over again without variance. Once a single player discovered this dominant strategy, all players would adopt it. We were concerned that this dominant strategy would make further playthroughs less engaging for players. Instead, however, we saw a positive effect on engagement. This was particularly evident at the community center, where players were often participated less in their first play of the game. Once the dominant strategy came into play, players at the table would remind one another of turn order and other rules, and success rates for turns went up and players more frequently won the game.

We interpret this evidence using the pre-training effect. As players were getting better at playing the game, they had more cognitive resources for other kinds of activities, like helping one another or checking their actions against the rules (which, being held in working memory, were easier to access). In our redesign, therefore, we aimed to redirect more of those resources at the learning goals of the game, namely asking questions. But, we wanted to keep the useful outcomes of the pre-training effect, particularly for our community center players.

To accomplish this, we reframed what we had been calling a "dominant strategy" as an interim plateau. We expected that by their second or third playthrough, players would discover a particularly effective set of questions, as we indeed observed at both our sites. However, we could introduce a new level of expert play by offering high-risk, high-reward moves for players who felt comfortable with the basic mechanics. Players were given the ability to select rooms with varying difficulty (i.e., rooms have a displayed signal of level 1, 2, or 3 difficulty where level 3 offered the most risk – three threats – for the most reward – three antidotes). Additionally, we built in some cards that were near-replicas of others, with identical room titles, in order to make memorization of the actual solution less likely. After these changes, we found that players did engage in discussion over choosing risky vs. safer rooms. We did not see observable differences between community center and science center players regarding these conversations.

Understanding the pre-training effect helped us playtest in a way that was aligned with our eventual goals for deployment. While first-time players needed to have a good experience, we wanted the game to be played multiple times. We also knew that the game might be played in different contexts, (e.g., at home, at school), and with different sets of players, (e.g., a single expert, a group of experts, or all first-timers). That meant we needed to understand how new players played, to be able to identify when the game rules and procedures had been internalized through repeated play, and to observe gameplay afterwards as well.

We note that in order to align with our planned deployment strategy, we needed to know what that deployment strategy would be. If the game has a "legacy" model, such as *Risk Legacy*, which adapts as it is being played over time but can only be played once, that demands a different playtest strategy from a game that uses remixing to present a randomized, new puzzle every time and where players will encounter a small subset of all possible puzzles no matter how long they play. Answering these questions is particularly important for classroom deployment. One in three game-using teachers feel that not knowing *how* to use games in the classroom is a barrier to using them more often (Takeuchi & Vaala, 2014), and supporting materials need to take into account the fact that multiple playthroughs will drastically impact the learning outcomes. This, too, is also an inherent risk with the strategy of multiple play-throughs: deployment to classrooms is already a difficult problem (Klopfer et al., 2009). A game that requires repeated playthroughs may present additional barriers to deployment and evaluation, which may be mitigated by such steps as sending the game home to be played or allowing the game to be an independent station choice after its initial introduction.

Table 2
Team Iteration Strategies Based On Cognitive Load Principle

Area of Focus	Cognitive Load Principle	Ways to Iterate
Prototype Fidelity	Essential & Incidental Processing (Mayer & Moreno, 2003) Coherence and Signaling Principles (Mayer & Moreno, 2003)	Improve the quality of game materials without altering mechanics. Run an additional playtest to evaluate differences in how strategic players are being with choices. Alternate tests occasionally between low- and higher-fidelity materials. Move relevant images and text on game materials closer together.
Theming	Extraneous Information (Mayer & Moreno, 2003) Information Channels, Coherence Principles (Moreno & Mayer, 1999; Paas, Renkl, & Sweller, 2004)	Use principles from Culturally Relevant Pedagogy and Codesign (Sanders & Stappers) to identify what themes will work with players' pre-existing cognitive schema and which are unfamiliar. Explore ways to convey theming that are used at different times or on different channels from the channels used to play the game.
Replayability	The Pre-Training Principle (Mayer & Moreno, 2003) (Kalyuga, 2009) Segmenting Principle (Mayer & Moreno, 2003)	Consider deployment context early. How often and where will players play in the wild? If players may only play once, how can you reduce the information needed to understand the game one time? Test at least some groups of playtesters with at least one person who has played previously. Compare differences. If the game has a dominant play strategy, does that strategy fit with what you want players to master? If not, consider removing it. If so, what mechanics can you introduce later on to compel players who have mastered the first dominant strategy and need a higher challenge?

Limitations

In this paper, we present a case study for a single game, *Outbreak*. This choice allows us to explore multiple design iterations and solution spaces to problems with cognitive load, described in Table 2. However, because it is a case study, we cannot fully rule out alternative explanations for the phenomena we understand as evidence of cognitive load – nor do we intend to. As noted earlier in this paper, we believe that cognitive load theory provides *one* useful lens for improving the playtest process, not the *only* useful lens for doing so. While cognitive theory principles need no further verification, as they have been extensively researched, we have not chosen to compare their impact on the playtest process with the impact of potential alternate explanations. While we find the evidence presented here persuasive, additional studies on this topic are needed.

The case study design also limits the generalizability of this work. For example, some of our findings are specific to non-digital games (e.g., backing early prototypes with cardboard), and we expect that there are additional tensions that emerge when designing in other genres (e.g., mixed-reality games, competitive games) with cognitive load in mind. The value of this work is to expose some of the ways in which game design practice can come into tension with instructional design theory, and to suggest ways that designers can move forward in their own projects.

Another limitation of this project is that we do not directly link design improvements to learning (transformational) outcomes. The data analyzed in this paper is from design iterations, observations, and qualitative field notes, not pre-post tests or other measures of learning gains. It is possible that our metrics of design improvement (e.g. playability) would have unexpected effects on the learning goals of the game. While we consider this unlikely, we cannot rule it out.

Finally, while our subjects were drawn from multiple sites and demographic categories, they all resided in the same mid-sized American city. While they come from a range of cultural backgrounds, they also have significant cultural similarities. Similarly, while the designers in the project were trained in a range of places, all received academic game design training, and most had professional work experience in North American small-to-medium-size game companies. It is possible that their knowledge of the state of the field is incomplete.

Conclusion

In this paper, we develop a theory-driven approach to inclusive playtesting and describe how it was implemented in the iterative design process of a cooperative board game. Players drawn from marginalized groups may experience increased cognitive load during playtesting for a variety of reasons, such as stereotype threat. Cognitive load theory has implications for a range of game design and playtest design processes, including prototype fidelity, the degree and type of game theming, and how many times playtesters encounter the game.

Our work contributes to improving the game design process both by making playtest design more inclusive and by providing designers with a lens to use for making decisions about iteration post-playtest. Researchers can also use this work to understand the game-specific challenges of working with cognitive load theory. On the surface, cognitive load theory is in tension with game design. To completely reduce cognitive load in a game, researchers might aim to create a game with no extraneous detail, theming, or uncertainty – and also no fun. By looking at the specific tensions between game design and cognitive load, designers and researchers can address these tensions with meaningful intention.

In our future work, we hope to explore the lens of cognitive load theory as it relates to other types of games. The value of working deeply with one game as an exemplar helps us explore cognitive load theory within an iterative design process. By exploring cognitive load in the playtest process for additional games, we can identify additional factors about the games themselves, such as how they are intended to be deployed, that would affect the way cognitive load theory manifests.

We could also think about generalizing beyond cognitive load theory, and developing other lenses for analyzing playtest processes. Just as Schell's lenses help designers look at their game in many different ways, to break habits and increase creativity, a book of lenses for playtesting could help designers – not just trained researchers – conduct more inclusive and rigorous iterative design processes.

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Reference

Akilli, G. K. (2007). Games and simulations: A new approach in education.

Aleven, V., Myers, E., Easterday, M., & Ogan, A. (2010). Toward a framework for the analysis and design of educational games. In *Digital Game and Intelligent Toy Enhanced Learning (DIGITEL), 2010 Third IEEE International Conference on* (pp. 69–76).

Ambinder, M. (2011). Biofeedback in gameplay: How valve measures physiology to enhance gaming experience. In *game developers conference* (Vol. 2011).

Baddeley, A. (1992). Working memory. *Science*, *255*(5044), 556–559.

Bureau, U. C. (2010). Pittsburgh PA census map.

Choi, J. O., Forlizzi, J., Christel, M., Moeller, R., Bates, M., & Hammer, J. (2016). Playtesting with a Purpose. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play* (pp. 254–265).

Costikyan, G. (2013). *Uncertainty in games*. Mit Press.

DiSalvo, B., Guzdial, M., Bruckman, A., & McKlin, T. (2014). Saving Face While Geeking Out: Video Game Testing as a Justification for Learning Computer Science. Journal of the Learning Sciences, 23(3), 272-315. doi: 10.1080/10508406.2014.893434

El-Nasr, M. S., Drachen, A., & Canossa, A. (2016). *Game analytics*. Springer.

Enfield, J. (2012). *Designing an educational game with ten steps to complex learning*. Indiana University.

Fron, J., Fullerton, T., Morie, J. F., & Pearce, C. (2007). The Hegemony of Play. In *DiGRA Conference*.

Fullerton, T. (2014). *Game design workshop: a playcentric approach to creating innovative games*. CRC press.

Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in Entertainment (CIE)*, *1*(1), 20.

Gerling, K., & Masuch, M. (2011). When gaming is not suitable for everyone: Playtesting wii games with frail elderly. In *1st Workshop on Game Accessibility*.

Hanington, B., & Martin, B. (2012). *Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions*. Rockport Publishers.

Hayes, E. R., & Games, I. A. (2008). Making computer games and design thinking: A review of current software and strategies. *Games and Culture*, *3*(3–4), 309–332.

Irvine, J. J. (2010). Culturally Relevant Pedagogy. *Education Digest: Essential Readings Condensed for Quick Review*, *75*(8), 57–61.

Kalyuga, S. (2009). Instructional designs for the development of transferable knowledge and skills: A cognitive load perspective. *Computers in Human Behavior*, *25*(2), 332–338.

Kalyuga, S. (2007). Enhancing instructional efficiency of interactive e-learning environments: A cognitive load perspective. *Educational Psychology Review*, *19*(3), 387–399.

Kalyuga, S., & Plass, J. L. (2009). Evaluating and managing cognitive load in games. In *Handbook of research on effective electronic gaming in education* (pp. 719–737). IGI Global.

Ke, F. (2009). A qualitative meta-analysis of computer games as learning tools. *Handbook of Research on Effective Electronic Gaming in Education*, *1*, 1–32.

Khaled, R. (2008). Culturally-relevant persuasive technology.

Klopfer, E., Osterweil, S., Salen, K., & others. (2009). Moving learning games forward. *Cambridge, MA: The Education Arcade*.

Lazar, J., Feng, J. H., & Hochheiser, H. (2017). Research methods in human-computer interaction. Morgan Kaufmann.

Mani, A., Mullainathan, S., Shafir, E., & Zhao, J. (2013). Poverty impedes cognitive function. *Science*, *341*(6149), 976–980.

Martin, Bella.Hanington, Bruce M. (2012) *Universal methods of design :100 ways to research complex problems, develop innovative ideas, and design effective solutions* Beverly, MA : Rockport Publishers, 2012. Print.

Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, *38*(1), 43–52.

Molzhon, A. (2016). *Exploring the influence of socioeconomic status on the executive function and theory of mind skills of preschoolers*. Virginia Commonwealth University.

Moreno, R., & Mayer, R. E. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology*, *91*(2), 358.

Paas, F., Renkl, A., & Sweller, J. (2004). Cognitive load theory: Instructional implications of the interaction between information structures and cognitive architecture. *Instructional Science*, *32*(1–2), 1–8.

Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & Education*, *52*(1), 1–12.

Preston, J. (2010). Prosthetic white hyper-masculinities and `disaster education'. *Ethnicities*, *10*(3), 331–343.

Rosewater, M. (2012). Piggybacking.

Sanders, L., & Stappers, P. J. (2012). *Convivial design toolbox: Generative research for the front end of design*. BIS.

Schell, J. (2014). *The Art of Game Design: A book of lenses*. CRC Press.

Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology*, *85*(3), 440.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, *75*(3), 417–453.

Squire, K. D. (2008). Video games and education: Designing learning systems for an interactive age. *Educational Technology*, *48*(2), 17.

Sweller, J., Van Merrienboer, J. J. G., & Paas, F. G. W. C. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, *10*(3), 251–296.

Swink, S. (2009). Game feel. *A Game Designer's Guide to Virtual Sensation. Burlington, MA, 1.*

Takeuchi, L. M., & Vaala, S. (2014). Level up Learning: A National Survey on Teaching with Digital Games. *Joan Ganz Cooney Center*.

Thompson, J. (2014). Engaging girls' sociohistorical identities in science. *Journal of the Learning Sciences*, *23*(3), 392–446.

To, A., Holmes, J., Fath, E., Zhang, E., Kaufman, G., & Hammer, J. (2017). Modeling and Designing for Key Elements of Curiosity: Risking Failure, Valuing Questions. *Proceedings of DiGRA 2017.*

To, A., Fath, E., Zhang, E., Ali, S., Kildunne, C., Fan, A., Hammer, J., & Kaufman, G. (2016). Tandem Transformational Game Design: A Game Design Process Case Study. In *Proceedings of the International Academic Conference on Meaningful Play*.

To, A., Fan, A., Kildunne, C., Zhang, E., Kaufman, G., & Hammer, J. (2016, October). Treehouse Dreams: A Game-Based Method for Eliciting Interview Data from Children. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts*(pp. 307-314). ACM.

Van Merriënboer, J. J. G., Kirschner, P. A., & Kester, L. (2003). Taking the load off a learner's mind: Instructional design for complex learning. *Educational Psychologist*, *38*(1), 5–13.

Vasalou, A., Khaled, R., Gooch, D., & Benton, L. (2014). Problematizing cultural appropriation. In *Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play* (pp. 267–276).

Westera, W., Nadolski, R. J., Hummel, H. G. K., & Wopereis, I. G. J. H. (2008). Serious games for higher education: a framework for reducing design complexity. *Journal of Computer Assisted Learning*, *24*(5), 420–432.

Wilson, A. J., Dehaene, S., Dubois, O., & Fayol, M. (2009). Effects of an adaptive game intervention on accessing number sense in low-socioeconomic-status kindergarten children. *Mind, Brain, and Education*, *3*(4), 224–234.

Woodcock, A., Hernandez, P. R., Estrada, M., & Schultz, P. (2012). The consequences of chronic stereotype threat: Domain disidentification and abandonment. *Journal of Personality and Social Psychology*, *103*(4), 635.

LONGITUDINAL NETWORK DYNAMICS AMONG PLAYERS OF A RECREATIONAL COMPETITIVE BOARDGAME

JOE A. WASSERMAN

Background

Games are frequently played with and/or against other people. In some instances, socializing during gameplay may be more important than the game itself, which only serves as a pretext for social interaction (Woods, 2012). Other players can substantially influence gameplay experiences and outcomes, in terms not only of game performance (Bowman, Weber, Tamborini, & Sherry, 2013), but also learning and strategy acquisition (Weintrop & Wilensky, 2013), social-psychological experiences (Backus, Cubel, Guid, Sanchez-Pages, & Mañas, 2016), and social relationships (Pace, Bardzell, & Bardzell, 2010). Nevertheless, despite some understanding of underlying motivations for playing games in general (Sherry, Lucas, Greenberg, & Lachlan, 2006), little is known about how individuals seek out and select others to play games with and against. Because opponent selection is an antecedent to the experience and consequents of gameplay, understanding this process is critical for understanding and predicting gaming effects—including learning and other meaningful outcomes.

Aim

This study analyzed gameplay logs to explore opponent selection dynamics among a group of recreational online boardgamers. Although this study was largely descriptive and exploratory, future research will generate a predictive model of opponent selection.

Method

To explore opponent selection dynamics among recreational boardgame players, available data in the form of gameplay logs were collected from an online portal for playing boardgames, BoardSpace.net, and subjected to network analysis. Gameplay logs for the boardgame *Hive* (Yianni, 2001), a two-player, competitive, turn-based boardgame, were collected from available records on BoardSpace.net. In this study, tournament plays were excluded so as to focus on autonomous opponent selection and plays against AI bots were excluded to focus on human opponent selection only. In total, these data represent 3,741 distinct players who collectively played a total of 18,983 games of *Hive* between July, 2006, and September, 2017.

Results

Initial descriptive analyses suggested that the vast majority of individual players, as well as dyads of individuals who played against each other, were active for only a single month of the 135 months contained in the dataset. Despite this high level of variability at the level of individuals and dyads, overall network structures remained consistent over time. Regardless of the time period, player networks were characterized by a consistent core-periphery structure (see Appendix A). A small number of players who played games against each other formed the cores of these networks. Many other individuals either (a) only played against one of the players who formed this core or (b) only played against one of *those* players who otherwise played only against a core player. A large number of player dyads never played against anyone outside of their dyad. Although many of these isolated dyads only played a small number of games, some played intensely.

Conclusions

The variability in individuals' gameplay patterns suggests that individuals used multiple opponent selection strategies. The consistency of overall player network structures suggest that although individual players varied over time, a consistent set of opponent selection strategies were used. For example, some players may have chosen opponents at random, while others may have specifically played against individuals they already knew. Potential additional network analyses and future research directions will be discussed.

References

Backus, P., Cubel, M., Guid, M., Sanchez-Pages, S., & Mañas, E. L. (2016). *Gender, competition and performance: Evidence from real tournaments* (IEB Working Paper 2016/27 No. ID 2858984).

Bowman, N. D., Weber, R., Tamborini, R., & Sherry, J. (2013). Facilitating game play: How others affect performance at and enjoyment of video games. *Media Psychology*, *16*, 39–64. doi:10.1080/15213269.2012.742360

Pace, T., Bardzell, S., & Bardzell, J. (2010). The rogue in the lovely black dress: Intimacy in World of Warcraft. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 233–242. doi:10.1145/1753326.1753361

Sherry, J. L., Lucas, K., Greenberg, B. S., & Lachlan, K. (2006). Video game uses and gratifications as predictors of use and game preference. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 213–224). New York, NY: Routledge.

Weintrop, D., & Wilensky, U. (2013). Know your enemy: Learning from in-game opponents. *Proceedings of the 12th International Conference on Interaction Design and Children*, 408–411. doi:10.1145/2485760.2485789

Woods, S. (2012). *Eurogames: The design, culture and play of modern European board games*. Jefferson, NC: McFarland.

Yianni, J. (2001). *Hive* [Board game]. Hertfordshire, United Kingdom: Gen42 Games.

INCREASING SELF-ADVOCACY OF ADOLESCENTS WHO STUTTER THROUGH INTERACTIVE NARRATIVE DESIGN

LISA M. KOPF, CHRISTOPHER KHAN, AND PATRICIA ZEBROWSKI

Introduction

Many persuasive games allow players to role-play to better understand an individual's or group's point of view. No known studies have evaluated the ability of patients (non-game designers) to tell the story of their own disease/disorder through game design.

Speech and language disorders, such as stuttering, often negatively impact an individual's quality of life (Wolter, DiLollo, & Apel, 2006). One approach to help patients with this issue is narrative therapy, an approach that can benefit multiple patient populations including those who stutter (DiLollo, Neimeyer, & Manning, 2002; Wolter, DiLollo, & Apel, 2006). Narrative therapy encourages a patient to shift the focus of their life story (or personal narrative) from a disorder-centric narrative (where the disorder is in control) to a patient-empowered narrative (where the patient has control over the disorder). While the goal of narrative therapy is to change the patient's personal narrative over the course of therapy, both narratives (disorder-centric and patient-empowered) are a valid representation of the patient's experience. Therefore, the ability to intertwine the two forms of the narrative one gives the creator (the patient) the ability to design an interactive experience for others (e.g., family, friends). Rather than simply telling others about how the disorder impacts his/her life or asking others to read a static narrative about the impact, both of which are in the third person, the interactive narrative acts as a simulation, allowing others to experience consequences of choices the patient has to make from the patient's point of view (first person).

The act of creating a patient-generated interactive narrative (PGIN) may provide a unique way to increase a patient's self-advocacy. Prior literature indicates that writing one's own life story can be a method of self-advocacy (Meininger, 2006), but creating an interactive experience may further increase patient self-advocacy. We explore this idea through a study of individuals attending a summer camp for adolescents who stutter (AWS). The AWSs, with the help of graduate student clinicians (GSC), created and mixed earlier and later versions of the personal narrative using Twine (twinery.org), an open-source software for designing narratives. We discuss the results of a group interview with summer camp attendees post-PGIN creation.

Methods Participants

Fourteen AWS [10M, 4F; Age: M=14.5 years (12-18 years)] attended the weeklong summer camp (UISPEAKS). Each AWS was paired with a GSC [2M, 12F; Age: M=23 years (22-30 years)].

Study Procedures

Prior to UISPEAKS, the GSCs received training in using Twine through a one-hour workshop led by author C.K. On the second day of the camp, each AWS and his/her GSC created the initial version personal narrative and copied it into Twine in a 1-hour session. On the fifth day, each AWS and GSC pair participated in a 1-hour session to "thicken" the interactive narrative using Twine with the GSC prompting the AWS to add patient-empowered alternatives based on experiences during camp.

Outcome Measures

At the end of UISPEAKS, a semi-structured group interview was conducted with all AWSs, and a follow up survey was emailed to GSCs. Results from the interview and surveys were analyzed using consensus coding (Braun & Clarke, 2006) between two coders (authors L.K. & C.K.). After creating the codes, codes were grouped into emerging themes through affinity diagramming (Beyer & Holtzblatt, 1998).

Results

In this extended abstract, we focus on the main findings from the group interview with the AWSs. The results are summarized in Table 1, and emerging themes are further explained below.

Theme	Code	Count
Likes Twine and Creating PGINs	Likes Twine (in general)	8
Likes Twine and Creating PGINs	Desire to share Twine narrative	6
Impact of Coding Experience	Twine is confusing to use at first	5
Impact of Coding Experience	Twine is easy to use	4
Likes Twine and Creating PGINs	Twine allows for narrative therapy	4
Likes Twine and Creating PGINs	Likes Twine's customizability	4
Likes Twine and Creating PGINs	Twine is interesting/novel	3
Impact of Coding Experience	Having help using Twine was useful	2
Likes Twine and Creating PGINs	Likes creating interactive narratives	2

Table 1: Common codes from the group interview with AWSs about using Twine for creating PGINs.

Theme 1: Impact of Coding Experience

Twelve of the fourteen AWSs did indicate prior coding experience. This was partially reflected in the theme "Twine is easy to use" (four codes) although there were five codes indicating that "Twine is confusing to use at first." These findings suggest that prior coding experience may provide some limited benefit in using Twine for narrative therapy but support using the program may still be needed ("Having help using Twine was useful", 2 codes).

Theme 2: Likes Twine and Creating PGINs

The results indicate that, overall, the AWSs had positive views of creating their own interactive narratives in Twine. None of the AWSs had used Twine previously, but many AWSs commented that they liked Twine in general (8 codes), liked the program's customizability (4 codes), and that Twine is a good program for creating interactive narratives in narrative therapy (4 codes). The AWSs reported they liked creating interactive narratives (2 codes) and liked the novelty of the experience (3 codes). In addition, multiple AWSs expressed a desire to share the Twine narrative with others (e.g., friends, family; 6 codes). One AWS stated that she planned to share her interactive narrative in Twine for "self-advocacy." These results support the use of Twine for creating PGINs because it is a positive experience for AWSs.

Discussion

While another recent study examined the impact on game designers of creating a game based on their own illness/disability (Danilovic, 2018), this is the first known study to evaluate the ability of patients (non-game designers) to tell the story of their own disease/disorder (stuttering) through game design. The results provide preliminary evidence that using PGINs can be a positive experience for AWSs, and that AWSs want to share PGINs with others. Future studies should further explore the impact of PGINs in other patient populations. In addition, future studies should follow up with patients to determine whether patients do share PGINs with others and the impact that has on the patients.

References

Beyer, H., & Holtzblatt, K. (1998). Contextual design: Defining customer-centered design. San Diego, CA: Morgan Kaufmann Publishers.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101.

Danilovic, S. (2018). Game design therapoetics: Authoring the computer game autopathography. Presentation at Meaningful Play, East Lansing, MI.

DiLollo, A., Neimeyer, R. A., & Manning, W. H. (2002). A personal construct psychology view of relapse: Indications for a narrative therapy component to stuttering treatment. Journal of Fluency Disorders, 27(1), 19-42.

Meininger, H. P. (2006). Narrating, writing, reading: life story work as an aid to (self) advocacy. British Journal of Learning Disabilities, 34(3), 181-188.

Wolter, J. A., DiLollo, A., & Apel, K. (2006). A narrative therapy approach to counseling: A model for working with adolescents and adults with language-literacy deficits. Language, Speech, and Hearing Services in Schools, 37(3), 168-177.

RACIAL DIVERSITY IN THE FIGHTING GAME COMMUNITY

JONMICHAEL SEIBERT

Extended Abstract

In recent year competitive video games and game streaming has become an increasingly popular medium, along with competitive 'Esports' tournaments. Fighting games such as Street Fighter, Mortal Kombat, and Super Smash Brothers have their roots in early arcades and remain popular to this day, attracting a sizable and passionate competitive community. Today, however, first-person shooters, real time strategy, and multiplayer online battle arena are among the most popular among both viewers and players (Entertainment Software Association, 2017). Fighting games are typically games that are played in a one versus one format while physically in the same space as one's opponent. These video games communities, online and shared in-person are typically seen as being predominantly white, and when looking at game competitions within these genres of games, this holds true (Paterson, 2017). While industry demographic reports gladly espouse the distribution of men and women playing video games, there is unfortunately a lack of racial demographics data however (Entertainment Software Association, 2017). Observational data suggest that fighting games seem to be different yet there is a lack of academic work examining this phenomenon. Thus, this study aims to examine the presence of minority gamers within the competitive fighting community. More specifically, this work aims to fill this gap in literature by first answering if there is a heightened level of racial diversity within the fighting game community, and then what factors lead to it developing in this way.

To achieve this, popular press articles and community forum discussions were gathered to examine how this community sees and presents itself to the world at large. Preliminary findings indicate higher levels of racial diversity have been noted within the popular video games press and discussed within the video games community. According to sources within popular press as well as from members of this community, lower barriers to entry of fighting games through physical arcades is a prominent driver of heightened levels of diversity. It was far less expensive in the early 90s to go to a local arcade and play a few rounds of Street Fighter II than to buy a personal computer and play Quake over the internet. Additionally, the physically present nature of these games leads to a far more human and social gameplay experience, resulting in a more inclusive space for people to play games together. Additionally, semi-structured interviews with members of the fighting game community were conducted to ensure a more robust understanding of the presence/absence of diversity. Overall,

participants indicate that they whole heartedly agree with the conclusions and statements found within the popular press. To obtain more information from a wider group of individuals, focus groups will be conducted with members of local fighting game tournament communities. The primary aim of these focus groups will be discussing fighting games in detail with groups of community members, with the intention of discovering how they came to be a member of this community and to find commonalities between their lived experiences. It is hoped that these interviews will also agree with research conducted within the popular press as well as data obtained from the informal interviews.

PLAYER-ROLES IN MASSIVELY MULTIPLAYER ONLINE ROLE-PLAYING GAMES, AND PERCEIVED SKILL AND RELATIONSHIP BENEFITS, DIVERGE WITH SOCIAL ATTITUDES AND POLITICAL IDEOLOGY

CM SMITH, P RAUWOLF, J INTRILIGATOR, AND RD ROGERS

Massively Multiplayer Online Role-Playing Games (MMORPGs) afford an enriching range of leisure, educational, and social opportunities. Individuals are motivated to play MMORPGs through a variety of psychological mechanisms. Drivers include a sense of achievement associated with progress through game structures, the excitement generated by immersive experiences and, in particular, the social rewards of interacting, and developing relationships, with other players and groups. Other data highlight player characteristics linked to hazardous patterns of MMORPG play that can be detrimental to health and well-being, sometimes categorised as 'gaming addiction'. Strikingly, some of the most salient aspects of vulnerability to these problems include difficult social experiences such as loneliness, introversion, hostility to others as well as social disadvantage (e.g. unemployment). Collectively, these reflections highlight the possibility that individuals' motivations to play MMORPGs (to the benefit of well-being or otherwise), and the choices that they make within these games, reflect their broader social values and attitudes. However, almost nothing is known about how MMORPG play relates to social values, attitudes to others, and political ideology even though these factors may well mediate players' gaming experiences and any resultant cognitive and social benefits.

Here, we surveyed 5,847 players of Jagex's Runescape to test the relationships between player-role preferences and players' social values, attitudes to others (as trait hostility) and political orientation. We sought to test the hypotheses that players' choice of in-game roles (Skillers, Killers, and Questers) and the benefits they derive from gaming are linked to social values, their resentment or suspicion of others (as hostility), and their liberalism-conservatism. We focused upon (i) whether the skills that players gained from MMORPG play helped them in other areas of their lives; (ii) whether their online relationships had produced benefits for their offline relationships; and (iii) the importance placed by players on their in-game achievements relative to their real-life achievements.

Overall, players were most likely to report prosocial orientations reflecting our sample being drawn from a long-established MMORPG, with a strong and well-recognised community ethic. However, players who prioritised skill acquisition/improvement (Skillers), combat (Killers) and narrative challenges (Questers) also differed in broader socio-cognitive factors. Killers were the most likely to show individualist and competitive social value orientations, report the most hostility to others and report the most conservative (social and economic) political ideology. Questers reported the least hostility and most liberal outlooks. Players identified as individualists reported the weakest benefits of MMORPG play. By contrast, the most hostile players reported the strongest importance of in-game relative to offline achievements (possibly indicating hazardous play) but the strongest cognitive and social benefits. Finally, players with libertarian outlooks reported the strongest benefits while players with liberal-left outlooks reported the weakest. These findings offer new perspectives on the socio-cognitive processes of MMORPGs, and can inform discussion of how individuals derive leisure, education and social capital benefits from MMORPG play. Critically, our research provides evidence that the choices of player-roles reflect social and political cognitive processes and that even those vulnerable to patterns of play that might damage health and well-being appear to gain the most tangible benefits from these games.

DESIGNING CONTEXT-SENSITIVE GEOLOCATIVE MODERATED GROUP ACTIVITY GAMES

PAUL GESTWICKI AND KATELYNN RADER

Abstract

We present two case studies in the design of context-sensitive geolocative mediated group activity games. These are games that: use geolocation as an input mechanism; are constrained to be playable only in a specific geographical location; whose design is infused with the history, culture, or other qualitative features of the location; and whose primary gameplay exists between the players and their surroundings, mediated by a minimal software system. The two case studies cover *Spirits at Prairie Creek Park* and *Fairy Trails* and include an analysis of their requirements, constraints, design process, technical implementations, and informal evaluations. We discuss the benefits and drawbacks of this genre of games, relating both to the case studies, related work, and literature on games and play, as well as the implications of this work for future research.

Modern computing technology provides unprecedented opportunities for playful and meaningful game experiences that diverge from the dominant popular approaches. We are particularly interested in breaking the assumption that gameplay constitutes primarily a player-device interaction. "Video games" can foster player interactions that are unfettered by screens or controllers, strengthening existing social connections and building new ones, teaching something meaningful along the way. In this paper, we describe two case studies that explore unique design spaces for serious games. The cases incorporate general video game design principles with specialized local constraints. We are primarily concerned with the intersection of two design features: context-sensitive geolocation and moderated group activity.

We define *context-sensitive geolocation* to mean that the player's geographical location is an input to the game, and the game reacts to this input in a way that is contextualized to that location. For example, Conner Prairie in central Indiana includes a historical re-enactment village called 1836 Prairietown. Visiting children are welcome to play a simple role-playing game in which they choose an occupation to which staff and volunteers react throughout the village. The responses and reactions to the players are keyed to the specific locations of the re-enactment; for example, taking the role of a fur trader will result in relevant conversations at the village's general store. For contrast, consider the context-insensitive geolocative game, *Pokémon Go* (2016): it uses geolocation as an input, but the relationship of the game's content at that location to its cultural context is essentially arbitrary. Pokémon discovered in Prairietown do not wear 19th-century attire.

We define *moderated group activity* to mean that the screen-based content serves to encourage and reward behaviors that occur outside of video games' conventional player-screen dyad, and that the game is played by a collocated group of players, one of whom moderates the play activity through the provided software system. The game is played out in a combination of physical reality and the digital game space. While it is true that even a single-player game can be modeled as an asynchronous communication between player and designer (Bateman, 2017), we are concerned with collocated, synchronous, group play.

An activity theoretic lens is pragmatic for considering how the game is related to the overall play experience. Activity theory is a descriptive theory that draws upon social and psychological approaches, using activity as the unit of analysis (Engeström, 1987). It has been deployed extensively in human-computer interaction research (Kaptelenin & Nardi, 2006) but less frequently in games scholarship. Notable recent examples incorporating activity theory include: Carvalho et al. (2015), who use activity theory to propose a novel conceptual model for serious games; Phelps (2016), who advocates using Activity Theory as a lens for design and analysis; and our own earlier work using activity theory to study game design and development teams (Gestwicki and McNely, 2016). In Figure 1, we illustrate how this theory allows us to analyze the constituent parts of the play activity. The players are the subjects of the system, and their object is play, which is intrinsically motivating; the labor is divided, however, such that the moderator likely initiates play as well as moderating it, while the other players participate. The activity is mediated by a software system as well as the players' physical location and the technology that permits the integration of these. The rules of the system include those that are manifest through the software as well as cultural rules of play, such as the unspoken but shared admonition against cheating. Taken as a whole, and when functioning properly, the system produces the outcomes of entertainment and—for serious games—learning. The system in Figure 1 focuses on the players' immediate experience, but activity theory lends itself to analysis of nested and overlapping activity systems; for example, our play activity is situated within a larger one that includes the developers and publishers, the Apple App Store and Google Play Store, the agencies that fund the maintenance of cultural and historic sites, and so on. The influence of these factors, which exist outside of the immediate play activity, are discussed within the context of the case studies.

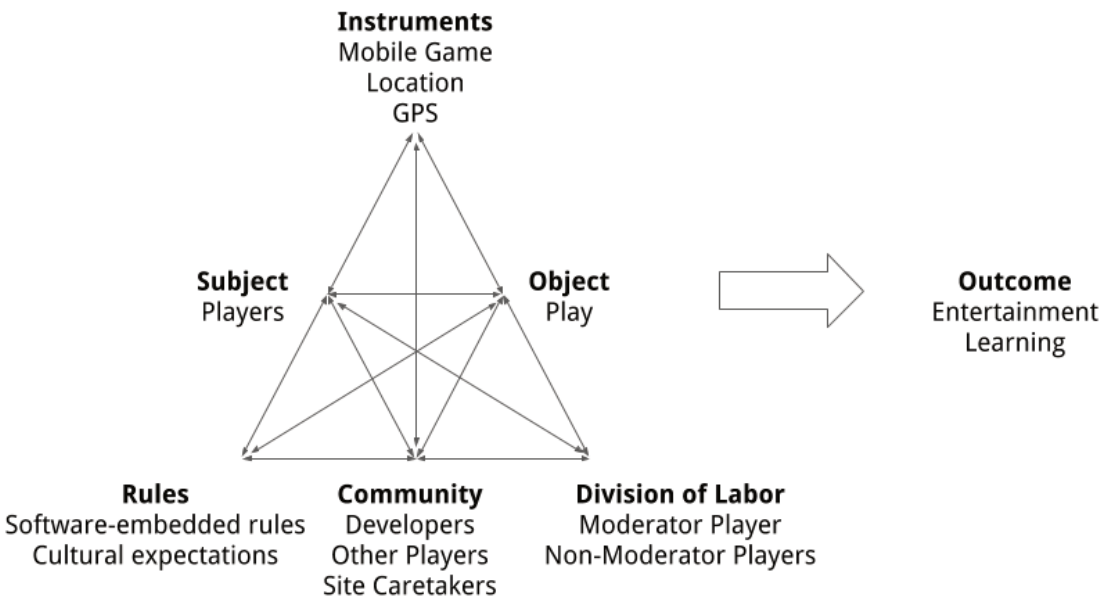

Figure 1: Activity-theoretic analysis of players' experience

Both of our case studies followed the Double Diamond design model (Design Council 2005) as interpreted by Schneider (2015) for software development. The cases were conducted by multidisciplinary teams of undergraduate students at Ball State University, which is a public university in Muncie, Indiana, that enrolls roughly 20,000 students. Each case took place across two semesters, as shown in Figure 2. In the first semester, as part of an introduction to serious game design, the students were given a themed design challenge, where the theme was articulated in collaboration between the faculty mentor and a community partner. The overall approach to design followed the steps articulated by Schreiber (2009), using the principles of educational game design framed by Klopfer, Osterweil, and Salen (2009). Between semesters, the faculty mentor and community partner closed off the first diamond by evaluating the students' prototypes and electing from them the one that identified a solvable problem that was within scope for digital production. In the second semester, another team of students—which included a subset of those from the previous semester—formed a development team that produced the game using iterative and incremental software development techniques. The production team was mentored following the Academic Studio pedagogy, an approach that blends contemporary practices of interdisciplinary project work with traditional academic values (Gestwicki & McNely, 2016). The specific practices of the production team are guided by Scrum (Schwaber & Sutherland, 2017) and informed by theories of agile software development (Cockburn, 2016).

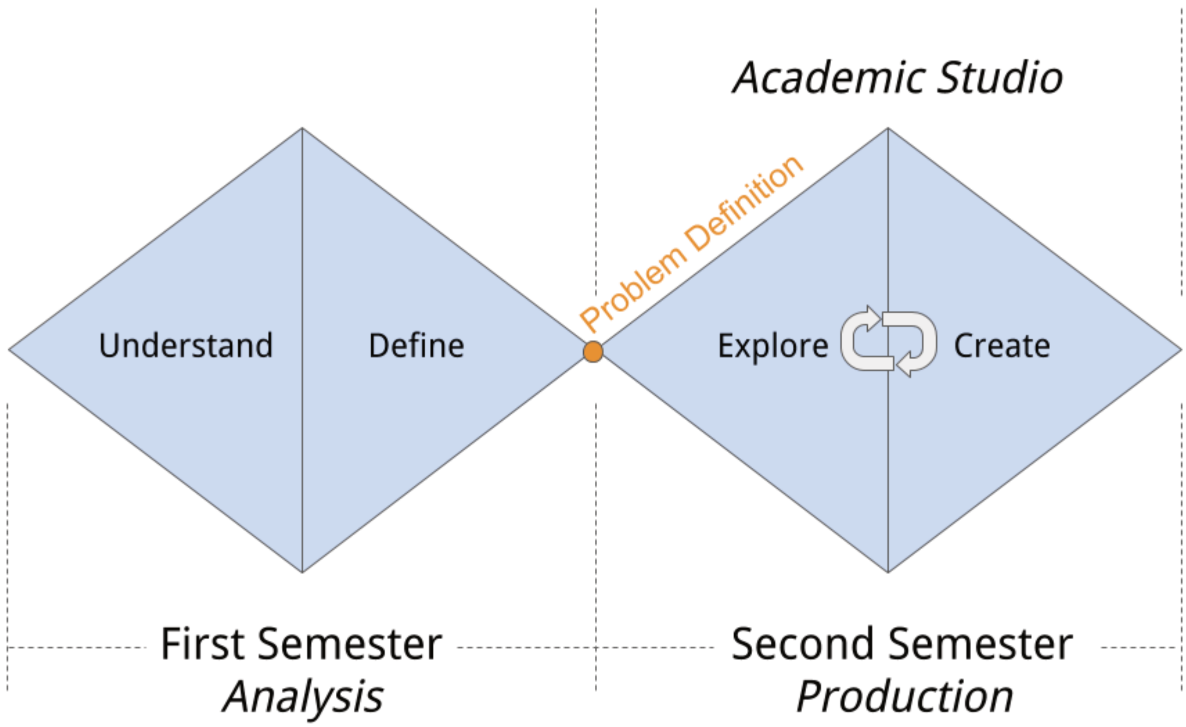

Figure 2: The Double Diamond model used by our case studies. (Adapted from Schneider (2015)).

This work is inspired in part by player practices around board games. Board games and card games have traditionally emphasized systems-based social play, and we observe trends to formally and informally incorporate digital elements that enhance gameplay. BoardGameGeek.com provides an excellent example of an informal enhancement, given that hobbyists have voluntarily tracked play data on that site for many years. Formal integration has included using apps to add new ways of playing existing games, as with the smartphone app *Road to Legend* (Hajek & Kemppainen, 2016) that adds a purely cooperative experience to popular one-vs.-all board game *Descent* (Clark *et al*., 2012). The same publisher—Fantasy Flight Games—has also published board games that require an app to play, including *XCOM: The Board Game* (Lang, 2015) and *Mansions of Madness* (Valens, 2016). Similar phenomena can be found in role-playing games, such as with *Roll20* (Orr Group, 2012), which allows people to play "tabletop" role-playing games without being in the same room.

Many scholars have seen the utility of playful digital experiences that reach beyond conventional video game design. One of the most well-known frameworks for creating geolocative games is ARIS from the University of Wisconsin Field Day Lab. This system allows end users to create interactive simulations and games through the Web that run on an iOS client. ARIS has been used to create many notable educational game projects, including *Occupied Paris* (Nelson, 2017), *Jewish Time Jump* (Gottlieb, 2017), and *Mentira* (Holden & Sykes, 2011). Alternate reality games such as those created and championed by Darvasi (2016; Fallon & Darvasi, 2017) further demonstrate how playful learning environments engage students and provide unparalleled learning experiences.

Case Study 1: Spirits at Prairie Creek

Our first case study is *Spirits at Prairie Creek Park* from Flame Llama Studio (2017) in collaboration with Muncie Sanitary District's Office of Stormwater Management. The goal of the design was to explore themes of environmental sustainability and water quality. The game takes place at Prairie Creek Reservoir, which is approximately five miles outside of Muncie and comprises roughly 1275 acres of water and 750 acres of land for recreation. Prairie Creek Park is on the east side of the reservoir, and it includes a playground, basketball court, docks, picnic pavilions, and a swimming area. When the city's public pool was closed for repairs in the summer of 2009, the Office of Stormwater Management started Camp Prairie Creek—a free week-long summer day camp for children in first through eighth grades. The activities of Camp Prairie Creek are designed to make children comfortable in nature and reflective about sustainability, while maintaining an atmosphere of fun and engagement; it also served as a vehicle to inform children and families about the possibility of swimming in the reservoir while the city pool was closed. It was in this ecosystem of ideas that *Spirits at Prairie Creek Park* was born, sharing the educational goals of Camp Prairie Creek. Note that the wide range of ages served by Camp Prairie Creek presents a significant design challenge, since what engages and educates a first-grader may not be the same as an eighth-grader.

One of the inspirations for this game was local stories of *pukwudgies*—mischievous creatures from Native American folklore who play tricks on humans who would disrespect them. Various pukwudgie stories and tales are told throughout many regions, including parts of the United States and Canada ("Legendary Native American," 2015). There are many different stories that depict Pukwudgies as being kind-natured spirits who would only play harmless tricks on humans who came through their forest, but in other regions of the world, and among tribes in southern New England, Pukwudgies were known to be more malicious by committing deadly acts of sabotage upon those who entered their forest. Stories of pukwudgies provided inspiration for the game, but the team decided to avoid using them directly. There were challenges identifying authoritative sources on these mythical creatures, given the variety of cultures and folklore involved; more importantly, however, was that iterative prototyping informed the team that purely beneficial spirits were more aligned to our educational goals than trickster spirits.

Any children visiting Prairie Creek Park must have been brought by parents, teachers, or other adults. The team realized that this had important implications for the design: rather than presume the conventional player-screen dyad, the game design could take advantage of the number of players, the likely distribution of devices (for example, parents would tend to have a smartphone whereas their younger children would not), and the high levels of trust among the players. We do not think that it is a coincidence that the relationships among play, trust, and friendship were contemporaneously being explored by Koster, Cammarata, and their team at the Google Advanced Technology and Projects group (Koster 2018) as well as a Project Horseshoe working group (Cook et al. 2017); rather, we suspect that these groups recognized the trends and opportunities discussed in the introduction, and we see this in the synergy of our conclusions and results. *Spirits at Prairie Creek Park* leverages the fact that our players already know and trust each other, that they are willing to be guided through activities by their responsible adult, and—particularly for family units with young players—that multisensory, active experiences will be intrinsically motivating.

Gameplay

Spirits at Prairie Creek Park is played by groups of people, but only one player has the app on a mobile device. We will call this player the "facilitator," borrowing the nomenclature used by Falk and Dierking (2013) in a way that will help connect this case study to the next. The game can only be played at Prairie Creek Park, and attempting to run the game from anywhere else will produce directions to the park instead. Once on site, the facilitator's screen will display a map of the park with icons marking five locations (Fig. 3a). Walking to one of those locations will prompt the facilitator to instruct the rest of the players to engage the environment using a specific sense while a thirty-second timer begins (Fig. 3b): players are asked to observe, touch, smell, or listen to their surroundings. When the timer expires, the players are presented a list and select the items they experienced (Fig. 3c). They are rewarded by meeting a friendly spirit (Fig. 3d), whom they can choose to name—a feature that we found gave players a strong sense of attachment to the spirit and motivated their desire to find (and name) more. After visiting all five locations, the players are shown a montage of their five spirit friends arranged in a heroic lineup.

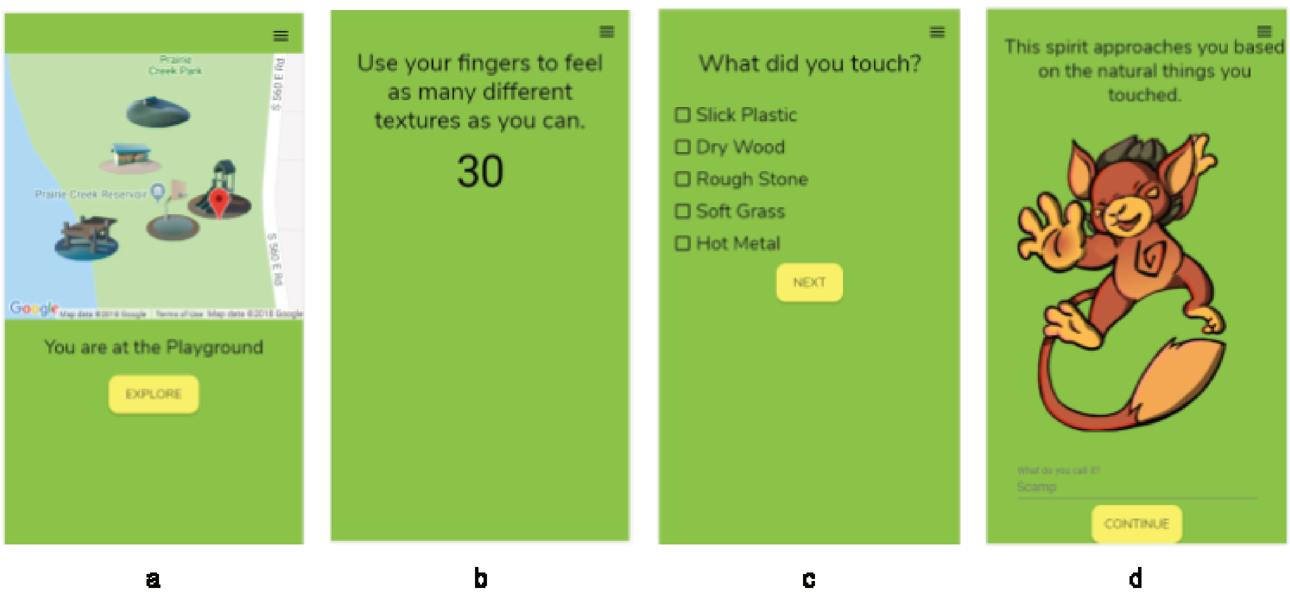

Figure 3: Interaction sequence in Spirits at Prairie Creek Park.

The items in each location's list were carefully chosen to include natural and man-made items, and each location has two potential spirits. Under the hood, each item has a "nature score," and which spirit they befriend is determined by whether they record having seen more natural or more artificial phenomena. The "natural" spirits draw inspiration from nature, while the "artificial" spirits include visual elements drawn from man-made artifacts. The mechanics for how players befriend specific spirits and the presence of multiple spirits are not revealed to the player directly; it is through replaying the game, potentially with different player groups, that players may come to understand the underlying systems.

Production and Playtesting

Prairie Creek Park has poor cellular connectivity and no Wi-Fi capability, which means that our solution had to be as lean as possible. The team used Polymer Web components to build *Spirits at Prairie Creek Park* as a Progressive Web App: it can be downloaded and installed directly to the home screen on both iOS and Android, and it caches all of its data to be robust in the face of network disconnection. The team had hoped to integrate social media features in order to compensate for the app's low discoverability: allowing Snapchat filters or Facebook photos of players with their fairies would encourage others to try the game. These features were lower priority than core gameplay features, however, and they were not incorporated into the final build.

The art direction for *Spirits at Prairie Creek Park* required designing spirits that would be enjoyable for young players, entertaining for older players, and appropriate for both the location and the artificial/natural distinction. The artists generated many concept drawings that were subjected to internal evaluation and review by the community partner. The final decision for which two spirits to choose for each location came down to a combination of fitness for purpose and representation of the various artists.

There was limited playtesting of the game prior to release, primarily with family groups. The players uniformly enjoyed the game: children and adults alike enjoyed exploring the park with different senses. We observed parents spontaneously engaging their children in discussions about nature and their relationship to it, in accordance with the goals for the design. Unfortunately, although *Spirits at Prairie Creek Park* was designed to be played at Camp Prairie Creek, it was not deployed for lack of technology support. Park attendees were informed that they could return to play the game, but this did not overcome the game's severe lack of discoverability: it can only be played at a single location, but there is not any indication at the location that there is a game that could be played. The game is available to everyone and played by almost no one.

Case Study 2: Fairy Trails

Fairy Trails (Guy Falls Down Studio, 2018) is a collaboration with Minnetrista—a cultural center in Muncie, Indiana. Its 40-acre campus includes gardens, a historic home, museum building, a nature area, and a portion of the riverside walking and biking trail that runs through the city. Its property includes the original homes of the Ball brothers, who were pioneers in glass production, founders of the Ball Corporation, and philanthropic benefactors of Ball State University.

A part of Minnetrista's mission is to support and communicate the legacy of the Ball family, and this provided a theme for the student designers' creative work. The original design team explored many different aspects of the Ball family's life and legacy, but the piece that captured most designers' imaginations was the story of Elizabeth Ball. Elizabeth was born in 1897, and as a child she showed a particular fascination with fairies. This fascination was evident in the Ball family's extensive collection of children's books (Schiller, 1997). Elizabeth's love of fairies is featured in many of Minnetrista's educational resources and activities, including the popular Fairies, Sprites, and Lights event. This annual event engages children in meeting fairies throughout the grounds, and it is a highly-structured event that includes significant investment in materials and staff. *Fairy Trails* was designed to explore similar themes to Fairies, Sprites, and Lights on a much smaller scale, allowing for family and group engagement without needing paid staff or volunteers to coordinate the activity.

Minnetrista has used a psychometric model for analyzing museum visitor behavior (Falk & Dierking 2013) to determine that their primary visitor types are *facilitators*, *explorers*, and *rechargers*. Rechargers tend to visit by themselves, using the expansive grounds as a retreat, whereas Facilitators and Explorers come in groups. In particular, a group often consists of one Facilitator and several Explorers, where the Facilitator is interested in bringing a good experience to their group. These are often intergenerational groups, such as parents with children or a college student with visiting parents.

Transitioning from Rechargers to Facilitator-Explorer Groups

Fairy Trails evolved from *Down the Wishing Well* (Mills-Rittman, 2017), a prototype created during the first semester of the project. *Down the Wishing Well* was designed as geolocative interactive fiction, implementable in a system such as ARIS. It is a single-player experience targeting rechargers: a single player could use the game to meet fantastic fairy creatures while wandering the grounds. The game's main dramatic theme encouraged the player to consider whether they embraced imaginative play. The faculty mentor and community partner agreed that while the structure of the game was appropriate for the context, it would be more fruitful to target facilitator/explorer mixed groups. Rechargers, after all, do not need additional engagement in order to recharge, whereas facilitators regularly seek new means of engaging the explorers they bring.

The second semester production team was given *Down the Wishing Well* and were introduced to the recharger-facilitator-explorer taxonomy. In consultation with Minnetrista, the team defined their mission statement, which was printed and posted on the studio wall:

> We are making a geolocative, narrative-rich mobile app that helps facilitators engage with explorers at Minnetrista—an app that features the varied grounds of Minnetrista's campus and the early 20th-century fairies beloved of Elizabeth Ball. The app will bring people together to be creative and engage the group in imagination and reflection.

Despite agreeing upon this mission, the design team found it to be a difficult target. They found that single-player, single-screen motifs kept creeping into their prototypes. This is potentially attributable to their being novice designers and also to many being video game hobbyists. That is, their conceptual model of video games led to the inappropriate inclusion of familiar tropes. For example, many designs featured extended dialog with fairy characters as commonly seen in computer role-playing games. While these may be appropriate for an individual's reading (or skipping) screens, it does not scale well to groups of players. The point of the mission statement was to be able to throw away good ideas; yet, even when the conflict with the mission was pointed out, some team members were too attached to their ideas to evaluate them objectively.

The team spent many iterations refining a single fairy meeting, each time coming closer to understanding the unique design space of this project. This is appropriate given the design approach described in Fig. 2, although retrospectives revealed rising tensions as the project deadline drew closer. There was a watershed moment halfway through production when one of the key designers realized that the *facilitator* in our vision statement was akin to the *Dungeon Master* in *Dungeons & Dragons*. Once he realized that our fairy encounters were like *D&D* modules rather than like conventional video games, he became much more productive and also helped the rest of the team to better understand the design space.

Gameplay

Fairy Trails is playable only at Minnetrista, and directions are provided for those who are elsewhere. Once on campus, the player is shown a screen that lists the names of three fairies and their locations on Minnetrista's grounds (Fig. 4b); selecting one of these shows a drawing and hint about its location (Fig. 4c). Approaching one of these locations produces an audible sound and a short interaction with the fairy, during which the fairy will ask the players to complete a task (Fig. 4d-f). Upon completing the activity, the fairy expresses their gratitude and friendship with the players (Fig. 4g), and their portrait is then shown in the fairy list (Fig. 4h).

Figure 4: Interaction sequence for Fairy Trails.

There are three location-based scenarios in the game—a wishing well (demonstrated in Fig. 4), an outdoor stage, and a rose garden—and the activity at each location corresponds to its physical and cultural features. The wishing well is an iron sculpture sitting in a garden with two concentric circular paths; the sculpture features youth holding hands and dancing in a circle, and so the fairy who meets the player here invites them to join the dance. The fairy at the stage asks the players to improvise a four-scene play about a fairy party. The fairy at the rose garden is more contemplative, inviting the players to reflect upon and share some of their hopes and dreams. Through these activities, the team manifests the vision statement, encouraging creativity, imagination, and reflection.

Playtesting revealed that some facilitators would focus on their phones rather than joining in the activity with their group. In order to encourage all the players to participate, a feature was added whereby the app asks to be put away (Fig. 4f) and responds to being closed. This feature surprised many playtesters, but all of them did as instructed and enjoyed the scenario. This feature was inspired in part by *Undertale* (Fox, 2015), arguably the most popular video game to incorporate application closure as an input mechanism.

Production and Playtesting

The team chose Unreal Engine to implement *Fairy Trails*. Several team members had just finished coursework in game programming using Unreal Engine, which incorporates a user-friendly visual scripting language called Blueprints along with many asset production tools. The decision was finalized by knowing Unreal Engine supports deployment to both Android and iOS and that the team could incorporate more advanced augmented reality features if time allowed. As anticipated, the team found that competent undergraduates could easily learn Blueprints and that the artists were able to incorporate assets with relative ease. The team used Perforce Helix for version control because of its integration with Unreal Engine and its capacity for locking assets to prevent concurrent modification.

Despite support for cross-platform augmented reality from Unreal Engine, the team decided against incorporating it. One reason was the amount of time invested in ensuring the team understood their unique design space: they ensured that the first scenario designed truly captured their ethos. While it took several weeks to develop the first scenario, the other two came quicker; however, there was still the non-negotiable deadline of the semester's end, and so these two were not subject to the rigorous playtesting of the first. The other reason against using advanced augmented reality is that it further restricts what devices can run the app. The team decided it was better to make a simpler app available to more users than either to reduce the number of users or risk being seen as a gimmick.

If one were to re-engineer *Fairy Trails*, it could be built with a much simpler and more lightweight technology than Unreal Engine, although the learnability of its Blueprints system and its integrated asset production pipeline should not be understated. As in *Spirits at Prairie Creek*, the team behind *Fairy Trails* had hoped to incorporate social media functionality in order to encourage a wider audience to play; again, however, the core gameplay features required higher prioritization, and social media integration was not possible within the project constraints. We anticipate that working with Minnetrista's marketing department, however, we will be able to have much more adoption than *Spirits at Prairie Creek Park*.

Using Unreal Engine allowed the team to distribute the game on the Google Play Store and the Apple App Store. Being listed on the Play Store was characteristically simple, whereas the App Store process was more challenging. All potential App Store offerings are subject to both automated and human-led review. The reviewer's first response to *Fairy Trails* was that it was "not a game"—a response sure to ruffle the feathers of any seasoned games scholar. The justification for their claim was that, paraphrasing, all you do is tap through the screens to read about fairies, and that no native iOS features were used. In order to justify our claim that this is indeed a game, we first supplied a rationale for what "game" means, drawing upon Koster (2013), and who our audience was, drawing upon Falk and Dietring (2013). We also had to explain that geolocation and responding to app closing and reopening were key features of the game. The team also produced three videos in response to serial rejections, the first showing the sequence of activity, the second showing a sample play session, and the third pedantically explaining the relationship between the screen and the gameplay activities. The game was eventually approved and released on the App Store.

Discussion Design Considerations

Context-sensitive geolocative games provide an unparalleled opportunity to explore the narrative of space through procedural rhetoric (Bogost, 2010). The specific history, culture, or context of a location can be explored in geolocative gameplay, and the procedural rhetoric manifest in the game presents these ideas such that playing the game is learning about them. The player is physically in the place when the game makes the implicit argument that its context is worth knowing. However, by making the game exclusively playable at that location, it also reduces the discoverability and the potential for impact: those who know the least about the location are, practically by definition, those least likely to seek out and play a game about it, especially if this requires significant travel. Hence, the opportunities afforded by context-sensitive geolocative games needs to be balanced against their inherent risks. The commercial risks, however, do not detract from the opportunities for academic exploration.

During the testing of *Fairy Trails*, a player asked, "What does Henrietta [the fairy at the wishing well] do if you don't dance?" This question came from a player during a debriefing session, and upon further discussion, the player explained their assumption that the phone could use sensors to measure movement and use those measurements to determine whether the player was dancing. From a constructivist point of view, this is a useful conceptual model in that it provides a coherent and pragmatic way of interacting with the game. In practice, however, there is no way to determine if any particular series of motions is a *dance*. *Fairy Trails* does not actually try to determine if a player is dancing. Rather, it embodies an assumption on the part of the designers that if you are invited to dance, you will dance. A player can elect not to dance, but this is equivalent to deciding not to play; that is always an allowable choice, given that play is voluntary (Huizinga, 1938; Caillois, 1961). A non-dancer is a non-player, and ergo, all players dance. Returning to the activity theoretic lens, it is not important whether dance-enforcement is a cultural rule or a mediating artifact, or even whether the players have "correct" conceptual models of the design: the activity system still functions and produces the intended outcome.

Design challenges arise due to deviations from player expectations. Players as well as the App Store gatekeepers expect a "game" downloaded to a phone to abide by unspoken conventions. Bateman (2017a) describes the mismatch between the designer's and the player's expectation as *interface perplexity*, and we certainly observed this in a subset of playtesting scenarios. Following Norman's (2013) principles for design, we can see this as a mismatch between the designers' conceptual model and that of the players; such dissonance needs to be overcome through a combination of signifiers and feedback. Perhaps ironically, the affordances for such play are already embedded into the devices and environment, despite their not being leveraged. Neither case study conducted research to determine which game features contributed most significantly to players' understanding of the design space. However, in every testing session, we saw that players who engaged in any activity eagerly sought the next. This supports our claim that the design space is a fruitful one for engaging players, despite its being uncommon and a challenge to communicate.

Neither of the games examined in these case studies uses an overt or pedantic approach to game-based learning. Both are built around "soft" learning objectives relating to attitudes and perceptions, as opposed to easily quantified and assessable "hard" learning objectives. More importantly, however, they are designed such that the primary learning happens in the interpersonal, technology-mediated discussions around the play experience. In both games, we observed player groups spontaneously engaging in debriefing behaviors after playing, particularly with parents asking their children what they thought of the experience. Debriefing is a crucial process for educational games (Nicholson, 2012), and both games were designed so that that their inherent socialness and trust-building would encourage such spontaneous debriefing. Further research could serve to clarify which design elements led most consistently or robustly to spontaneous post-play debriefing; however, it may be impossible to prove the causation experimentally, since it is not clear that one could make a game that is otherwise equivalent to *Spirits at Prairie Creek Park* or *Fairy Trails* but without the social component. That is, without the social component, they would no longer be mediated group activity games. Those complications aside, neither game has been subject to rigorous research regarding short- and long-term learning outcomes, but we see this as a fruitful area for future work.

Games and Play

This style of game can serve to increase playfulness, particularly along Caillois' (1961) dimensions of *mimicry* and *ilinx*. We see this in *Spirits at Prairie Creek Park*, as players race around the playground feeling for different textures or as they pause to notice the various smells and sounds around them. They are even more direct in *Fairy Trails*, as players act out a fairy play on a stage or dance along with the figures of a 19th-century iron sculpture. We note that, in general, children needed very little encouragement for playful activity: they were hungry for it, and left to their own discretion, they would engage in playful and exploratory activity anyway. Adults may be a different case, some seemingly needing more of a nudge toward playful behavior, but the impact of being watched during a playtesting session should not be overlooked here. Both apps provided a motivation or an excuse for parents to become more playful with their children. College students who tested *Fairy Trails* opened themselves up to new, playful, imaginative experiences. In a prototype that incorporated singing for a fairy, a group of young college men broke into a full chorus of the original *Pokémon* television series theme song. In itself a wonderful sight to behold, this also illustrates a testing of, and a strengthening of, the trust and friendship bonds recently explored by Cook *et al*. (2017) and Koster (2018). The hesitation that culturally adult groups have with this game echoes the cultural shift toward *ludus* and away from *paidia* that Callois (1961) described decades ago.

There are several formalisms from game design and design writ large that can provide insight into the unique design space explored by these two case studies. The activity-based analysis in the introduction establishes that people are engaged in a meaningful activity that produces desirable outcome, and a general systems approach (Meadows, 2008) highlights the power of feedback loops. Bateman (2017b) recently proposed a lens that views games as being comprised of *player practices*, and this certainly resonates with the activity-theoretic approach applied here. The rules, behaviors, expectations, and division of labor among players can be considered as practices that are embodied and spatially located. However, the systems-based atomic approach advocated by Koster (2012) observes that not all mechanical elements of a game are behaviors; some, such as physics in sports, are inherent to the system.

Using this systems perspective on our two case studies, we see that two kinds of feedback loops exist:

the conventional screen-based feedback loops as well as social feedback loops. An example of the former is the discovery of a fairy or spirit, which indicate positive progress' being made in the game. Examples of the latter are much more interesting and nuanced. In *Spirits at Prairie Creek Park*, there is a sense of peace that comes from quietly listening or smelling—the tranquility bordering on spiritual that one can feel when recognizing the beauty of nature. In *Fairy Trails*, we observe the strengthening of trust or friendship bonds, for example, when sharing hopes and dreams for the future; here is the positive feedback in a social dimension, coming with a feeling of belonging and kinship. Conducting analysis in terms of player practices, ludic elements, or skill atoms (Cook, 2007) can produce some insight into the construction of these games. However, we feel that the activity theoretic approach is the one that best captures the playfulness of these titles, since it is explicitly oriented toward balanced analysis of players, rules, contexts, mediating artifacts, and so on. Future work could investigate whether a ludological, systems-based design approach for such games is more or less fruitful than DeKoven's (2014) singularly whimsical *Playful Path* approach.

Art and Productivity

There is little doubt that *Spirits at Prairie Creek Park* lacks the visual polish of *Fairy Trails*, and it would be easy to make the erroneous conclusion that the latter had more of an art budget than the latter. Both projects had the same duration, budget, and resources, yet *Spirits at Prairie Creek Park* had four artists on its team to *Fairy Trails*' one.The *Spirits at Prairie Creek Park* team produced ten original spirit drawings, whereas the lone *Fairy Trails* artist produced six fairy drawings and three background illustrations; roughly speaking, the *Fairy Trails* artist appeared four times as productive as any artist on the other team. This was not the first time that we have witnessed a smaller art team outperforming a larger one in an Academic Studio project: the single artist working on *Traveler's Notebook: Monster Tales* (Studio 368, 2016; Gestwicki, Rittichier, & DeArmond, 2017) produced 17 original monster drawings along with several cinematic still images along with other miscellaneous visual elements. This raises an important and pragmatic question: given an otherwise equivalent environment in terms of budget, space, and methodology, what would make some art teams so much more productive than others?

The source of the problem for the *Spirits at Prairie Creek Park* team may have been "too many cooks." The four artists included one animation major, one student who changed her major from animation, and two non-art majors with significant hobbyist experience that included limited commercial work. The art major positioned herself as *de facto* art lead despite the team's explicit intention for a flat organizational hierarchy. Cultural differences between animation production and agile software development may be a contributing factor here. The animation production pipeline tends to use formal leads and rigorously scheduled milestones (Beane, 2012). This pipeline is akin to the waterfall model for software development, attributed to Royce (1970) and standard fare in software engineering textbooks such as Pressman and Maxim (2014), which presumes that requirements are known, correct, and unchanging. While these assumptions may be true in animation production, Royce himself derides these assumptions as dangerous for software development, foreshadowing the *Manifesto for Agile Software Development* (Beck *et al*., 2001) and its attention to changing requirements and rapid iteration. Given that the Academic Studio pedagogic framework is firmly rooted in the philosophy of agile software development (Gestwicki & McNely, 2016), it would come as no surprise that there could be culture conflicts between those enculturated in art production and those enculturated in software production. However, the lone artist on *Fairy Trails* was from the same animation program; more research is required in order to differentiate between personal, cultural, and organizational factors.

Regardless of differences in productivity, it is the lack of visual polish in *Spirits at Prairie Creek Park* that is truly astounding: one would expect a team that is almost half artists to be rigorously reviewing and improving the visual aesthetics. All Academic Studio teams engage in periodic retrospectives, following best practices of agile software development (Cockburn, 2006). Reviewing this team's retrospective notes reveals that the team was aware of the visual inelegance, and yet no one made the effort to improve it. It is important to note that, following Scrum (Schwaber & Sutherland, 2017), team members select their own work for each iteration; this means that if work is not done it is because no one on the team valued its being done, all else being equal. By contrast, the *Fairy Trails* team iteratively improved the layout and usability of their UI from the second iteration onward, learning and utilizing Unreal Motion Graphics to do so. Notably, this UI improvement was led entirely by students from technical majors with no significant art education. Hence, we tentatively conclude that the human factors (such as personnel, culture, and communication) rather than technological factors had a dominant impact on the usability and interface design of the final games. Untangling the various factors that contributed to the difference in artistic productivity between the two teams would have required a rigorous, embedded, ethnographic research approach such as those conducted by O'Donnell (2014) and Hashimov (2015), and we hope that the results reported in this paper help motivate more of such research.

Both games addressed in our case study are *free software* in the technical sense, meaning that they respect the four software freedoms identified by Stallman (2002): the freedom to run the program as you wish, the freedom to study how it works, the freedom to redistribute, and the freedom to distribute modifications. We believe that this philosophy is crucial for scholars of games to embrace for anything but strictly phenomenological study. The source code of video games is like the rules of a board game: it allows distinction between what is and what is not the game. It is only the source code access that allows us to properly contextualize and address the player's question about how *Fairy Trails* knows if you are dancing, for example. The source for *Spirits at Prairie Creek Park* and *Fairy Trails* are released under the GNU General Public License (Free Software Foundation, 2007) and can be found on GitHub at https://github.com/orgs/spring2017gamestudio and https://github.com/orgs/GuyFallsDownStudio, respectively.

Conclusions

Context-sensitive geolocative mediated group experience games have many positive properties for educational and serious purposes. They build upon existing networks of trust and friendship to produce rich opportunities for reflection and discussion. This allows for direct inclusion of social and emotional learning experiences in addition to other serious game design goals; these lessons are built directly into the embodied activity of the player rather than abstracted from a digital simulation. However, this style of game is still uncommon despite being technically feasible, and this can lead to complications in discoverability, expectations management, and learnability. The proliferation of digital education and entertainment options means that strategic use of contemporary marketing techniques may be required to overcome these challenges.

Our case studies demonstrate that there are opportunities for a scientific approach to game design as well as the analysis of game design environments. Deploying techniques such as activity theory, systems theory, software development methodology analysis, procedural rhetoric, and emerging theories of trust and friendship can bring new insight into how games are created. The phenomena under scrutiny will take the shape of the lens that is applied, and so further evaluation and integration of these models and additional qualitative research are necessary in order to differentiate the factors at play.

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References

Bateman, C. (2017a). No-one Plays Alone. *Transactions of the Digital Games Research Association*, vol. 3, no. 2. DiGRA.

Bateman, C. (2017b). Are Videogames Made of Rules? [Web log post]. Retrieved May 26, 2018, from http://blog.ihobo.com/2017/09/are-videogames-made-of-rules.html

Beane, A. (2012). *3D Animation Essentials*. Hoboken, NJ: Sybex.

Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., …, Thomas, D. (2001). *Manifesto for Agile Software Development*. Retrieved May 26, 2018, from http://agilemanifesto.org.

Bogost, I. (2010). *Persuasive Games: The Expressive Power of Videogames*. Cambridge, MA: MIT Press.

Caillois, R. (1961). *Man, Play, and Games* (M. Barash, Trans.). New York, NY: Free Press of Glencoe.

Carvalho, M. B., Bellotti, F., Berta, R., De Gloria, A., Islas Sedano, C., Baalsrud Hauge, J., Hu, J., & Rauterberg, M. (2015). An activity theory-based model for serious games analysis and conceptual design. *Computers & Education* (pp. 166-181). Volume 87. Amsterdam: Elsevier.

Clark, D., Konieczska, C., Sadler, A., & Wilson, K. (2012). *Descent: Journeys in the Dark* (2nd ed.). Roseville, MN: Fantasy Flight Games. [Board game].

Cockburn, A. (2006). *Agile Software Development: The Cooperative Game* (2nd ed.). Boston, MA: Addison-Wesley.

Cook, D. (2007). The Chemistry of Game Design. Gamasutra. Retrieved May 26, 2018, from https://www.gamasutra.com/view/feature/129948/the_chemistry_of_game_design.php

Cook, D., Bialoskursky, Y., Fulton, B., Fitch, M., & Gonzales, J. (2017). Game design patterns for building friendships [Web log post]. Retrieved May 21, 2018, from http://www.lostgarden.com/2017/01/game-design-patterns-for-building.html.

Darvasi, P. (2016). The Ward Game: How McMurphy, McLuhan, and MacGyver Might Free Us from McEducation. In Williams, C., *Teacher Pioneers: Visions from the Edge of the Map* (pp. 70-105). Pittsburgh, PA: Carnegie Mellon University: ETC Press.

DeKoven, B. L. (2014). *A Playful Path*. Pittsburgh, PA: Carnegie Mellon University: ETC Press.

Design Council. (2005). The "double-diamond" design process model. Retrieved May 21, 2018, from https://www.designcouncil.org.uk/designprocess.

Engeström, Y. (2015). *Learning by Expanding: An Activity-theoretical Approach to Developmental Research* (2nd ed.). New York, NY: Cambridge University Press.

Falk, J. H. & Dierking, L. D. (2013). *The Museum Experience Revisited*. New York, NY: Routledge.

Fallon, J. & Darvasi, P. (2017). Privacy, Pedagogy and Protocols. In Caldwell, K. E., Seyler, S., Oschner, A. & Steinkuehler, C. *Games + Learning + Society (GLS) Conference 12.0* (pp. 271-277). Pittsburgh, PA: Carnegie Mellon University: ETC Press.

Fox, T. (2015). *Undertale*. [Video game].

Flame Llama Studio. (2017). *Spirits at Prairie Creek Park*. [Video game]. Muncie, IN: Ball State University. http://spiritsatprairiecreek.com.

Free Software Foundation. (2007). *GNU General Public License* (version 3). Boston, MA: Free Software Foundation.

Gestwicki, P. & McNely, B. (2016). Interdisciplinary Projects in the Academic Studio. *ACM Transactions on Computing Education*. 16(2). New York, NY: ACM.

Gestwicki, P., Rittichier, K., & DeArmond, A. (2017). Culture-narration games: A definition and pilot study. In Caldwell, K. E., Seyler, S., Oschner, A. & Steinkuehler, C. *Games + Learning + Society (GLS) Conference 12.0* (pp. 261-270). Pittsburgh, PA: Carnegie Mellon University: ETC Press.

Gottlieb, O. (2017). New Design Principles for Mobile History Games. In Caldwell, K. E., Seyler, S., Oschner, A. & Steinkuehler, C. *Games + Learning + Society (GLS) Conference 12.0* (pp. 271-277). Pittsburgh, PA: Carnegie Mellon University: ETC Press.

Guy Falls Down Studio. (2018). *Fairy Trails*. [Video game]. Muncie, IN: Ball State University.

Hajek, N. I. & Kemppainen, J. (2016). *Road to Legend*. Roseville, MN: Fantasy Flight Games. [Android and iOS app].

Hashimov, E. (2015). Immersive Learning, Multiliteracies, and Reflective Practice through Scrum (Unpublished doctoral dissertation). Ball State University, Muncie, IN.

Holden, C. L. & Sykes, J. M. (2011). Leveraging Mobile Games for Place-Based Language Learning. *International Journal of Game-Based Learning*. 1(2), 1-18. IGI Global.

Huizinga, J. (1949). *Homo Ludens: A Study of the Play-Element in Culture*. London: Routeledge & Kegan Paul.

Kaptelenin, V. & Nardi, B. A. (2006). *Acting with Technology: Activity Theory and Interaction Design*. Cambridge, MA: MIT Press.

Klopfer, E., Osterweil, S., & Salen, K. (2009). *Moving Learning Games Forward*. Cambridge, MA: The Education Arcade: MIT.

Koster, R. (2012). An Atomic Theory of Fun Game Design. [Web log post]. Retrieved May 26, 2018, from https://www.raphkoster.com/2012/01/24/an-atomic-theory-of-fun-game-design/

Koster, R. (2013). *Theory of Fun for Game Design* (2nd ed.). Sebastopol, CA: O'Reilly Media.

Koster, R. (2018). The Trust Spectrum [Web log post]. Retrieved May 21, 2018, from https://www.raphkoster.com/2018/03/16/the-trust-spectrum.

Lang, E. (2016). *XCOM: The Board Game*. Roseville, MN: Fantasy Flight Games. [Board game and Android/iOS app.]

Legendary Native American Figures: Pukwudgie (2015). Retrieved May 21, 2018, from http://www.native-languages.org/pukwudgie.htm.

Meadows, D. H. (2008). *Thinking in Systems*. White River Junction, VT: Chelsea Green Publishing.

Mills-Rittman, E. (2017). *Down the Wishing Well*. [Video game prototype]. Ball State University.

Nicholson, S. (2012). Completing the Experience: Debriefing in Experiential Educational Games. In *Proceedings of the 3rd International Conference on Society and Information Technologies* (pp. 117-121). International Institute for Informatics and Systemics.

Nelson, T. J. (2017). Occupied Paris. In Caldwell, K. E., Seyler, S., Oschner, A. & Steinkuehler, C. *Games + Learning + Society (GLS) Conference 12.0* (pp. 287-294). Pittsburgh, PA: Carnegie Mellon University: ETC Press.

Norman, D. (2013). *The Design of Everyday Things: Revised and Expanded Edition*. New York, NY: Basic Books.

O'Donnell, C. (2014). *Developer's Dilemma*. Cambridge, MA: MIT Press.

Orr Group. (2012). *Roll20.* https://roll20.net. [Web app].

Phelps, D. (2016). Using Activity Theory to Design Game-Based Learning Environments. *SIMAGES* 2016.1. NASAGA.

Pokémon Go. (2016). Niantic, Inc. [Video game].

Pressman, R. S., & Maxim, B. R. (2014). *Software Engineering: A Practitioner's Approach* (8th ed.). New York, NY: McGraw-Hill.

Royce, W. W. (1970). Managing the Development of Large Software Systems. *Technical Papers of Western Electronic Show and Convention* (pp. 1-9). IEEE.

Schiller, J. G. (1997). *Digging for Treasure: An adventure in appraising rare and collectible children's books*. Bloomington, IN: Indiana University: Friends of the Lilly Library.

Schneider, J. (2015). The Double Diamond: Strategy + Execution of the Right Solution. ThoughtWorks. [Web log post]. Retrieved May 23, 2018, from https://www.thoughtworks.com/insights/blog/double-diamond.

Schreiber, I. (2009). *Game Design Concepts*. [Web log]. Retrieved May 23, 2018, from https://gamedesignconcepts.wordpress.com.

Schwaber, K. & Sutherland, J. (2017). *The Scrum Guide* (November 2017 ed.). Retrieved May 21, 2018, from https://www.scrumguides.org.

Stallman, R. (2002). *Free Software, Free Society*. Boston, MA: GNU Press.

Studio 368. (2016). *Traveler's Notebook: Monster Tales*. [Video game]. http://travelersnotebookgame.com

Valens, N. (2016). *Mansions of Madness* (2nd ed.). Roseville, MN: Fantasy Flight Games. [Board game and Android/iOS app].

A CASE STUDY OF DREAMWALK – LEVERAGING MYTH AND RITUAL FOR GAME DESIGN

Leveraging Myth and Ritual for Game Design

DORIS C. RUSCH AND ALLEN TURNER

Extended Abstract

How can we design games that shed light on the human experience and can contribute to a meaningful life? This is a big question that seems to hold much interest for the gaming community. It is also an incredibly daunting one, screaming for definitions and qualifications: what is a meaningful life? To whom? How do we know a game is contributing to it?

The authors do not believe there are final answers to any of these concerns. There is no recipe that spells out how you create anything meaningful and transformative. And the kind of impact we are looking for so complex and personal, eludes measurement (see Paolo Pedercini's "Making Games in an F*** Up World", 2014). Yet, we have some thoughts we would like to share, hoping to inspire transformative games.

We propose drawing on myth and ritual (=enacted myth) with their archetypal patterns and transformative structures in order to create games that have the potential to increase our understanding of ourselves and others and construct our relationship to ourselves and the world around us. This approach is informed by an existential perspective. According to Irvin Yalom, the human experience is characterized by anxiety, stemming from the Givens of Existence or Ultimate Concerns: death (life is finite), freedom (we have to make choices and it is unclear what they should be based on), existential isolation (we are all ultimately alone in this universe), and meaninglessness (life has no inherent meaning, we have to find our own) (Yalom, 1980, pp.8-9). When we speak of games that can contribute to a meaningful life, we specifically mean games that help players grapple with the Givens of Existence – feelings of loss, loneliness, alienation, purposelessness, choice and suffering – in ways that can put them on a path to coming to terms with these experiences and discover their authentic desires, aspirations, connectedness, human potential and "bliss".

There is a close connection between existentialism and mythology. "A myth is a way of making sense in a senseless world" (May, 1991, p.15) and to "reconcile consciousness to the preconditions of its own existence; that is to say, the nature of life." (Campbell, 2004, p.3). In myth and ritual metaphor and symbolism become messengers from the unconscious, shedding light on what goes on "down below", bringing us back in touch with our deeper selves (see Segal, 1998; Larsen, 1996; Feinstein and Krippner, 1997; Jodorowski, 2004). Myth and ritual are excellent starting points for transformative game experiences, as the purpose of myth since the dawn of humankind has been to reveal the

struggles of the human psyche and provide a guide to overcome them. This guide resides in the story structure and the actions taken that bring about the hero's transformation or demise. (Bonnett, 2006).

In *Pathways to Bliss – Mythology and Personal Transformation,* Joseph Campbell explains one function of mythology as **games people play**: "how to make believe you're doing thus and so. Ultimately, through the game, you experience that positive thing which is the experience of being-in-being, of living meaningfully." (2004, p. 6). Campbell is speaking of games metaphorically: when reading the story, we pretend we're in it, we pretend we're the hero, and we look at the world through his / her eyes. We live in a time now, where we can understand Campbell's statement literally, though: we can actually make *games* that allow people to explore new ways of acting and being – of "owning" the myth in a manner not previously possible in non-interactive, linear media. The intersections between games and ritual (as enacted myth) and other symbolic performative arts have been investigated in-depth by Huizinga (1955), Caillois (2001), (Schechner 1985) and Turner (1992), and we can identify one of their salient, common denominators as being liminal spaces or "inter-structural situations" in which participants are free to experiment with new identities and play with social norms within the magic circle. This relationship is further emphasized by Murray who speaks of games as symbolic dramas that allow us to enact our basic relationship with the world ((1997, pp.142-144)). Velázquez, Soares and Mendes further emphasize the emotional and symbolical language of videogames which mirrors that of myth, allowing games "to cast a powerful spell that, far from providing the cold and tired approach to rational denotative power, seduces us through the dynamics of its resources and opening an authentic playing field between the domain of simulation and the human realm." (2015, p. 8).

Not every game, however, is infused with mythical content, archetypal patterns, evocative symbolism or potent, ritualistic performance. We still have to design for that – we have to design for experiences that facilitate self-reflection, emotional resonance and transformation. This requires exploration along two axes: 1) The Self: how can we access our own imaginations and creative unconscious to birth viable symbols and emotionally resonating, archetypal game content (see Feinstein and Krippner 1997; Larsen 1996; Bonnett 2006; Conner 2008)? 2) The Intersection of Ritual and Game: what can we learn from ritual and other psycho-technologies that are based on performative, symbolical acts that access the unconscious (e.g. Jungian psychodrama (Moreno, J.L. and Moreno Z.T., 2011) and sand-play therapy (McCarthy, 2015) as well as shamanic psychotherapy (Jodorowski, 2004) to inform evocative and transformational game structures and mechanics? A thorough discussion of these axes can inform a conceptual, theoretical framework of mythical, existential game design, but goes beyond the scope of this paper. We are thus focusing on a particular case study of a table top, storytelling, role playing game called *DreamWalk* that shall serve as a first, concrete illustration of how we can leverage self-exploration, myth and ritual for game design.

Case Study *DreamWalk*

DreamWalk is a game of personal exploration through storytelling and mythmaking. It is an adventure game that waits for player participation to form its narrative definition. We designed processes and rituals to help players to get into the proper mindset for engaging the deeper play loop of the game. The game is made of the following parts.

The first part is the players' part. It is the creation of a self that will navigate and explore the Dreamspace. In making avatars, or dream self, players have to identify important pieces of themselves which we call virtues. These virtues are narrative elements that are the inventory of tools that they bring into Dream with them. Each player identifies three virtues which will be used to help them engage the narratives that arise in play. Players also identify a flaw. This flaw represents the constant struggle and the part of themselves that causes not only trouble for others, but also for themselves. There is an understanding that it is all the troubles, of all the players, working in unison, that are the destabilizing factors of the Dream that would otherwise be at balance and a source of nourishment. In addition, players all have to manage a resource called Essence. Essence represents the inherent creative ability in everyone. It presumes that no one is mundane and that we all have a magical spark. Care must be taken to ensure that the spark doesn't take us towards madness or allow us to turtle into extreme comfort spaces of bliss. Essence is consumed, generated and transformed as the player interacts with the places and denizens of Dream. When a player's Essence falls out of balance (too much madness or too much bliss) they disappear from dream and have to tell stories to their companions that allow them to re-enter the Dream.

The second part of the game is the Dream itself. The Dream is comprised of The Maelstrom, which lies at the heart of Dream, generating troubles which creep out into the world. The Havens, which are locations in Dream that represent archetypal ideals of nourishment and growth; places where learning and transformation can happen. Lastly there are the Dwellers who represent all sort of archetypal personifications. The Dwellers have interactions and needs in relation to each other, representing collaborating or conflicting inner forces. As the player meets and interacts with the Dwellers, the Dweller's present trials to the player – i.e. the Self striving towards fulfilling of its potential expressed through building and meaningfully transforming its Essence. The trial is presented in the form of a card that suggests it is about helping or hindering another Dweller. On the card is one word, an action verb like "love", or "take" or "guard", that sets the nature of the interaction.

The player's role in dream is to meet the Dwellers, project their own ideas onto the dwellers to give them identity and then describe the story of the interaction and what trial is at hand. The players create myth where they must alternately claim the roles of protagonists and perpetrators. They then support or challenge each other to overcome the challenge or add to the narrative of the challenge. Success brings the players closer to overcoming their own flaws, which allows them to all, eventually, descend into the Maelstrom and tame it once they've turned their own flaws into virtues. The taming of the Maelstrom and bringing balance to Dream is the endgame, representing the integrative nature of living your authentic self and coming to terms with existential struggles.

Because of the introspective nature of the storytelling process, the players don't do all of this alone. The game requires an extra player, the Scribe, whose role is to ask the players what they're doing, why they're doing it, what they find in the Dwellers, what they perceive the Dwellers needs to be, and how those needs speak to each other. The Scribe also tends to the troubles that are spilling into the world from the Maelstrom, which players mut also manage else they overwhelm the Havens. If a Haven is overwhelmed with troubles it is lost to Maelstrom. If enough Havens are lost, the Maelstrom is empowered to swallow everything. This, too, ends the game.

We intend this case study to be an illustration of how salient elements of myth and ritual – narrative events as representations of internal processes, characters as personifications of inner aspects, symbols as evocative images from the soul (places, resources) and symbolic action as vehicle for transformation to make the ideal real – can be leveraged for game design. Clearly, a life action role playing game has very specific affordances that digital games do not possess and more theoretical investigation as well as application of theory to design experimentation is required to build a robust conceptual framework that can guide the design of games that tackle existential themes the way myth and ritual do and potentially contribute to a meaningful life.

References

Bonnett, J. (2006): *Stealing Fire from the Gods.* Studio City, CA: Michael Wiese Productions.

Caillois, R. (2001): *Man, Play and Games*. Urbana and Chicago: University of Illinois Press

Campbell, J. (2004): *Pathways to Bliss.* Novato, CA: New World Library.

Conner, J. (2008): *writing down your soul.* San Francisco, CA: Conari Press.

Feinstein, D. & Krippner, S. (1997): *The Mythic Path*. New York, NY: Tarcher / Putnam. Gazzard, A. & Peacock, A. (2011): Repetition and Ritual Logic in Video Games. *Games and Culture, 6* (6), 499-512. doi: 10.1177/1555412011431359

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

G4C14 [Games 4 Change]: (2014, May, 1) Paolo Pedercini Making Games in an F**** Up World. [Video file]. Retrieved from https://www.youtube.com/watch?v=MflkwKt7tl4

Huizinga, J. (1955): *Homo Ludens; A Study Of The Play-Element In Culture*. Boston, MA: Beacon Press.

Jodorowski, A. (2004): *Psychomagic.* Rochester, VT: Inner Traditions.

Larsen, S. (1996): *The Mythic Imagination*. Rochester, VT: Inner Traditions.

May, R. (1991): *The Cry for Myth.* New York and London: W.W. Norton & Company.

McCarthy, D. (2015): *Deep Play. Exploring the Use of Depth in Psychotherapy with Children.* London, UK: Jessica Kingsley Publishers.

Moreno, J. L., & Moreno, Z. T. (2011). *Psychodrama*. New York: Beacon House.

Murray, J. (1997): *Hamlet on the Holodeck*. Cambridge, MA: MIT Press.

Schechner, R. (1985): *Between Theater and Anthropology*. Philadelphia, PA: University of Pennsylvania Press.

Segal, R. A. (1998): *Jung on Mythology.* Princeton, NJ: Princeton University Press.

Turner V. (1982). From ritual to theatre: The human seriousness of play. London, England: The John Hopkins University Press

Velázquez, C.; Soares, A. & Mendes, P. (2015). Technology in Games. Myth as Encouragement to Experience the Real. *The International Journal of Critical Cultural Studies, 14* (1), 1-10.

Yalom, I. (1980): *Existential Psychotherapy.* New York, NY: Basic Books.

EOTA: A METHOD FOR IMPROVING PEER FEEDBACK IN THE GAME DESIGN CLASSROOM

JESSICA HAMMER AND AMY COOK

Abstract

Peer feedback is an essential part of the iterative game design process. Peer feedback requires students to develop a range of skills, both to provide high quality feedback to others and to reflect on the feedback they receive. Students also often engage in reflection activities as a team, requiring even more skill development for effective peer feedback exchange to occur. Students often struggle to develop the skills necessary for giving and receiving feedback effectively. This paper presents the EOTA method, a pedagogical approach designed to elicit formative feedback during in-class playtests of student games. We discuss our experiences using the EOTA method in university-level game design classes and identify how the EOTA method can help address issues that often arise in peer feedback exchange, such as supporting student engagement, improving *quality* of student feedback, and helping students reflect on feedback received.

Introduction

For game designers, peer feedback is a critical part of the iterative design process (Fullerton, Swain, & Hoffman, 2008). Designers in industry must integrate feedback from teammates, and often seek additional input from colleagues outside their immediate team. Feedback from players is also critically important to the game design process because games are emergent systems, which are difficult to fully understand until they are played (Salen & Zimmerman, 2004). The game design classroom provides opportunities for students to engage in peer feedback during live critiques, such as project presentations or live playtests, and to respond to peer feedback during their iterative design process.

Peer feedback requires the development of a range of student skills (Butler & Winne, 1995; Liu & Carless, 2006). In their role as game designers, students must learn to listen carefully to the feedback they are getting, to interpret and analyze it, to critically evaluate it, and finally to incorporate it into their designs. In their role as feedback providers, students must learn to provide relevant and high-quality feedback on game designs and prototypes. Mastering these skills benefits students' learning; feedback receivers improve their self-regulated learning abilities (Butler & Winne, 1995) and develop self-assessment skills (Liu & Carless, 2006), while feedback providers learn to recognize what good work looks like and to correctly interpret standards and criteria (Nicol & Macfarlane-Dick, 2006). Additionally, peer feedback provides benefits for instructors, as they can see students' reasoning about games, and can scale feedback processes beyond what they personally can provide (Kulkarni, Bernstein, & Klemmer, 2015).

In practice, however, students struggle with both delivering and receiving constructive feedback on game design. These struggles are not unique to game design, but rather reflect larger challenges around the peer feedback process. Prior research has shown that peer feedback faces issues with student engagement, feedback quality, and how feedback is reflected on and used in the iterative design process (Ertmer et al., 2007; Kulkarni et al., 2015; McMahon, 2010). However, these issues can be mitigated with the appropriate design of pedagogical methods and/or educational technologies (Shannon, Sciuto, Hu, Dow, & Hammer, 2017).

This paper presents one such pedagogical approach, the EOTA method. EOTA is designed to elicit formative feedback during in-class playtests of student games. It uses an end-to-end approach, considering *before feedback*, *during feedback*, and *after feedback* as opportunities to intervene in the peer feedback process. Finally, it addresses three key issues in peer feedback: supporting student engagement in the peer feedback process, improving the quality of peer feedback that students provide, and helping students reflect on the feedback they receive from peers.

Literature Review

We draw on existing literature about peer feedback in the design classroom to identify benefits and challenges of peer feedback that affect game design students.

Peer Feedback in the Design Classroom

Giving and receiving feedback is an essential skill for design students (Beyer & Holtzblatt, 1997; Fullerton et al., 2008). Peer feedback provides an opportunity for students to get more feedback (Topping, 1998) and faster feedback (Kulkarni et al., 2015) than if the instructor was the only feedback provider. This is particularly important in game design classrooms, when students need feedback to rapidly iterate game prototypes. Peer feedback is also an essential aspect of playtesting, or using feedback from play to guide game design (Choi et al., 2016; Fullerton et al., 2008). Peer feedback provides opportunities for students to learn to incorporate player feedback into the next iteration of a game.

Benefits of Peer Feedback for Stakeholders

The peer feedback process has three stakeholders: feedback providers, feedback receivers, and instructors. Each stakeholder benefits from peer feedback in different ways. Feedback providers learn to recognize what "good" work looks like and to correctly interpret standards or criteria (Nicol & Macfarlane-Dick, 2006). Providers also learn to focus their feedback on a student's work, rather than on the student's personal characteristics (Gibbs & Simpson, 2004). By reflecting on feedback given by others, feedback receivers improve their self-regulated learning skills (Butler & Winne, 1995) and self-assessment abilities (Liu & Carless, 2006). Instructors benefit because peer feedback lowers their burden to generate comments for the entire class in a timely manner (Topping, 1998). Prior work shows that peer feedback can be equally as effective as expert feedback (Cho & Schunn, 2007;

Topping, 1998), and peer feedback allows students to get a high quantity of feedback and a more diverse set of feedback, which enhances their learning experience (Beyer & Holtzblatt, 1997).

Challenges of Peer Feedback

Whether peer feedback is conducted as a verbal, written, or digital process, researchers have identified three key challenges to learning from peer feedback.

First, students often struggle to engage in the peer feedback process. During verbal critique, only a few students have the opportunity to speak, and the conversation may become dominated by one or two voices. Written or digital critique can be time consuming for students (Ertmer et al., 2007), which may cause them to begrudge the peer feedback process (Kulkarni et al., 2015).

Second, students may not learn to improve the quality of feedback they give. While prior work shows that peer feedback varies in quality (McMahon, 2010), it has not shown that students improve over time. In addition, all three feedback methods limit the number of perspectives feedback providers are exposed to (Beyer & Holtzblatt, 1997; McMahon, 2010), so struggling students are not shown what better feedback looks like.

Third, students may not know how to reflect on the feedback they receive. Peer feedback is only helpful if reflected on (Gibbs & Simpson, 2004), but typically students are not supported during reflection. Prior work in digital feedback systems has struggled to help students reflect on feedback and integrate feedback into future work (Kulkarni et al., 2015).

The EOTA method seeks to address the challenges of engaging students in the peer feedback process, helping students improve the quality of feedback they provide, and helping students reflect on feedback they receive.

The EOTA Method

The EOTA method is a set of pedagogical activities designed to enhance the peer feedback process. It is meant to be implemented in support of feedback provision during live in-class playtests of student games. However, EOTA is an *end-to-end process.* It begins before peer feedback is provided, with training activities to help students engage in effective peer feedback. It continues during the provision of live peer feedback during in-class playtesting. Finally, after designers receive their feedback, it includes methods to help students reflect on feedback they received and integrate it into their designs.

EOTA is a non-digital method; no technology is required to participate. EOTA can be applied to digital and non-digital games. For the purposes of this paper, we assume that in-class playtests involve paper prototypes, either of digital or non-digital games. However, the method can be used for digital games as long as students can see both the playtester(s) and the screen.

Finally, we clarify how we will use a few key terms. These terms are important because in peer feedback, students serve both as feedback *receivers* and as feedback *providers*. We therefore distinguish students by these roles. ***Designers*** are students in their role as feedback receivers; their game is playtested by peers, and they must interpret the feedback they receive as they iterate their game. ***Players*** are the students who played the game. ***Peers*** are students who observed the playtest. Both players and peers take the role of feedback provider. ***Students*** refers to all students in the class, regardless of role. Finally, ***instructors*** can include faculty, teaching assistants, or other course staff.

Before Feedback: Norm-Setting Through Low-Stakes Design Activities

The EOTA method begins with training students to value and engage with the feedback process. It uses short-form, low-stakes design activities that require students to create imperfect work, and treats them as both opportunities to practice gaining critical distance from a game and opportunities to practice giving and receiving feedback. For example, in Five Spoons, teams of students must create a game given insufficient time and challenging materials (five spoons, plus one item from each person's pockets or bag). Designers must then iterate their game multiple times, each time with additional constraints and less time for the design process. The final round of iteration is a frantic one-minute scramble to make decisions and change the rules.

After each round of design and/or iteration, one or more teams of designers are selected to share their game with the class. All teams must share their game at least once. The instructor then models providing one piece of helpful feedback per game, and explains what about that piece of feedback made it helpful. Optionally, instructors may also model unhelpful feedback.

At the end of the entire activity, the instructor explains how this process will play out in the rest of the class. As designers, students will share work in progress and will be expected to hear critical feedback. As peers, students will be asked to provide high-quality feedback. Finally, the instructor led the class in applause and welcome all students to the game design community.

The Five Spoons exercise makes it impossible for students to succeed in any conventional way. Students must show imperfect work to the class. Students also know that all other students were also faced with an impossible task and are showing imperfect work. This can help detach student egos from their projects and prepare them to hear feedback (Boud & Molloy, 2013). By closing with a celebration, students receive positive reinforcement for sharing work-in-progress, for being non-defensive about their game, and for participating in a feedback process (Värlander, 2008). These factors can support student engagement with peer feedback.

Additionally, students-as-peers have the opportunity to hear the instructor model high-quality feedback and reflect on what makes it successful. In addition to learning about high-quality feedback in the context of a real project, Five Spoons lowers the stakes for providing critical feedback, and can help peers be more willing to provide critical feedback in the future. These factors can improve the quality of peer feedback (Nicol & Macfarlane-Dick 2006).

Instructors may create their own low-stakes design activities as part of the EOTA process, using the following principles:

1. Activities should be ungraded. Creating external stakes for students will make them more, not less, attached to having a "good" outcome (Craven, Marsh, & Debus, 1991).
2. Activities should be short. The more time students invest, the higher the expectations. Students should not continue working on their designs beyond a single class period.
3. It should be impossible to succeed at the design activity in any conventional sense, which

lowers the stakes for the design activity (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011).

4. Instructors should model helpful feedback, and reflect aloud on why it is helpful. Instructors can also share examples of unhelpful feedback with reflection, if time permits (Nicol & Macfarlane-Dick 2006).
5. Instructors should end the activity by celebrating and applauding the imperfect work, and welcoming students into the community of game designers.

During Feedback: Experiences, Observations, Theories, Advice

As noted earlier, the EOTA method is meant to be used with in-class playtests of student games. This portion of the method describes what happens at the in-class playtest sessions.

Ideally, one team of designers playtests at a time. The instructor should arrange the room so that all peers can see the game-in-progress. However, for larger classes or if time is short, teams can playtest in parallel. The instructor can select an initial set of teams to playtest their games, and assign each team a group of players and peers such that every game has 1) sufficient players and 2) at least three peer observers. Students maintain one role through the full EOTA process, then rotate roles when they move on to the next game.

Before the first playtest of the class session, the instructor should remind the class about the purpose of the feedback session. Designers are there to learn, not to advise on strategy or to get players to play 'correctly.' Designers will be evaluated on how much they learn, not on how well their game meets their expectations. Players and peers should be specific, concrete, and kind when providing feedback. They will be evaluated on how effectively they help the design team accomplish their goals.

The first portion of the playtest often involves players learning the rules. Ideally, designers will have provided the rules to playtesters in advance. However, if players need to learn the rules during the playtest session, designers should teach rules *within* the context of play. For example, the designers might give players the rules just-in-time during a sample game round, instead of reading all the rules aloud and expecting players to remember what to do.

During play, the designers are permitted to answer player questions about the rules, or correct a misplay. However, if the designers begin discussing strategy or helping players play "correctly," the instructor should intervene. For example, "The rules say you must discard two cards" is allowable, but "if you discard two cards then you can gain more territory" is not. The instructor should judge when the playtest is complete.

When the playtest is complete, the feedback process begins. Designers should take notes on everything they hear, but should not record the conversation without the class's permission. From this point onwards, designers may not speak, except to say "Thank you," unless explicitly told to say something by the instructor. If designers are asked a question, they should note down the question, not answer it in that moment. Designers should not get involved in the feedback or treat it as a conversation. Listening without responding can be difficult for student designers, and instructors should be prepared to enforce this rule repeatedly. Peers and players should address their comments to the group rather than directly to the designers, which will help designers decenter themselves and stay detached from their design.

The EOTA feedback process includes four stages: players describing their *experiences*, players and peers describing things they *observed*, players and peers developing *theories*, and players and peers delivering *advice*. Within each stage, instructors should use a strategy for calling on students that maximizes the diversity of student perspectives. A "numbering" approach can be particularly effective. In numbering, the instructor asks students to raise their hands and counts them off; the instructor does not move on to actually taking comments until the desired number of hands have been raised. Students will get a chance to speak when the instructor calls their number. If more students raise their hands during the discussion, the instructor can flash a number at them with their fingers or quietly assign them a number without interrupting the group. The instructor should not let students interrupt each other or jump the line, as those behaviors will reduce the diversity of comments. With these things in mind, the instructor leads the following four feedback phases, as described in Figure 1:

Experiences. **Only players** may speak. They may describe their strategy, their behavior, or their internal experiences during the game. They can explain why they made the choices that they did, but should not theorize about other players or offer advice about the game.

Observations. **Peers and players** may speak. They should describe things they noticed, focusing on observable behavior or on specific moments of gameplay. They should not theorize about why they observed what they did, only provide data.

Theories. **Peers and players** may speak. Using experiences and observations, participants may now theorize about why they saw what they saw. During this phase, the instructor can encourage students to make reference to game rules and to class readings as appropriate. The instructor should reflect back and/or rephrase student theories as needed, but should not allow other students to start a discussion of those theories.

Advice. **Peers and players** may speak. Based on the theories derived by the group, participants may now make suggestions for how the designers should iterate their game. The instructor should encourage students to phrase their comments in the form of, "In order to X, you could Y." By linking proposed changes to imagined outcomes, peers will make it easier for designers to determine whether they want to follow up on a given design proposal. During this phase, the instructor should steer participants away from building on or iterating each other's proposals. Having people raise their hands at the beginning, before they hear one another's comments, will help with this.

Phase		Players	Peers	Designers
Collect Data	E - Experiences	Describe personal strategy or explain choices they made while playing.	Silently listen.	Silently take notes. May say “thank you” (but nothing more) in response to feedback.
	O - Observations	Describe observable behaviors they noticed during specific moments of gameplay.		
Share Ideas	T - Theories	Using experiences and observations, theorize about why they saw what they saw.		
	A - Advice	Based on the theories derived by the group, make suggestions for how the designers could iterate their game.		

Figure 1. Explanation of the EOTA method. The EOTA method structures peer feedback after in-class playtests by providing scaffolds for what type of feedback to give at each stage.

If students try to contribute something that belongs in a later phase (e.g. advice during the observation phase), the instructor should cut them off and ask them to hold it for later. If students contribute something that belongs in an earlier phase (e.g. an observation during the theory phase), the instructor should note that they have done so but accept the contribution. For example, the instructor might comment, “Thanks, that is a great observation that will help us continue to build theory.”

All students who raised their hand at the beginning of a given phase should have the opportunity to share their insights so that designers can get as many different perspectives as possible (Beyer & Holtzblatt 1997). Instructors should use their judgment about when to move to the next phase and warn students when only a few more comments will be taken.

At the end of the process, the instructor may synthesize key themes from the student feedback and summarize to designers. They should always thank the designers for sharing their game and lead the rest of the class in applause.

Using this method during in-class feedback sessions helps *engage* students in the feedback process. By collecting multiple experiences, observations, and theories before moving on to advice, this method captures a breath of perspectives and prevents peers who are verbally fluent from dominating the entire feedback process (Beyer & Holtzblatt 1997). It also reduces students echoing and/or arguing with one another by making them pre-commit to comments before they hear what others have said, and by having the instructor explicitly interrupt such behavior. By conducting the feedback sessions during class, it both expresses to students that feedback is valuable and encourages them to participate without an additional burden of finding time outside of class (Kulkarni et al. 2015).

The EOTA method demands that peers engage with evidence (experiences and observations) before ideas (theories and advice). By the time they are allowed to theorize or advise, peers have many concrete observations to draw on to justify their feedback. Additionally, framing feedback as “theories about observed phenomena” can help peers be critical, as the focus of the feedback moves from the designer and the game to the experiential and observational data collected by the group. This process therefore supports feedback that is both critical and justified, which are key elements of high-quality feedback (Gibbs & Simpson 2004).

Similarly, this process provides designers with both evidence and ideas. In feedback methods where peers primarily provide suggestions, suggestions may not align with the designers' goals, or the designers may not have enough information about the ideas underlying those suggestions to use them effectively. The EOTA method takes a different approach. Because peers build a body of evidence before offering ideas, designers gain insight into what provoked particular suggestions. Designers can also use the underlying observations or experience reports even if the suggestions are unhelpful. This supports designers in *reflecting* on feedback, and incorporating the feedback into their design (Gibbs & Simpson 2004).

After Feedback: The Process Document

The value of formative feedback on game design projects is in how the feedback is used during the iterative design process. At the end of each game design project, student design teams are required to submit a process document along with their game. This document provides insight into how students used feedback and iterated their game.

In contrast to a postmortem, which summarizes lessons learned, a process document is expected to show artifacts from the design process and to expose the team's reasoning about how those artifacts were created, evaluated, and iterated. Reading a process document helps the instructor understand *how* a design team reached their final design, and should expose the team's thinking as much as possible. A sample assignment for a process document might be:

Explain how you made what you made. Show your iterative design process and how you changed your design over time. What unsuccessful designs did you explore? What made you decide not to pursue them? Document your playtest process, particularly showing what you expected to learn and how you designed your playtests. What technical challenges did you face, and how did you overcome them? Include sketches, photographs, or other visuals as necessary to show your process, e.g. iterations of your project over time.

While there is no specific requirement to use information from the in-class playtests, teams must write about how playtesting and feedback informed their design.

It is important that process documentation is graded. A grading rubric for process documents should involve evidence of the team's critical thinking, the inclusion of materials from multiple phases of the game's design, and any work that may not be evident in the final product (e.g. because the materials were cut for scope reasons or did not survive playtesting).

Process documents require designers to select which feedback they will report on, as the design team typically has a limited amount of time to produce the process document and a limited amount of space in the document itself. This selection process forces designers to evaluate the quality of feedback they receive; in turn, the insights from this evaluative process can help them improve the *quality* of their own feedback in the future (Nicol & Macfarlane-Dick 2006). Teams must also *reflect* on the feedback received as part of the selection process, as they determine how to incorporate it into the story of their design process (Gibbs & Simpson 2004).

Initial Observations from Classroom Deployments Context for Previous Classroom Deployments

As described in Figure 2, we believe that the EOTA method supports these aspects of the peer feedback process based on observations from a decade's worth of game design classes involving hundreds of students. During this time, the method has been iteratively developed and adjusted to address problems observed in the classroom, such as a few opinionated students dominating the discussion and reducing the diversity of the feedback. Additionally, we have experimented with using pieces of the method separately, which has allowed us to see the way these activities amplify one another when used together.

	Engagement	**Quality**	**Reflection**
Before feedback: All participants get norm-setting	Reduce fear of failure	Demonstrate high- and low-quality feedback	
During feedback: All participants use EOTA	Diversify participation & perspectives	Increase provision of justified and critical feedback	Provide many levels of data for teams to use
After feedback: Receivers create process document		Select feedback to respond to	Requires reflection on feedback use

Figure 2: Value of the EOTA method. The EOTA method addresses three common challenges of peer feedback: engagement, feedback quality, and reflection.

As part of our iterative development process, we observed student behavior during feedback sessions. This included both qualitative data (e.g. the nature of student comments) and quantitative data (e.g. the number of students who contributed to class discussion). We discussed this pedagogy with course staff, and requested feedback on the EOTA method from students. Finally, we evaluated student process documents, which included student reflections on what feedback they found useful and how they iterated their games as a result.

To date, classroom deployments of the EOTA method have included both digital and non-digital game design classes; class sizes ranged from 18 to more than 40 students and have included both graduate and undergraduate students. With one exception, which had only 20% female students, classes have been gender and racially diverse. All classes were taught at the university level, in four different departments across two universities. One university maintains an active games program, while at the other university, the classes being taught were the only game courses available.

Observed Benefits of the EOTA Method

Increased Student Engagement. Across this range of contexts, our observations to date suggest that the EOTA method engages a larger and more diverse group of students than more typical discussion-based feedback, including some students who otherwise do not participate in class discussion. This includes both a larger number of distinct observations about the game, and a larger number of competing theories or design directions.

Improved Feedback Quality. The quality of the feedback is also improved compared to open-ended feedback. When using EOTA, feedback providers refer to specific observations and experiences when building theories or providing advice. Feedback providers make fewer assumptions about the team's goals. They focus on explaining what they observed, rather than telling the team what they ought to have been trying to design for. In team process documents, teams almost always report iterating their game using the low-level feedback (experiences and observations) gathered during in-class playtesting, whether or not the class's synthetic work on theorizing and advising was helpful.

Higher Receptiveness to Criticism and Risk. We have also observed that EOTA can help students be more willing to engage with critical feedback. There are several possible failure states when students receive critical feedback. First, students may choose "safe" projects that they think will not be critiqued harshly by their peers. Second, students may be resistant to hearing and integrating feedback from players, peers, and/or experts. Finally, students may treat feedback as a to-do list, rather than critically selecting a response based on their own design goals. While these manifestations are quite different, they stem from the same issues: fear, defensiveness, and a lack of confidence in the student's identity as a designer. Low-stakes design activities, framing critical feedback as explanations of evidence, and rewarding students for critical thinking during the design process can help address these issues. During the iterative development of EOTA, we have observed that students become more willing to take risks, not only with their ideas but also with their personal choices. For example, students are more willing to take on new roles within their project group, such as volunteering to be a team's developer when they have limited prior experience. Students are also more willing to pivot their projects based on peer and/or expert feedback, to playtest work-in-progress, and to submit their projects to game design competitions and festivals. Overall, fewer students choose "safe" or boring ideas, and more students are willing to try experimental and exciting work, knowing that they can still be a successful game designer (and student!) if it fails.

Conclusion & Future Work

In this paper, we have presented the EOTA method, which works to address three major challenges of peer feedback: how to engage students with the process, how to improve the quality of peer feedback, and how to support designers in reflecting on the feedback they receive. Before feedback, low-stakes design activities can help students feel comfortable with the feedback process, and understand the difference between high- and low-quality feedback. During live peer feedback at in-class playtests, students use the EOTA method to structure feedback provision, which helps diversify participation, increase the amount of critical and justified feedback, and provides many levels of data for the team to use. Finally, design teams must create graded process documentation, which requires them to select high-quality feedback to engage with and to reflect on how to use it in the story of their game.

While we present this method in the context of live playtests during game design classes, it can be adapted to other types of project-based classes, with minor adaptation. For example, the EOTA method assumes that projects are interactive, and that players will have some insights not shared by observers. For projects where all peers have the same experience, such as watching a video, the "experience" and "observe" stages can be collapsed into one. Additionally, elements of this method can be used separately to target individual aspects of the peer feedback process. For example, Five Spoons has been used in a rapid prototyping class, as well as in an educational technology design class where students designed a learning activity instead of a game.

As future work, we look forward to a more formal validation of the impact of the EOTA method. We have a dataset that includes records of student feedback, process documents from game design projects, and the final versions of each game. We will also interview other game design educators who have used these methods in their classroom.

We also plan to extend our work to the game industry. In particular, we will explore the contextual differences between classrooms and workplaces, such as increased power distance between peers, and investigate how those differences affect EOTA. In the meantime, we hope that these activities are useful for improving feedback and supporting iterative design.

References

Beyer, H., & Holtzblatt, K. (1997). *Contextual Design: Defining Customer-Centered Systems*. Elsevier. Retrieved from https://books.google.com/books?hl=en&lr=&id=JxQaQgOONGIC&pgis=1

Boud, D., & Molloy, E. (2013). What is the problem with feedback? In *Feedback in Higher and Professional Education* (pp. 1–10). London. Retrieved from https://www.researchgate.net/publication/298095123_What_is_the_problem_with_feedback

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research*. Retrieved from http://rer.sagepub.com/content/65/3/245.short

Cho, K., & Schunn, C. D. (2007). Scaffolded writing and rewriting in the discipline: A web-based reciprocal peer review system. *Computers & Education*, *48*(3), 409–426. http://doi.org/10.1016/j.compedu.2005.02.004

Choi, J. O., Forlizzi, J., Christel, M., Moeller, R., Bates, M., & Hammer, J. (2016). Playtesting with a Purpose. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play – CHI PLAY '16* (pp. 254–265). New York, New York, USA: ACM Press. http://doi.org/10.1145/2967934.2968103

Craven, R., Marsh, H., & Debus, R. (1991). Effects of internally focused feedback and attributional feedback on enhancement of academic self-concept. *Journal of Educational Psychology*, *83*(1), 17–27. Retrieved from http://psycnet.apa.org/journals/edu/83/1/17/

Ertmer, P. A., Richardson, J. C., Belland, B., Camin, D., Connolly, P., Coulthard, G., … Mong, C. (2007). Using Peer Feedback to Enhance the Quality of Student Online Postings: An Exploratory Study. *Journal of Computer-Mediated Communication*, *12*(2), 412–433. http://doi.org/10.1111/j.1083-6101.2007.00331.x

Fullerton, T., Swain, C., & Hoffman, S. (2008). *Game design workshop : a playcentric approach to creating innovative games*. Elsevier Morgan Kaufmann.

Gibbs, G., & Simpson, C. (2004). Conditions under which assessment supports students' learning. *Learning and Teaching in Higher Education*. Retrieved from http://www2.glos.ac.uk/offload/tli/lets/lathe/issue1/issue1.pdf#page=5

Kulkarni, C., Bernstein, M. S., & Klemmer, S. (2015). PeerStudio: Rapid Peer Feedback Emphasizes

Revision and Improves Performance. *Proceedings from The Second (2015) ACM Conference on Learning @ Scale*, 75–84. Retrieved from https://hci.stanford.edu/publications/2015/PeerStudio/Peerstudio.pdf

Liu, N.-F., & Carless, D. (2006). Peer feedback: the learning element of peer assessment. *Teaching in Higher Education*. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/13562510600680582

McMahon, T. (2010). Peer feedback in an undergraduate programme: using action research to overcome students' reluctance to criticise. *Educational Action Research*, *18*(2), 273–287. http://doi.org/10.1080/09650791003741814

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education*. Retrieved from http://ewds.strath.ac.uk/REAP/public/Papers/DN_SHE_Final.pdf

Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology*, *36*(1), 36–48. Retrieved from https://www.sciencedirect.com/science/article/pii/S0361476X10000536

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. Retrieved from https://books.google.com/books?hl=en&lr=&id=UM-xyczrZuQC&oi=fnd&pg=PP13&dq=Rules+of+Play,+Zimmerman+%26+Salen&ots=2BEDAS9AVo&sig=UOrY4A4mKnH0KbSGahskpmjtu1k

Shannon, A., Sciuto, A., Hu, D., Dow, S. P., & Hammer, J. (2017). Better Organization or a Source of Distraction? Introducing Digital Peer Feedback to a Paper-Based Classroom. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2017)*. ACM. http://doi.org/http://dx.doi.org/10.1145/3025453.3025564

Topping, K. (1998). Peer assessment between students in colleges and universities. *Review of Educational Research*. Retrieved from http://rer.sagepub.com/content/68/3/249.short

Värlander, S. (2008). The role of students' emotions in formal feedback situations. *Teaching in Higher Education*, *13*(2), 145–156. http://doi.org/10.1080/13562510801923195

BEADED ADVENTURES: USING TANGIBLE GAME ARTIFACTS TO ASSIST STEM LEARNING

Using Tangible Game Artifacts to Assist STEM Learning

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Abstract

This paper describes the design principles guiding the creation of a versatile STEM education digital game, *BeadED Adventures*. Introducing the tangible aspect of tabletop games into a video game, *BeadED Adventures* is an interactive narrative where players solve STEM-based puzzles and make choices affecting the narrative plot by creating a tangible learning artifact: a string of beads that can be worn as a bracelet or used as a keychain, bookmark, etc.

The game's treatment of STEM subjects is intended to appeal to underrepresented youth who may be uninterested in these fields due to the way they are traditionally presented and represented. Following constructivist philosophies of learning and emphasizing player autonomy, the design of *BeadED Adventures* followed four main goals: to be engaging, to generate tangible learning artifacts, to encourage creativity, and to foster autonomy. A variety of future studies are planned to investigate the impact of this tangible learning artifact.

Background

Board games customarily require the player to physically interact with tangible elements in order to play the game. The *Chess* player moves the pieces by hand, the card game requires physical shuffling and dealing of the deck, and even tic-tac-toe requires a tangible writing implement. The digital versions of these respective games prevent the player from handling the game objects, placing them all on the digital screen as if under glass, removing the tactile element from the game experience altogether. In response, video games with non-standard and tangible interfaces are becoming more popular, especially among game design researchers (Carlsson, Choi, Pearce, & Smith, 2017; Lohmeyer, 2016; Sullivan & Smith, 2016) and specialized conference showcases such as alt.ctrl.GDC (alt.ctrl.GDC, 2018). By creating games with these types of interfaces, these designers are re-introducing touch and materiality back into video games.

As technology becomes more integrated with learning spaces, previously tactile education-oriented projects are also experiencing digitization and placement under glass. As more students gain access to mobile devices, traditionally hands-on learning activities from manipulatives to chemistry experiments are being recreated in digital spaces as simulations and games (e.g., Reimer & Moyer, 2005; Brinson, 2015; Squire et al., 2004). The loss of the tactile elements previously embedded within these educational activities, and the increasing popularity of digital games with tangible interfaces inspired the authors to design *BeadED Adventures*, an educational game with a child-friendly physical interface. We designed this game with the intent to leverage the affordances of digital games and tangible objects in an exploration game where players create tangible learning artifacts as they interact with STEM concepts.

BeadED Adventures

Inspired by the tangible artifact-creating game, *Loominary* (Sullivan, et. al 2018), *BeadED Adventures* operates using a Makey-Makey and a PC to display a choose-your-own-adventure story created in Twine. The game is set in an abandoned castle, which the player explores freely, learning and engaging with computational thinking content. We use pseudo-code rather than a specific coding language, so that the students are not required to learn syntax for a particular language. Throughout the castle, players interact with a variety of items and beings as they progress through the game. Each choice available to the player is presented as a series of options worded as second-person statements, like the popular *Choose Your Own Adventure* novels (Hendrix, 2011).

Beside the door in the dim light from the skylight down the hall, you discover a long, narrow ledge next to the door. Above it, on the wall is faded writing. The writing contains some words you can recognize, but in a strange order:

```
[IF marbles are aligned THEN
door IS unlocked
ELSE
door IS locked
ENDIF]
```

You try the handle. Locked.

You take a step forward to inspect this cryptic message, and you feel something bump your foot. Looking down, you discover seven marbles made of translucent blue glass scattered around on the floor.

You pick up the marbles and put them in your pocket—they could come in handy later. Then you retrace your steps back toward the skylight.

You look more closely at the ledge.

You turn around, retracing your steps back toward the skylight.

Image 1. An example puzzle teaching conditionals in BeadED Adventures.

The player makes a selection by lifting the dispenser containing the bead color corresponding to the story choice, removing a bead, and adding it to their bracelet (Figure 2). The sensor connected to the dispenser then records the player's selection as a button push when the dispenser is replaced, and advances to the next scene accordingly. At the end of the game, players will be able to take the tangible learning artifact they created as a record of their educational journey through the game. The string of beads can then be worn as a bracelet or used as a bookmark, keychain, etc.

Image 2: Player selecting bronze beads to indicate her choice.

Like game artifacts developed to augment the player's retelling of gameplay for entertainment purposes (Sullivan & Smith, 2016), the bracelet a player creates in *BeadED Adventures* can later be referred to when recalling information learned in the game, compared with peer-created artifacts, and more. Additionally, we predict that the creation of the learning artifact will be a motivating factor for players—even those initially uninterested in STEM subjects—to approach and complete the game. The game is not intended to thoroughly teach the player how to code in any specific language, but rather to pique their interest and spur them to further their knowledge on their own.

Through exploration and narrative, the player interacts with educational content. The system is created in such a way that different games can address various STEM topics, and our first prototype focuses on computational thinking. The player chooses which areas in the castle to explore, and at various locations throughout the castle, there are puzzles they must leverage their newly constructed knowledge to solve. The castle in this early prototype has three areas, with player interactions within each area focusing on distinct aspects of computational thinking: variables, conditionals, and loops. Within each area, knowledge is gained through exploration, and a puzzle must be solved in order to move on to a different area. The final puzzle, which allows the player to leave the castle and ends the game, requires cumulative knowledge of all three areas.

Design and Educational Goals

Prior to the design of *BeadED Adventures*, we established a set of core principles to guide the game's design. We wanted to ensure that the game would:

1. Be engaging to the player
2. Generate a tangible, player-created, personalized learning artifact
3. Encourage creativity
4. Foster player autonomy

Before a game can teach, it must motivate learners to play—therefore, it must be engaging. We predict that the novelty of the tangible artifact will entice learners to begin the game, but we must ensure that the entire game is engaging and enjoyable so that players are motivated to continue playing and learning after the novelty factor wears off (Henderson & Yeow, 2012).

Next, the decision to have the player create the tactile learning artifact was both of necessity and purposeful. On one hand, we were not interested in engineering an automated beading system. On the other, we wanted the player to be involved in the physical creation of the artifact, predicting that this will increase learning retention, given that physical and even imagined manipulation of objects in relation to a text have been shown to increase reading comprehension (Glenberg et al., 2004). If players were simply handed an artifact at the conclusion of their gameplay session, we expect it would hold less meaning than the one they created during gameplay, and we hypothesize it would not be as useful as a knowledge recollection aid.

Additionally, we wanted the game to explore the coupling of creativity and learning. Creativity is a fundamental aspect of the nature of science (Peters & Kitsantas, 2010; Abd-El-Khalick, Bell, & Lederman, 1998). Research suggests that creative thinking practice can improve computational thinking skills (Miller et al., 2013), and that even students in middle school can create their own knowledge when the environment "sparks and then rewards creative ideas" (Sternberg & Lubart, 1991, p. 613).

Finally, autonomy is closely linked with intrinsic motivation in learners (Ryan & Deci, 2000). Player agency also plays a vital role in game enjoyment (Ryan, Rigby, & Przbylski, 2006). When players feel empowered to make their own choices in a game, they are more likely to enjoy the game and therefore keep playing. Providing learners with choices rather than a scripted instructional path is an established educational technique that empowers students and increases their motivation (Patall, Cooper, & Wynn, 2010; McCombs & Whisler, 1997; Passe, 1996).

For the informal settings where we envision this iteration of the game being played, we felt it was appropriate to remove direct instruction from the game and allow the learner to explore and acquire knowledge autonomously in an exploratory learning environment (ELE) (Guitierrez-Santos, Mavrikis, Geraniou, & Poulovassilis, 2015). Thus, unlike the scripted 'story bracelet' (*Thanksgiving Story Bracelet*, n.d.) or 'story retell' bracelet and bookmark (*Story Retell and Sequencing,* n.d.) activities sometimes seen in elementary classrooms, we designed *BeadED Adventures* to be less rigidly structured, which necessitated a setting that would naturally induce exploration.

These four principles work together to align with a constructivist philosophy of learning, which follows Piaget's (1970) theory of cognitive development. Constructivism (Bruning et al., 2004; Geary, 1995) and discovery learning theories assert that learners retain knowledge better if they construct it themselves (Bruner, 1961; Schunk, 2006). In this game, players will be physically constructing a tangible artifact while they mentally construct new STEM knowledge.

Additionally, because the game focuses on STEM content, a set of fields that can be perceived as intimidating or inaccessible to youth, especially underrepresented populations, we decided on a fantasy setting that we anticipated would be somewhat broadly enticing: an abandoned castle. Each possible interaction within the castle allows the player to experience some aspect of computational thinking, such as variables and conditionals. Some interactions in the game are more passive, presenting knowledge within the narrative structure and asking players to make choices focused on the plot of the story, while others are more interactive, requiring players to solve puzzles. The goal of these varied interactions is to provide players with a positive, informal introduction to computational thinking with the intent to increase their interest in the field.

By creating a game environment that does not appear to be stereotypically STEM or masculine, like a laboratory or industrial space might—the setting is intended to foster an environment where underrepresented populations can feel a sense of belonging (Dasgupta & Stout, 2014). We predict that having an approachable, widely-appealing game environment will also increase positive student experiences with STEM subjects. This is important because research suggests that learning experience prior to entering college can heavily influence the likelihood that a student will pursue a major in that field (Wang, 2013).

Conclusion

BeadED Adventures is a STEM learning game that allows for player agency, allowing players to construct their own learning artifact that reflects their unique path through the game environment and the knowledge they gained in their journey. The design of this educational game reintroduces the tangible element into the digital video game experience. Intended for informal learning environments, this game will expose new or hesitant audiences to STEM subjects in an approachable, appealing way.

The game design followed four goals: to be engaging, to generate tangible learning artifacts, to encourage creativity, and to foster autonomy. *BeadED Adventures* follows constructivist philosophies of learning and emphasizes player autonomy as they create learning artifacts that can aid in learning comprehension and recall of STEM concepts. Future studies are planned to assess the game's efficacy in teaching STEM concepts, player perceptions of the gameplay and the STEM content, and any player attitudes toward STEM subjects that may be influenced by the game.

References

Abd-El-Khalick, F., Bell, R. L., & Lederman, N. G. (1998). The nature of science and instructional practice: Making the unnatural natural. *Science Education*, *82*(4), 417-436.

alt.ctrl.GDC. (2018). Retrieved from: http://www.gdconf.com/events/altctrlgdc.html

Brinson, J. R. (2015). Learning outcome achievement in non-traditional (virtual and remote) versus traditional (hands-on) laboratories: A review of the empirical research. *Computers & Education*, *87*, 218-237.

Bruner, J. S. (1961). The act of discovery. *Harvard educational review*.

Bruning, R. H., Schraw, G. J., Norby, M. M., & Ronning, R. R. (2004). Cognitive psychology and instruction (4th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.

Carlsson, I., Choi, J., Pearce, C., & Smith, G. Designing eBee: a reflection on quilt-based game design. In *Proceedings of the 12th International Conference on the Foundations of Digital Games* 24-34. ACM. (2017).

Dasgupta, N., & Stout, J. G. (2014). Girls and women in science, technology, engineering, and mathematics: STEMing the tide and broadening participation in STEM careers. *Policy Insights from the Behavioral and Brain Sciences*, *1*(1), 21-29.

Geary, D. C. (1995). Reflections of evolution and culture in children's cognition: Implications for mathematical development and instruction. American Psychologist, 50, 24–37.

Glenberg, A. M., Gutierrez, T., Levin, J. R., Japuntich, S., & Kaschak, M. P. (2004). Activity and imagined activity can enhance young children's reading comprehension. *Journal of Educational Psychology*, *96*(3), 424.

Gutierrez-Santos, S., Mavrikis, M., Geraniou, E., & Poulovassilis, A. (2015). Usage scenarios and evaluation of teacher assistance tools for exploratory learning environments. *Computers and Education*.

Henderson, S., & Yeow, J. (2012, January). iPad in education: A case study of iPad adoption and use in a primary school. In *2012 45th Hawaii international conference on System science (HICSS)* (pp. 78-87). IEEE.

Hendrix, G. (2011). Choose your own adventure: How *The Cave of Time* taught us to love interactive entertainment. *Slate.* 11 Feb. 2011. http://www.slate.com/articles/arts/culturebox/2011/02/choose_your_own_adventure.single.html#pagebreak_anchor_2

Lohmeyer, E. Navigating Haptic Space in Video Games. In *Analog Game Studies* 3(4). http://analoggamestudies.org/2016/07/smoothsketch-or-navigating-haptic-space-in-the-video-game-composition/, last accessed 2018/04/23.

McCombs, B. L., Whisler, J. S. (1997). *The learner-centered classroom and school: strategies for increasing student motivation and achievement*. San Francisco, CA: Jossey-Bass.

Miller, L. D., Soh, L. K., Chiriacescu, V., Ingraham, E., Shell, D. F., Ramsay, S., & Hazley, M. P. (2013). Improving learning of computational thinking using creative thinking exercises in CS-1 computer science courses. In *Frontiers in Education Conference, 2013 IEEE* (pp. 1426-1432). IEEE.

Passe, J. (1996). *When students choose content: A guide to increasing motivation, autonomy, and achievement.* Thousand Oaks, CA: Corwin Press.

Patall, E. A., Cooper, H., & Wynn, S. R. (2010). The effectiveness and relative importance of choice in the classroom. *Journal of Educational Psychology, 102*(4), 896.

Peters, E. E., & Kitsantas, A. (2010). Self-regulation of student epistemic thinking in science: The role of metacognitive prompts. *Educational Psychology*, *30*(1), 27-52.

Reimer, K., & Moyer, P. S. (2005). Third-graders learn about fractions using virtual manipulatives: A classroom study. *The Journal of Computers in Mathematics and Science Teaching*, *24*(1), 5.

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25,* 54–67.

Ryan, Richard M., C. Scott Rigby, and Andrew Przybylski. "The motivational pull of video games: A self-determination theory approach." *Motivation and emotion* 30, no. 4 (2006): 344-360.

Schunk, D. H. (2012). *Learning theories an educational perspective sixth edition*. Pearson.

Squire, K., Barnett, M., Grant, J. M., & Higginbotham, T. (2004, June). Electromagnetism supercharged!: learning physics with digital simulation games. In *Proceedings of the 6th international conference on Learning sciences* (pp. 513-520). International Society of the Learning Sciences.

Sternberg, R. J., & Lubart, T. I. (1991). Creating creative minds. *The Phi Delta Kappan*, *72*(8), 608-614.

Story Retell and Sequencing: Book, Bracelet, and Bookmark, Comprehension Tool (n.d.) Retrieved from: https://www.teacherspayteachers.com/Product/Story-Retell-and-Sequencing-Book-Bracelet-and-Bookmark-Comprehension-Tool-1613467

Sullivan, A., McCoy, J., Hendricks, S., & Williams, B. (2018). Loominary: Crafting Tangible Artifacts from Player Narrative. In *Proceedings of the Twelfth International Conference on Tangible, Embedded, and Embodied Interaction, 2018 ACM.* (pp. 443-450). doi>10.1145/3173225.3173249.

sSullivan, A., & Smith, G. Designing craft games. *interactions*, *24*(1), 38-41 (2016).

Thanksgiving Story Bracelet (n.d.) Retrieved from: https://www.teacherspayteachers.com/Product/Thanksgiving-Story-Bracelet-417876

Wang, X. (2013). Why students choose STEM majors: Motivation, high school learning, and postsecondary context of support. *American Educational Research Journal*, *50*(5), 1081-1121.

THESE GAMES ARE MADE FOR WALKIN': WALKING SIMS STEP UP & FILL IN

Walking Sims Step Up & Fill In

LIZ OWENS BOLTZ AND BRIAN J. ARNOLD

Abstract

Slower-paced narrative, puzzle, and mystery-based games have long held a place in the videogame medium; but in recent years, a subset of these games (sometimes called *walking simulators)* has received increased attention. However, little of this discussion has addressed the potential these games may hold for learning. In this paper, we analyze a sample of walking sims, drawing from popular and research literature, as well as the public work of teachers using games in the classroom, to examine the common elements of walking sims and explore the unique affordances that this type of game may offer for learning.

Although many traditional videogames contain some semblance of a narrative arc, the gameplay–and not the story–is usually the main focus of the player attention. The dominance of popular mainstream (action, adventure, role-playing, and strategy) videogames has been profitable for large game developers, but has left gaps in the gaming landscape. As some players have noted, mainstream games tend to focus on "telling a few stories for the same people," (Ramanan, 2016) despite the fact that–like film, books, and other media–games have the potential to offer many different types of experiences that reflect the diverse backgrounds and address the various preferences of the people who play them. Such concerns about untapped potential extend to considerations of the ways that learning can happen in and around games; whether informally, through games designed for education, or through entertainment games integrated into the curriculum. These concerns are particularly salient when acknowledging that the goal of education is to prepare creative, innovative learners who can solve complex problems and think critically, and that learning happens best through active, situated, personally meaningful interactions (Greeno, Collins, & Resnick, 1996; Squire, 2006). Many now argue that increased attention should be focused on the *situated* nature of games, and that the field should embrace a more diverse view of learners, games, and learning contexts (Clark, Tanner-Smith, & Killingswort, 2016; Young et al., 2012).

Exploratory, narrative-driven videogames have served as a longstanding alternative to competitive, action-oriented titles. Many of these games tend to follow what has been called a "string of pearls" approach to interactive storytelling that creates "a finely crafted story, punctuated with periods of interactivity and challenge," (Schell, 2008, p. 265). With roots tracing back to the 1980s, the fact that many new games adopt this style has been gaining more attention over the past several years. Games that deviated from the string-of-pearls approach were pejoratively dubbed "walking simulators" (WS) on internet forums in the early 2000s—a term intended as an insult based on their lack of traditional gaming conventions, but one that has since been embraced by its own community of players who value this departure from traditional structures. Often described as a sub-genre genre or pseudo-genre (Clark, 2017), walking sims deviate from well-worn tropes and push the boundaries of what is considered a (video) game.

What is a Walking Sim?

In his book on game design, veteran developer Jesse Schell (2008) takes issue with the claim that the lack of standardized definitions for games and their features is a crisis in the field while pointedly highlighting that this view tends to be held by those farthest removed from game development, people like academics. A lack of clean definition provides an unpleasant obstacle for academics keen to establish typologies, and so the debate rages on. There is no current consensus on the categorization of game features, nor the definition of a walking sim, or even a bounded definition of the word *game*. But Schell offers a hopeful take: At worst, he argues, this lack of clarity is merely an inconvenience; at best, it encourages us to continually clarify, analyze, and reconsider our ideas about games and how they work (Schell, 2008).

Therefore it is worth exploring the common traits of walking sims, how they converge and diverge from more traditional games, and the specific affordances they may offer for learning. WSs have already been acknowledged by critics and players alike for the opportunities they provide for artistic, narrative, ludic, and structural innovation. WSs are gaining popularity, appearing as a refreshing departure from traditional action-oriented and victory-seeking gaming conventions. As a direct consequence of that departure, walking sims have to reach into a new bag of tricks in order to engage players with games that are “often produced on a dime by indie studios [and] have to motivate a player using a non-standard set of tools,” (Clark, 2017). In other words, rather than immediately engaging players with conflict and graphic action, WSs often embrace an exploratory, narrative approach designed to not only build and engage curiosity, but also challenge norms, elicit emotional responses, and embody the player in a novel setting or persona.

Despite some fuzziness about exactly what constitutes a “walking sim”, it is possible to make some generalizations about the traits walking sims tend to exhibit in comparison to more traditional games (see Table 1).

Table 1

Traits of walking sims vs. traditional games

Element	Traditional Games	Walking Sims
Victory conditions / conquest	+	-
Narrative focus	sometimes	+
Affective reflection	rarely	+
Puzzles	+	sometimes
Metacognition	rarely	+
Failure / death	+	-
Time lock / urgency	+	-
Simulate walking (Clark, 2017)	+	+

For the purposes of this paper, we will define walking sims (WS) as a digital game embodying players in first person perspectives in order to explore virtual environments and discover new (or unexpected) features of that environment (and/or themselves).

Traditional games contain victory conditions, those conditions the player must meet in order to win. Games described as WSs tend to emphasize a singular game narrative (a strong storyline, dialogue, or even societal commentary/parody). Risk of failure is usually minimal, in that the playable character is rarely in immediate danger. WSs instead challenge the player in other ways–by confronting them with uncomfortable truths, prompting them to examine their own assumptions and biases, and upending their expectations based on traditional videogame conventions. Given their relatively slower pace and decreased emphasis on action and urgency, these games tend to forgo traditional combative interactions in lieu of affective reflection and metacognition.

Despite relatively smaller audiences and some vocal detractors, WSs are not confined solely to independent gaming communities and friends of developers. In fact, many have seen wide adoption and are available through mainstream download services such as the Playstation Store ® and Steam®. Several WSs have even earned critical commercial acclaim. To name a few: *Gone Home* won Best Debut Game and was nominated for Best Story at the 2013 British Academy Games Awards. *Firewatch* has been lauded for its artistic and narrative qualities, and was awarded Best 3D Visual Experience at the 2016 Unity Awards and Best Narrative at the 2017 Game Developers Choice Awards. *What Remains of Edith Finch* has been heralded for its narrative and innovative gameplay, named Best Game at the 2017 British Academy Games Awards and Best Narrative by the 2017 Game Awards.

Given WSs innovative, curiosity inducing and contemplative approach to gaming, what kinds of affordances and constraints might they offer for different kinds of learning (and different kinds of learners)?

Walking Sims and Learning

The fact that learning happens in and around games is, for most, not surprising: Games tend to be engaging experiences that spark interest in a variety of subjects and can serve as entry points to professional identities, whether they are intentionally designed to be educational or not (Squire, 2011).

The educational potential of WSs has already been recognized (and indeed, realized) by teachers, several of whom have written publicly about integrating several of these games into course curriculum. For example, Paul Davarsi wrote extensively about his use of *Gone Home* as a literary text in his high school English class (Davarsi, 2014). The game's suitability for learning was reinforced by a number of factors: from a content perspective, Davarsi notes that *Gone Home* offered opportunities to explore character development, environmental storytelling, non-linear narrative, and Aristotelian unities. More generally, incorporating a videogame into the curriculum (particularly one with adolescent characters and themes) can create the opportunity to engage students and enhance the relevance of lessons by fostering meaningful discussion based around a common experience. Davarsi points out several other practical affordances of *Gone Home* (which apply to other games in the genre) that are of key importance to our discussion of WSs: *Gone Home* is an indie game, and thus is relatively inexpensive (to make and to buy), less lengthy in terms of playtime, and not as processor-intensive as many popular commercial titles. These affordances make such games accessible to learners regardless of their experience level with similar games or gaming in general. WS's tend to be affordable and easier to support on a budget, thus lowering the barrier to entry for educators interested in incorporating videogames as part of an instructional strategy.

Adopting a similar strategy, educator Brian Dalton published a number of teaching guides that create context for using WSs as a learning tool in the classroom. His lesson plans and activities draw from his own experiences using the game *Firewatch* to explore literary elements such as exposition, foreshadowing, and characterization, and to teach strategies like annotation and compare/contrast (Dalton, 2016a). Dalton also shared guides on the use of another WS, *The Vanishing of Ethan Carter,* that focus on the game's applications for English Language Arts, evaluating digital media, and psychology and integrate game play with a number of other instructional activities such as graphic organizers, video creation, and class discussion, (Dalton, 2016b).

Walking the Line: Unique Affordances of Walking Sims

By deemphasizing conflict, the immersive, atmospheric game worlds of WSs create space for reflection and exploration. This shift can put additional burden on the narrative to engage players and hold their attention during the length of the game; this narrative focus of WSs also affords pedagogical potential. Stories, within games and elsewhere, can provide a "metaphoric loft" (Bruner, 2002). In other words, the specific content of a particular story (e.g., its dramatic arc, characters, and setting) often have the power to resonate and connect with a variety of individuals and experiences. Many WSs use story to embed the player in a complicated *mystery* that encourages them to examine not only its underlying meaning, but also the implications of their actions and any emotions the experience may elicit. Doing so can potentially *challenge players to evaluate their own biases and assumptions*. Through well-designed experiential, embodied play, research suggests that the narratives in games can actually do pedagogical work (Barab et al., 2013).

Videogames can also support learning by giving players the opportunity to try on new, *embodied* identities. As Gee (2005) notes, sometimes players become heavily invested in inhabiting a character because that character is particularly intriguing or relatable; other times, players enjoy taking on a relatively blank character for whom they can create a complex life story. In either case, by adopting a new identity in the game, the player can engage in the different activities and ways of knowing associated with that identity (p. 50). Because WSs are designed to offer different types of agency and challenge than traditional games, they can inspire players "to think about the characters, to relate to them on a human level rather than as agents of action," (Stuart, 2016). In WSs, the characters players inhabit are often in the process of *dealing with or healing from past trauma*, often contributing to an emotional experience that encourages the player to empathize with their avatar or even view themselves in a new light. For an overview of elements common among WSs, see Table 2 below.

Table 2

Walking Sim Elements

Theme	Description
Challenging player expectations, prejudices, and perspectives	Complicates player choice and agency to explore biases, moral challenges, or assumptions.
Challenging the boundaries of narrative gaming	Presents an interactive experience that does not necessarily conform to western dramatic narrative forms.
Embodiment and Agency	Embodiment is an empathic link between the player and their avatar that allows the player to feel as if they are inhabiting different entities (with different capabilities and associated controls). *Agency*, a subset of embodiment is the players' ability to use the embodied avatar to effect the game environment.
Environmental storytelling	In addition to text or narration, the design of the game environment or artifacts reinforce and add to the narrative (e.g., a lost letter, a secret panel, the remains of a meal).
Problem solving	The player must think their way past a tangible or conceptual obstacle (rather than shoot, jump or run).
Complicating the narrator	The game can give lie to the veracity of what the game narrator reports.
Exploration	The game encourages the player to make meaning from the game environment by granting access to new areas or in the form of backstory revelations.
Dealing and healing (re: the past), often family related	The game examines past loss or tragedy, encourages empathy, and may elicit an emotional response.
Finding meaning in mystery	Unlike traditional games and narratives, the game is more likely to explore the nuances of a meaningful question than give a concrete answer.

Walk This Way: The Walking Sim Experience

This analysis illustrates the aforementioned common elements of WSs, drawing from some of the most popular titles to date that have been tagged or designated as such: *Firewatch, Gone Home, The Long Dark, The Stanley Parable* and *What Remains of Edith Finch*. Though these games vary widely in content, between them they share a number of common elements that tie them to the WS genre.

Firewatch

Developed by Campo Santo and published by Campo Santo and Panic in February of 2016, Firewatch places the player into the persona of Henry, circa 1989, a conflicted young widower recently appointed fire lookout ranger (backstory comprises a significant portion of the opening gameplay).

Henry learns the ropes of his new gig, grows to trust the disembodied voice of fellow ranger, Delilah, over his walkie-talkie, and realizes that not everything in the Wyoming wilderness is as peaceful as it seems.

What it is. The story of *Firewatch* is one that gradually unfolds through dialogue, character development, and atmosphere. It is also a story that complicates the idea of healing and dealing with the past as protagonist Henry tries to take a break from the complexities of adulthood and the deteriorating health of his wife Julia. In his attempt to 'escape' to an initially idyllic forested environment, he finds opportunities for both loneliness and connection; for both beauty and danger.

There is some limited 'help' from the game in terms of learning how to interact with the game environment and how to use controls, but in large part the player learns a great deal on their own and is left to explore and/or follow a more linear, game-directed path. Time passes from day to day, and a relationship develops with Delilah over the walkie-talkie. Alongside this developing relationship and the gradual unravelling of Henry's backstory, a mystery within the park begins to unfold. Clues can be found to illuminate the narrative via environmental storytelling, exploration, and dialogue. The narrator is present, but somewhat bifurcated; initially embedded in the form of text in the introduction and later replaced by the conversing voices of Henry and Delilah.

One of the most notable features of *Firewatch* is the way it plays with the notion of urgency and time. As is the case in most WSs, the main character can't die in *Firewatch*–and in terms of completing objectives, the pace of the game is determined by the player and unconstrained by time limits. However, the one element of the game that does emphasize time and quick decision-making is the walkie-talkie mechanic: Often, when Delilah asks Henry a question, the player has a limited amount of time to choose dialogue options. The game employs unique controls for using the walkie-talkie (holding down the Shift key, then scrolling to the desired dialogue choice, then releasing the Shift key). The physical, *embodied* action of using the walkie-talkie to communicate, combined with a visible timer, subtly calls the player's attention to the conversation (as shown in Figure 1).

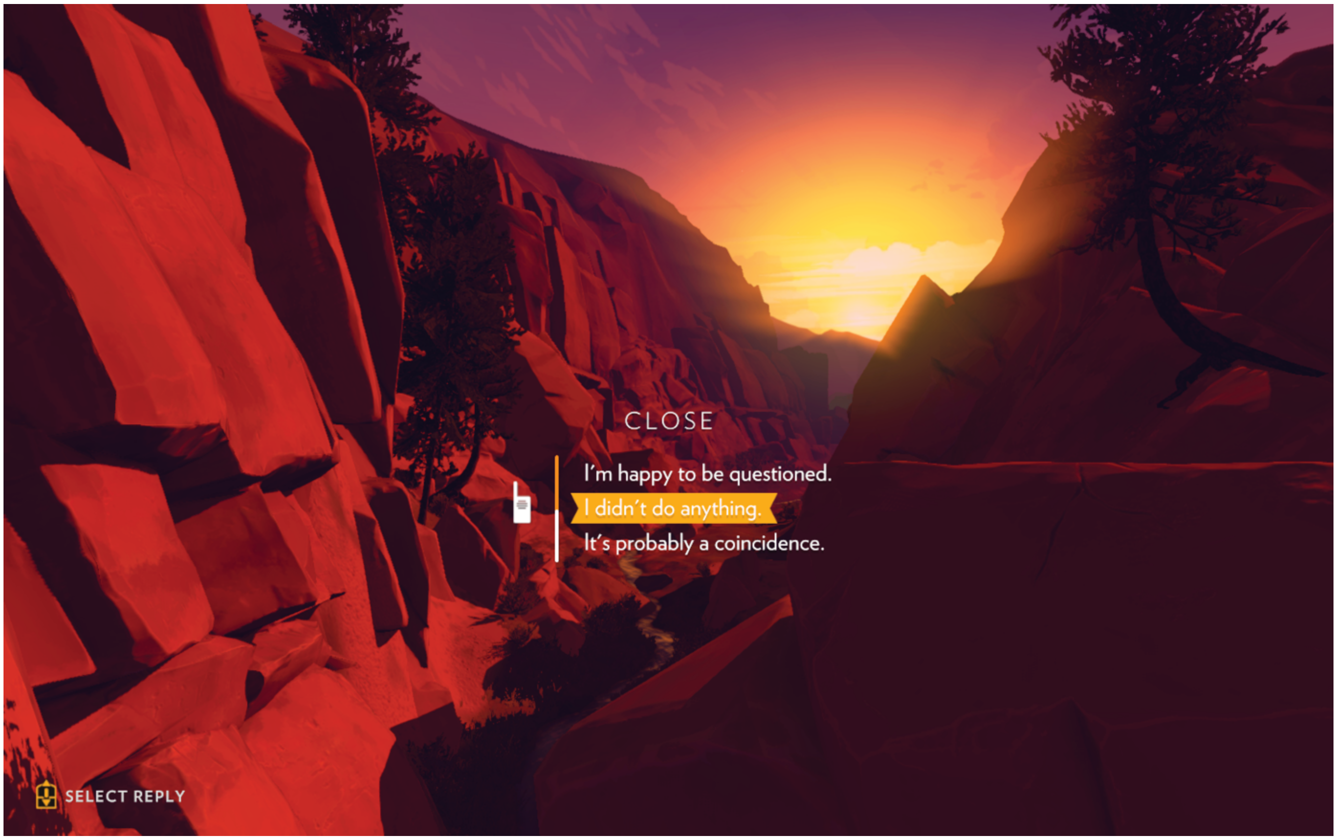

Figure 1: Dialogue choices in Firewatch

What it isn't. Admittedly an indie effort, the game is not particularly robust, often suggesting areas to explore only to disappoint with an empty corner. It is not a traditional survival adventure, nor is it fast-paced. Although the introduction has a slight 'choose your own adventure' feel, the rest of the game does not entirely follow suit. *Firewatch* falls outside the realm of traditional games by making it clear that your choices as a player are limited. Choices are limited in any game, certainly–but that is something that tends to be invisible to the player. This game is more explicit about how it is limiting you.

Why the difference matters. *Firewatch* is not a game that makes its intentions clear; it can be frustrating at times, and is transparent about the limited choices given to the player. But while "one player may get annoyed by the lack of agency in *Firewatch,* another may delight in the desperation in the illusion of choice," (Clark 2017). The choices made in the game may all lead to the same final outcome, but the way one plays can ultimately shape the experience of the game; as one reviewer notes, ignoring Delilah entirely can be a heart wrenching experience that reminds us of missed opportunities for even fleeting human connection when we need it most (Rankin, 2016). Others suggest that the games's apparent limitations encourage the player to confront traditional conceptions of masculinity (Kagen, 2017). In other words, different choices may not lead to a change in the outcome of the game–but they *can* have a different affective impact on the player.

These kinds of transformative experiences are possible in well-designed games that contain themes that resonate deeply and become important to the player (Schell, 2008, p. 53). For some players, *Firewatch* is that type of game–inspiring them, for example, to reflect and write about their own loneliness (e.g., Meitzler, 2016). In this respect, *Firewatch* is a WS that pushes back against the standard pace of traditional action games, providing a space for players to relate to its characters, make connections with their own lives, and interpret meaning (Stuart, 2014).

Gone Home

Published by The Fullbright Company in 2013, *Gone Home* is set in the year 1995 and embraces 90s nostalgia–complete with mix tapes and pop culture references to *Twin Peaks*, riot grrls, zines, and *The X-Files*. The player takes on the role of college student Katie Greenbriar exploring her family's sprawling, empty home in rural Oregon after returning from adventures abroad. The player explores the house and reveals exposition through the discovery of household objects that fill in the backstory.

What it is. In the legacy of *Myst* (minus the puzzles), *Gone Home* is an exploratory narrative game in which curiosity is prompted and rewarded as the player pieces together the events that led to this moment in time. The game is a first person walking sim as well as a bit of a mystery on a dark-and-stormy night. From luggage tags to discarded invoices, play involves delightfully interwoven clues that can be confirmed from multiple sources within the game environment. Ultimately a revelation of family issues, this game is a well told story that puts the player in the driver's seat.

Gone Home challenges player conventions at the level of most WSs; there is no combat, fail or win states, though the game can be completed once the primary narrative arc comes to a close. Embodied as Katie Greenbriar, the player is able to interact with the game environment and manipulate objects and artifacts within it to reveal them (and the clues they hold) in full detail. *Gone Home*'s environmental storytelling, focus on exploration, attention to traditionally underrepresented identities, and player-determined pace contribute to its exemplary status as a WS. There is some limited problem solving in the form of secret doors and locating key pieces of plot-propelling props. The game relies almost exclusively on exploration to drive the story and catalyze revelations of family history, trauma and well-kept secrets. Since the game can be completed without resolving all of its many mysteries, players of a completionist mindset may be enticed the player to replay the game more than once.

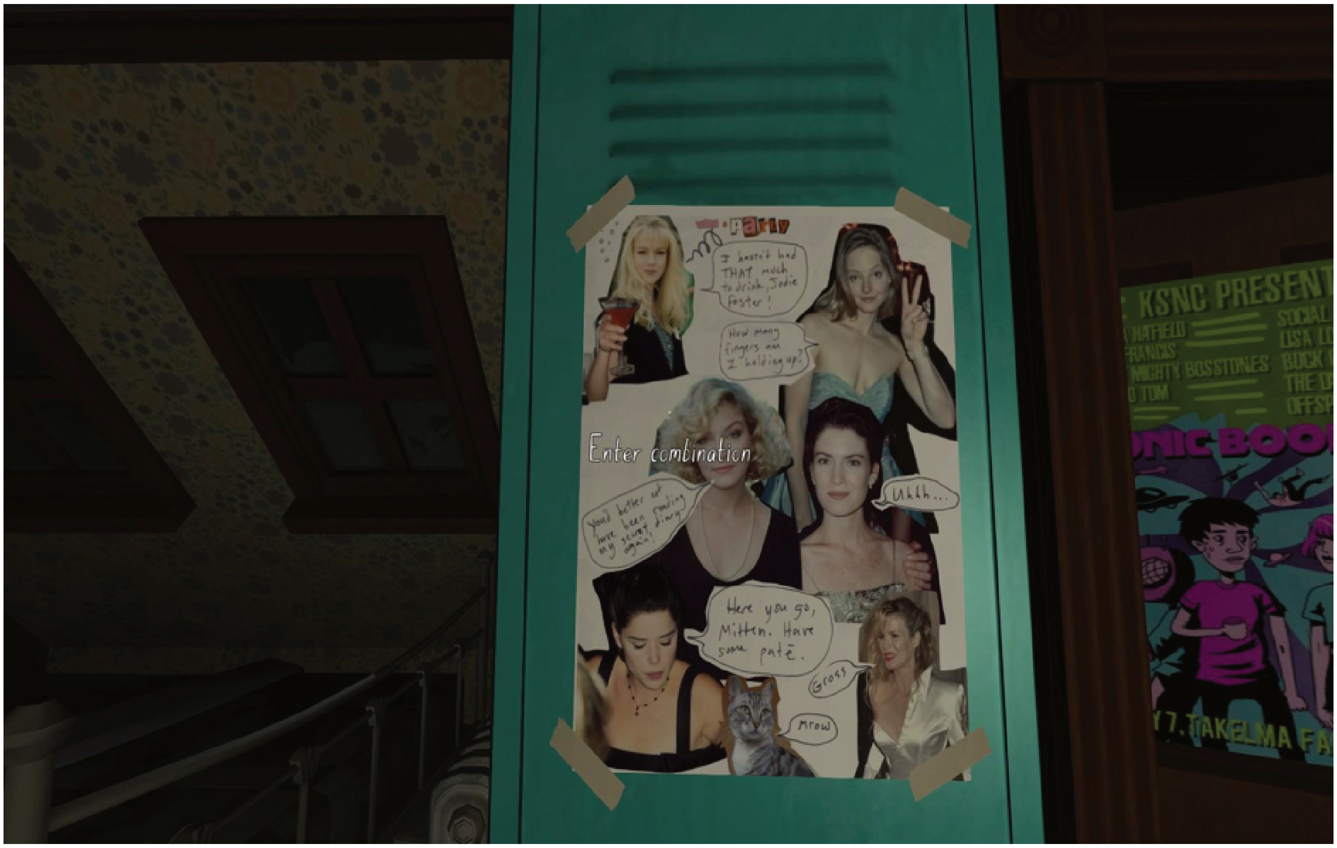

Figure 2: Problem solving is wrapped in plastic nostalgia in Gone Home

What it isn't. *Gone Home* is not a linear story, nor is it an interactive or social experience. There are precious few action verbs involved (no running, shooting, stabbing or ducking); mostly looking, listening and considering. There are no traditional victory conditions unless the unraveling of the mystery of 'What happened to the Greenbriar family?" can be considered as such. Although the game firmly embodies the player into a specific character (Katie), that character's perspective is not really at the heart of the story. In terms of representation, though, the game falls in line with a common criticism of WSs: The characters, family photos, and 90s pop-culture icons visually represented on screen tend to be limited to able-bodied, middle- to upper-class white folks (see Figure 2).

Why the difference matters. *Gone Home* has received attention for the sensitive way in which its narrative addresses issues of identity. However, Sam Greenbriar—the character actually grappling with the challenges of coming out to her family—is a non-playable character (NPC) who only appears in family photos and speaks only through letters to her sister. As such, the game renders Sam invisible and distances the player from any direct experience of her character; thus, the mystery of the game (like many in the genre) relies upon this "queer absence" (Mejeur, 2018). From a learning perspective, this may afford opportunities to identify and discuss the ways that media, and society more generally, often silences marginalized individuals.

The game also has the educational potential for teaching the player useful critical thinking and information consumption skills. The variety and conflicting accounts of events encountered in the game challenges the players to determine credible sources and to draw their own conclusions from the information provided–in much the same we must learn to do to become critical consumers of media by triangulating data points to arrive at a defensible conclusion supported by credible sources.

The Long Dark

Developed and published by Hinterland Studio and released in 2013, *The Long Dark* thrusts players into the role of bush pilot William Mackenzie, stranded in the frigid Canadian wilderness after a plane crash caused by a geomagnetic event. Players must unravel the nature and extent of this catastrophe while exercising extreme resource management in order to escape death's dogged and icy embrace.

What it is. Although it is often categorized as a WS, *The Long Dark* feels more like a survival / adventure game–and thus, emphasizes how inconsistently the WS designator tends to be applied. This episodic game can be played in different modes–Wintermute (story mode), Survival (a free form open world in which you must stay alive as long as you can), and Challenge mode (mission-driven survival). The game includes definite elements of danger and urgency; has clearly defined, immediate goals; and includes more traditional game play elements compared to most WSs. *The Long Dark* does, however, subvert expectations in the vein of other WSs: As one reviewer has written, in survival mode the game has "no 'win' state other than how long can you survive in an open sandbox that is out to kill you," (Clauson, 2014). With a dark narrative that pushes the player to make morally challenging choices, the initial two episodes take approximately 10 hours to complete.

The Long Dark uses more traditional game mechanics than one might expect in a WS. For example, unlike most WSs, it contains a command wheel that offers the player a character status screen, inventory, and access to skills. Character death is not only a possibility, but a likelihood. That being said, exploration and problem solving are essential survival tools–and despite the game's stark opening warning that the survival strategies it offers are not meant to be taken seriously, in-game choices do lead to surprisingly realistic and complex outcomes (for example, developing dysentery from unfiltered water teaches players that they must boil water before drinking it). The game also provides a sense of embodiment in many of the actions the player must perform (e.g., in the opening of the game one of the first views for the player is of their character's hand as he struggles to raise himself from the wreckage). As the player progresses throughout the initial episodes of *The Long Dark*, they find meaning in mystery by unravelling the roots of the apocalypse in which they find themself and exploring the ethical implications of the choices they make in the game world–whether to choose cooperation and sacrifice, or to survive at any cost.

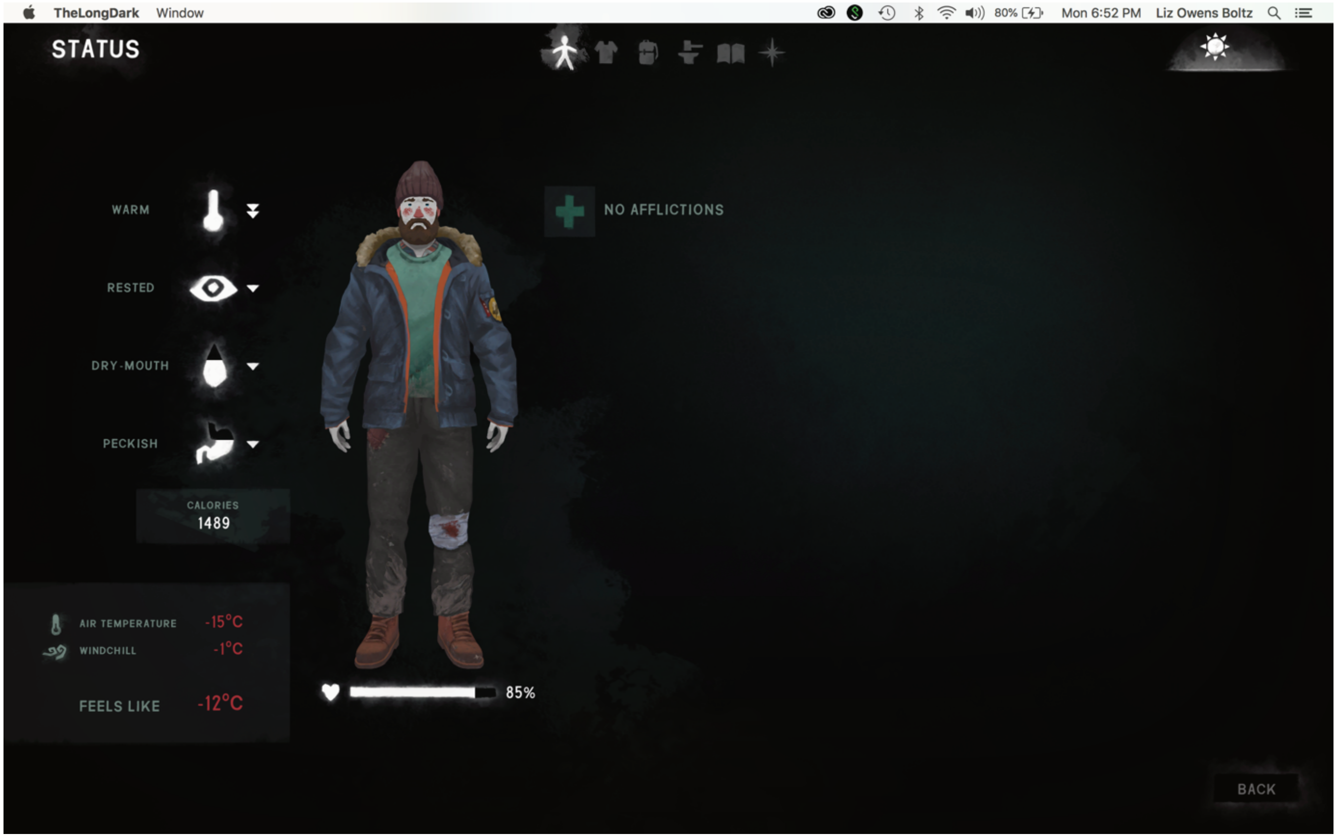

Figure 3: Character status screen in The Long Dark

What it isn't. *The Long Dark* may not technically qualify as a WS, at least not by the strictest definition. The fact that one's character can die, along with the traditional game play elements, differentiate this game from other WSs: Whereas the unknown is the source of mystery in most WSs, here it can actually kill you. But it's also far from a traditional AAA videogame. Developed by a team in Canada, the game reflects a strong national identity–aligned with cultural themes of isolation, a connection to nature, and a battle between rugged, untouched beauty and encroaching development. Indeed, the Canadian wilderness plays such a strong role in the game, it might even be considered a character. Environmental clues in *The Long Dark* (like coming darkness and changes in the sound of the wind) aren't just about unfolding a narrative; paying attention to those clues is key to your character's survival. However, the game does challenge the boundaries of gaming by hybridizing the survival and WS genres and by employing a number of common WS elements.

Why the difference matters. The fact that this game has been identified as a walking sim is in itself interesting, and may help with the formation of broad (and more narrow) definitions of the genre–or perhaps even sub-classes within the genre. As a player, you tend to approach a game differently when there is a sense of urgency or imminent threat, and when clear, immediate goals are given to you. Because the game affords players a bit more agency than many other WSs, *The Long Dark* may offer what Barab et al. (2013) call *narrative transactivity*–that is, a scaffolded space in which players can explore ideological dilemmas experientially, and examine the moral implications of their decisions. This type of game space can also allow players to "embody and practice the skills, knowledge, and thinking processes related to ethics…Participants can traverse and transgress boundaries of propriety, try on new identities and investigate diverse perspectives," (Schrier & Kinzer, 2009, p. 259).

Additionally, *The Long Dark* allows players to experience a perspective not often represented in the U.S.-dominated videogame market. Despite its (relatively) more urgent pace, playing the game is still an introspective and quiet experience that invites players to explore dark and complex themes framed by Canadian cultural motifs. As one author noted, it "isn't just about being outdoors; it is about being on the outside, a common theme in Canadian fiction," (Campbell, 2014). This facet of the game suggests that it, and other similar efforts, offer opportunities to expose players to unfamiliar cultural identities and broaden their understandings of diverse global perspectives.

The Stanley Parable

An experiment in interactive fiction that calls to mind the work of Douglas Adams, the movie *Brazil* (1985), and the tabletop RPG *Paranoia*, The Stanley Parable (originally a 2011 *Half-Life* mod) was formally released as a PC game in 2013. Players pilot Stanley, office nebbish, as he repeatedly fails to escape his cube farm prison with the inaccurate guidance of a snarky narrator. Despite the appearance of a high choice environment, players ultimately return to the starting point in this absurdist adventure.

What it is. *The Stanley Parable* is a dystopian, "work limbo" walking sim reminiscent of the narrative stylings of *Portal 2*. It is an exploration game with a gregarious, yet unreliable, narrator. It includes a series of choose-your-own-adventure style branching narratives each promising success and each, in turn, sending you back to the beginning of the game. Form fits function as the game is about an inescapable and illogical bureaucracy in which the player finds themselves trapped in an environment that preaches free will but offers little-to-none. In some ways this game allows the player to measure their tendency for blind obedience to authority against their impulse to go rogue. Neither stratagem can be dubbed *successful*, but it is a tool for self-reflection.

The Stanley Parable leans heavily on environmental storytelling, often repeating visual motifs to accentuate the bureaucratic dystopia and exploration, however, unlike most WS that reward exploration with revelation, this game offers small comfort before punishing the player for exploring by sending them back to the beginning of the game; a significant penalty. The game further shatters the fourth wall by bringing the players *backstage* to a room where the props for their journey are housed (See figure 4). Perhaps the most characteristic aspect of *The Stanley Parable* is the way it not only challenges standard gaming conventions, but outright turns them upside down. The narrator is demonstrably and grossly unreliable in a way that quickly becomes clear to the player; this comes as small comfort during play as the undesirable consequences of choices are unclear before it is too late to avoid them. This upending of player expectations is, itself, one of the innovations of WSs, and *The Stanley Parable* is an exemplar of such an approach.

Figure 4: A meta-visual moment in The Stanley Parable during which the player encounters scale models of the game environment

What it isn't. This game is neither a linear narrative, nor a game with clear goals or victory conditions, but instead, it is more of a *thing* to be experienced. As such, the main hallmarks of *The Stanley Parable* include subverting player expectations (for some players, to the point of annoyance) and challenging standard narrative and gaming conventions. This falls in line with Dan Pinchbeck's description of WSs: "It doesn't matter if you understand it or it doesn't matter if you 'get' it. It's not a problem to be solved, it's just a thing to be in for a while," (Campbell, 2016). The game begins with a large dose of snarkish charm, and follows a point-and-click approach. Moving the character along chosen paths often leads back to the beginning.

Why the difference matters. The potential for games like *The Stanley Parable* is in their ability to manifest the intangible idea of critically questioning authority, media and a supposedly trusted voice. In the right context this kind of game, in which the player can be "punished for doing things that classic games encourage," (Clark, 2017), could be used to show younger players that just because someone claims to be in charge and tells you what to do does not mean that they are competent correct or have your best interests at heart. This challenging of conventional behaviors can be a powerful tool for understanding and empathy.

What Remains of Edith Finch

In this Giant Sparrow (2017) release for PC PS4 and Xbox One, the player begins as 17-year-old Edith, a young woman returning to her family's ancestral Washington state home. Throughout the narrative, the player takes on a number of different identities while exploring rooms, passageways, pathways and secret spaces (strewn with revealing artifacts) in an attempt to understand the legacy of a family curse spanning five generations of Finches.

What it Is. *What Remains of Edith Finch* is an interactive mystery narrative replete with environmental storytelling. The player uncovers the mystery surrounding her family by exploring the empty Finch home, and the painful memories contained within each of its rooms. The game's "narration" occurs through haunting text that appears ex nihilo as the player moves through the game world, chronicling a first-person account that spans perspectives. The game is also an embodied experience that allows the player to enact a series of tragic mini-narratives that involve different ways of being, and different ways of physically enacting each piece of the story. From being a young boy pumping his legs to swing higher and higher into the air, to learning to fly as an owl, pounce as a cat, and slither as a sea monster, the unexpected qualities of each embodied experience push the player to a sense of childlike (but uneasy) wonder–and moves, eventually, to inexorable loss.

This game involves confronting the past and dealing with painful memories, and often doing so through an uncomfortable juxtaposition: as a toddler, imagining his bath toys coming to life and swimming with them deeper and deeper into the water, the player is reminded that the playful, uninhibited outlook of a child comes with the price of dangerous, even fatal, ignorance. As one might imagine, experiencing a series of tragic vignettes tends to provoke an emotional response in players, with the potential to connect to their own memories and fears.

Edith Finch also deviates from standard storytelling with surprising twists in the way it presents some of its stories. In the game's primary first-person perspective, the player navigates through a semi-standard virtual environment; but the game also subverts this norm by, for example, thrusting the player into the pages of a comic book, jumping from to frame to frame as the pages turn and the story moves forward. Such changes call the player's attention to the way that the story is being presented–and often reveal something about the character whose story is being explored. Similar subversions are accomplished through clever mechanics. While inhabiting the character of Lewis, Edith's brother, one must sludge through his monotonous work at the canning factory while simultaneously navigating through an imaginative inner fantasy world. It's a juxtaposition that gives pause; there's a tension as one struggles to safely navigate through both spaces, especially when one becomes much more compelling than the other.

Figure 5: Swimming with bath toys in What Remains of Edith Finch

What it Isn't. Since, in many ways, *Edith Finch* tends to subvert expectations, it's worth noting that it follows the same empty house "formula" as several other WSs (like *Gone Home*). Like many WSs, some players argue that it isn't truly a game, but rather an interactive fiction. Gameplay changes swiftly, continually surprising and keeping the player on their toes. Although it certainly isn't a traditional action game of any sort, the player is nearly always *doing* something–finding clues, unlocking narration, learning to play as a new entity (both in terms of figuring out each entity's capabilities and goals and how to use the game controls to achieve them).

Why the difference matters. Few, if any, of the other WSs explored thus far have taken the idea of embodiment to the level of *Edith Finch*. Although embodying characters using a dualshock controller doesn't offer the same level of immersion as virtual reality, but the controls and movements still manage to capture the unique and unusual experiences of becoming different characters. Something as outwardly simple as the height/perspective difference between being a young woman and a little girl has a surprisingly dramatic impact upon the player. As one reviewer noted, the game allows players "to experience something as an adult the way you used to experience books as a child — to see them open up in your head. To inhabit them the way you would another world," (Sheehan, 2017). On the one hand, it's an experience that only the videogaming medium seems capable of crafting successfully. On the other hand, and as the ending credits emphasize, it's a story; or more to the point, it's a story "about stories" (Diver, 2017). *Edith Finch* thus offers affordances in line with what several scholars have described as the possibility spaces within games; that is, the way that more open play can allow players/learners to imagine what might be possible (Flanagan, 2010; Squire, 2006).

Walk On: Discussion

When we conceptualize learning with games as *endogenous* (Reiber, 1996) or coming from within the game itself — it becomes inextricably embedded within its context. This perspective, with roots in the situative and sociocultural traditions, holds that learners play an active role in constructing meaning through inquiry, experimentation, and discovery. Knowledge is a tool set for solving authentic problems, and learning is an experience linked with identity. In short, learning through games involves “a set of well-designed experiences that elicit identities and encourage learners to confront existing beliefs, perform skills in context, and reflect on their understandings,” (Squire, 2006, p. 24).

Walking sims often encourage players to learn in these same modes. By embodying players in novel characters and/or settings, confronting biases, and challenging norms, they can encourage the player explore the nuances of complex issues and consider differing perspectives when a problem presents itself. Players encounter moral and ethical dilemmas that don’t have simple solutions; they are issues to be pondered, explored and experimented with to create an experience that is context- and player-dependent. WSs encourage players to explore more than just the game environment–and to push through to the exploration of ideas and feelings. By grappling with the ineffable, players may engage in their own *dealing and healing*, find meaning in an engaging mystery, and explore powerful stories that offer applications for literature and creative writing (Dalton, 2016a; Dalton, 2016b; Davarsi, 2014). In other words, WSs can leverage the kinds of emergent play that manifest when players bring their own goals, identities, and emotions into the game.

The slower pace of WS’s is a feature that works to build and engage player curiosity, challenge norms, elicit emotional responses and embody the player in a novel setting and resonant persona. A WS can gradually build the players’ relationship investment with game content so that when change or revelation finally takes place, it has a deeper impact. Players may therefore experience the meaning of key events, ideas, and relationships more directly and deeply than they would in games that give such content passing treatment or allow the player to rush through it. As such, WSs may afford more opportunities to expose players to themes that might not resonate as effectively in fast-paced play; indeed, exploration is encouraged alongside a strong message that there is meaning in the mystery and that the journey is the destination. In a WS, a player can wander but still be as “on task”, taking a deeper dive into the narrative intentionally constructed by game developers while simultaneously reflecting on the emergent experience in a more personal way.

By abandoning the standard western dramatic narrative structure related to pacing and time, the WS experience can be arranged thematically (instead of around plot and/or character arc). It can simply be a series of environmental events that challenge the player to reflect on assumptions, stereotypes, predispositions or world views. Since these games do not necessarily need to build to a climactic conflict (e.g, with a hero confronting the villain atop a windswept skyscraper), they can instead delve deeply into nuanced topics or explore an event or location with greater freedom.

Obstacles in WSs differ from the environment- or competition-centered variety and foster habits of mind rather than manipulation of playable characters or the environment. While some traditional games do offer dialog choices that unlock game options, these tend to be brief and isolated incidents tied to a character skill (charisma, bartering, diplomacy etc.) rather than the player’s own perspective and lived experiences. From a learning perspective, this aligns more closely with a holistic consideration of the players cognitive, affective and behavioral development than a grade-based assessment mentality.

Several of the common elements found in WSs–in particular, challenging player prejudices and perspectives, embodiment, and dealing and healing with the past–appear to offer affordances for empathy. If we consider embodiment as the emphatic link between the player and and avatar, this is in keeping with Gee's (2003) assertion that the interface between a virtual character and one's real-life identity (what he calls a *projective identity*) allows a player to entertain new perspectives, examine different value systems, and inspires an emotional investment. Well-designed games that recruit both the cognitive and affective dimensions of empathy have been recognized by educators as useful not only for empathy as an end in itself, but also as entry points for the discussion and examination of ethics, history, politics, and social studies (Boltz, 2017; Boltz, Henriksen, & Mishra, 2015).

Perhaps to the chagrin of those who would act as the gatekeepers of the gaming world, WSs also open games up to broader audiences. WSs can appeal to potential players who are not motivated by competition and action (or in fact are discouraged or alienated by it). For these potential players, WSs may serve as a space to explore and play at their own pace. Importantly, however, many players can't be pinned down to an oversimplified "type" of gamer, and simply look for different kinds of games at different times. WSs therefore offer space for all players to engage in particular forms of play and add variety to the gaming landscape.

Currently, WSs also share a range of limitations. Although they do tend to demonstrate greater sensitivity in addressing some social issues (e.g., identity and mental health) in comparison to other genres, most WSs are still extremely lacking in terms of the diversity of their playable characters and the limited, indirect, and problematic way the lived experiences of marginalized individuals are represented (Mejeur, 2018). As educators, we advocate for a continued evolution of the medium in hopes that future games will more fully represent the diverse lived experiences of potential players. WSs, like all videogames, must strive for more inclusivity, especially with regard to individuals from minoritized groups who have historically been underrepresented, oversimplified, and tokenized in popular media. In the meantime, these limitations may be used as opportunities for learners to identify, reflect upon, and discuss these problematic issues. Educators might also design revision activities to accompany game play that encourage students to imagine ways they might remix, rewrite, and redesign more inclusive WSs (e.g., via paper prototyping, Twine, etc., depending on age, available resources, and ability level).

Although their potential should not be overstated, WSs do appear to offer educative affordances in alignment with our current understandings of how learning happens—at least, given thoughtful design, attention to issues of representation, and integration within a carefully crafted learning experience that encourages reflection and connects game content with relevant themes and topics. More broadly, the walking sims of today may offer glimpses of and insights for the games of the future. As one writer notes, "Perhaps more than any other genre, the walking sim is preparing us for a future of synthetic worlds," (Stuart, 2016). As gaming continues to evolve technically with the adoption of virtual and alternate reality game mediums, WSs may continue to see increased adoption sponsored by broader audiences, novel interface and the ability to more fully experience a problem, issue or concept from the compelling, embodied perspective of another.

References

Barab, S. A., Dodge, T., Ingram-Goble, A., Pettyjohn, P., Peppler, K., Volk, C., & Solomou, M. (2010).

Pedagogical Dramas and Transformational Play: Narratively Rich Games for Learning. *Mind, Culture, and Activity,* 17(3), 235–264. https://doi.org/10.1080/10749030903437228

Boltz, L. O. (2017). "Like Hearing from Them in the Past": The Cognitive-Affective Model of Historical Empathy in Videogame Play. *International Journal of Gaming and Computer Mediated Simulations*, 9(4).

Boltz, L. O., Henriksen, D., Mishra, P., & the Deep-Play Research Group (2015). Empathy through gaming—Perspective taking in a complex world. *TechTrends* (59) , p. 3-8.

Bruner, J. (2002). The uses of story. In *Making Stories: Law, Literature, Life* (pp. 3–35). Cambridge, MA: Harvard University Press.

Campbell, C. (28 September 2016). The problem with 'walking sims'. *Polygon* [Website]. https://www.polygon.com/2016/9/28/13076654/the-problem-with-walking-sims

Campbell, C. (1 July 2014). The Long Dark is about self-reliance in a hard country. It is a game about Canada. *Polygon* [Website]. Retrieved from https://www.polygon.com/2014/7/1/5843612/the-long-dark-is-about-self-reliance-in-a-hard-country-it-is-a-game

Campo Santo (2016). *Firewatch* [Videogame]. Bellevue: Campo Santo.

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. *Review of Educational Research*, 86(1), 79–122. doi:10.3102/0034654315582065

Clark, N. (11 November, 2017). A brief history of the "walking simulator," gaming's most detested genre. *Salon* [Website]. https://www.salon.com/2017/11/11/a-brief-history-of-the-walking-simulator-gamings-most-detested-genre/

Clauson, J. (15 October, 2014). The Sting of Death in The Long Dark. *GameChurch* [Website]. Retrieved from: http://gamechurch.com/the-sting-of-death-in-the-long-dark/

Dalton, B. (11 May, 2016). *Playing with Fire* [Blog]. Retrieved from https://www.123readandwrite.com/single-post/2016/05/11/Playing-with-Fire-1

Dalton, B. (22 December, 2016). *I'm a Detective! Solving the Vanishing of Ethan Carter* [Website]. Retrieved from https://www.tes.com/teaching-resource/i-m-a-detective-solving-the-vanishing-of-ethan-carter-11465892

Davarsi, P. (5 March, 2014). Prologue: *A Video Game's Epic-ish Journey to a High School English Class* [Blog]. Retrieved from http://www.ludiclearning.org/2014/03/05/gone-home-in-education/

Diver, M. (26 April, 2017). 'What Remains of Edith Finch' Perfectly Illustrates Gaming's Storytelling Power. *Waypoint* [Website]. Retrieved from https://waypoint.vice.com/en_us/article/wn37d4/what-remains-of-edith-finch-perfectly-illustrates-gamings-storytelling-power

Flanagan, M. (2010). Creating Critical Play. In R. Catlow, M. Garrett, and C. Morgana (Eds), *Artists Re:Thinking Games.* Liverpool: Liverpool University Press, pp. 49-53.

The Fullbright Company (2013). *Gone Home* [Videogame]. Portland: The Fullbright Company.

Gee, J. P. (2003). *What Video Games Have to Teach Us about Learning and Literacy.* New York: Palgrave Macmillan.

Gee, J. P. (2005). Video games, mind, and learning. *The Interactive Digital Media & Arts Association Journal*, 2(1), 37–42.

Giant Sparrow (2017). *What Remains of Edith Finch* [Videogame]. Santa Monica: Annapurna Interactive.

Greeno, J., Collins, A., & Resnick, L. (1996). Cognition and learning. In D. Berliner & R. Calfee (Eds.), *Handbook of Educational Psychology* (pp. 15-46). New York, NY: Macmillan.

Hinterland Studio (2017). *The Long Dark* [Videogame]. Canada: Hinterland Studio.

Kagen, M. (27 April, 2017). *Firewatch: Precarious Manhood & Walking Simulators* [blog post]. Retrieved from https://melkagen.wixsite.com/strafe/single-post/2017/04/27/Firewatch-Precarious-Manhood-and-Walking-Simulators

Koehler. M.J., Arnold, B., Greenhalgh, S.P., Boltz, L.O., & Burdell, G.P. (2017). A taxonomy approach to studying how gamers review games. *Simulation & Gaming*. doi: 10.1177/1046878117703680.

Meitzler, R. (29 February 2016). Firewatch: How a Game About Loneliness Brought Me Closer to Other People. *DualShockers* [Website]. Retrived from https://www.dualshockers.com/firewatch-how-a-game-about-loneliness-brought-me-closer-to-other-people/

Mejeur, C. (2018, March). *Queer Not Here: On Queer Space and Absence in Video Games*. Paper presented at the Society For Cinema and Media Studies 2018, Toronto, CA.

Ramanan, C. (7 October 2016). About Walking Sims – Games or Not Games? *GameIndustry* [Website]. Retrieved from http://www.gameindustry.com/editorials/eurofiles/walking-sims-games-not-games/

Rankin, S. (20 February 2016). Ignoring Delilah in Firewatch is Heartbreaking. *IdieHaven* [Website]. Retrieved from http://indiehaven.com/ignoring-delilah-in-firewatch-is-heartbreaking/

Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research & Development*, 44(2), 43-58

Schrier, K., & Kinzer, C. (2009). Using digital games to develop ethical teachers. In D. Gibson (Ed.), *Games and Simulations.* IGI Global: Hershey, PA.

Sheehan, J. (2 September 2017). Reading the Game: What Remains of Edith Finch. *NPR All Tech*

Considered [Website]. Retrieved from https://www.npr.org/sections/alltechconsidered/2017/09/02/547922336/reading-the-game-what-remains-of-edith-finch

Stuart, K. (20 September 2016). How walking sims became as important as the first-person shooter. *The Guardian* [Website]. Retrieved from https://www.theguardian.com/technology/2016/sep/20/how-walking-sim-first-person-shooter-dear-esther

Squire, K. (2006). From content to context: Videogames as designed experience. *Educational Researcher,* 35(8), 19-29.

Squire, K. (2011). *Video games and learning: teaching and participatory culture in the digital age.* New York: Teachers College Press.

Young, M. F., Slota, S., Cutter, A. B., Jalette, G., Mullin, G., Lai, B., . . . Yukhymenko, M. (2012). Our princess is in another castle: A review of trends in serious gaming for education. *Review of Educational Research*, 82(1), 61-89. doi:10.3102/0034654312436980

UNPACKING MEANINGFUL PLAY IN THE CLINICAL CONTEXT: MOBILE APP USE BETWEEN CHILDREN WITH DISABILITIES AND THEIR SPEECH LANGUAGE PATHOLOGISTS

Mobile App Use Between Children with Disabilities and Their Speech Language Pathologists

YAO DU

Abstract

In recent years, children with disabilities who receive speech therapy services are increasingly interacting with iPad-based mobile applications (apps) to work on communication and social skills with their speech language pathologists (SLPs). Yet, limited research has been conducted to explore the collaborative use of mobile technology between them. Through interviewing 23 SLPs and analyzing their iPad use across different work settings, our study reveals that during their clinical practice, SLPs not only use a variety of mobile apps to support academic learning and treatment but also motivate children for therapy by engaging them in collaborative play. Additionally, app design recommendations reported by SLPs also closely align with prior research on usability, mobility, and playability heuristics for mobile games. Ongoing research should continue investigating SLPs' app use and play strategies in the clinical context and translating clinical utility of mobile apps to opportunities and guidelines for design that can support learning and meaningful play for all children with and without disabilities.

Introduction

With the widespread use of mobile devices, recent research indicates that 38% of U.S. children under 2 have used mobile devices for media consumption (Vatavu et al., 2015), and 80% of children between 2 and 4 years old spend at least 20 minutes a day using a tablet or a smartphone (Hiniker et al., 2016). Concerns about excessive "screen time" spent on digital media and games and its potential detrimental effects on children's academic performance, social engagement, and behavioral health, have not only led to public debates but also drawn attention from researchers from both health policymakers as well as researchers in child computer interaction and digital media (Mazurek et al., 2012; Read et al., 2018; Ito, 2017). While American Academy of Pediatrics encourages parents to create "personalized Family Media Use Plans" that attend to each child's age, health, temperament, and developmental stage (Chassiakos et al., 2016), media and game study scholars argue that this perspective on "screen time" is an outdated concept based on a dosage model, and could be decontextualized to reflect quality of learning over quantity of usage (Ito, 2017; Squire & Steinkuehler, 2017).

Unpacking the multifaceted use of technology among modern youth and educating various stakeholders (e.g., parents, teachers, administrators, healthcare practitioners, and even policy makers) has become a critical issue that warrants additional research. For example, how are youth making meaningful use of technologies like digital games? In what contexts is play meaningful to youth with disabilities? Unfortunately, despite the increased attention in medical and educational research as well as in the field of human computer interaction (HCI), children with communication-related disabilities has not been positioned at the center of the discussion.

Children with communication-related disabilities

It is estimated that one in 12 U.S. children between ages three and 17 may have speech, language, swallowing, and voice related disorders (Black et al., 2015). Specifically, 5 to 12% of children between 2 to 5 years old are estimated to have speech and language delays and disorders (Prelock et al., 2008), which are considered the "most common and least diagnosed disability of childhood" by primary care pediatricians (Wallace et al., 2015). Communication-related impairments can present as a co-morbid condition along with many different types of disabilities that are neurodevelopmental (e.g., autism spectrum disorder, attention-deficit disorder, intellectual disabilities), genetic (e.g., Down syndrome), congenital (e.g., cerebral palsy), and orofacial (e.g., cleft palate). Failure to provide therapy services to young children in a timely way may significantly hinder them from receiving early intervention and making effective progress, leading to challenges in acquiring functional communication and literacy skills for school readiness (Wallace et al., 2015; Morgan et al., 2015).

Children with communication impairments constitute a marginalized group of research subjects that are known to be challenging for research. For instance, they may have reduced cognitive and linguistic abilities to offer consistent and accurate user feedback to participate in traditional methods of inquiry (e.g., survey, interview, focus groups), and they may exhibit behavioral disturbances during user testing due to issues such as sensory and lack of interests in social communication (Hourcade, 2017). Ethnographic work by Alper (2017) with parents and children with autism suggests that researchers are limited in their knowledge about "the experiences that disabled youth, their siblings, and their parents have with media and technology at home and as part of domestic activities" (p. 23). For example, nonverbal children with autism who rely on using iPads as alternative augmentative communication (AAC) systems are "drawing on a larger ecology of speech tools, including interactive games and apps" to develop "creative expressions of voice through other media" (p. 63). To our knowledge, no research has systematically investigated questions such as: Who provided these "speech tools" and what tools have they implemented? How were these tools used across different settings (e.g., home, school, clinics) and what are the benefits and challenges when using these apps? Are these tools being used as a medium for instructional work, behavioral reinforcement, and/or leisure play? These questions remain unaddressed and require researchers to investigate key stakeholders who participate in the design and use of these digital tools with children with disabilities. Additionally, prior work primarily focused on how researchers approach design and/or service delivery with children (and their parents) in settings such as home and schools. How children with disabilities interact with their clinical service providers, such as their SLPs, remains a gap in research.

Speech language pathologists and Their Work

Governed under American Speech-Language-Hearing Association (ASHA), pediatric speech language pathologists (SLPs) are clinical professionals who provide speech therapy services to these children with communication impairments from birth to adulthood (ASHA, 2016). Speech therapy services can be provided at home and in both educational and medical settings such as a private clinic, or at care facilities (e.g., hospitals or daycare center). A report from ASHA (2017) indicates that more than 50% of SLPs – approximately 71,000 clinicians – were employed in educational settings in 2016, working with individuals from preschoolers to young adults. In the school setting, an SLP can work with students inside the classroom (referred to as "push-in") in an inclusive manner or outside the classroom in a speech therapy office (referred to as "pull-out"). An SLP may conduct speech therapy with an individual student or a group of students that can benefit from peer support and social communication with each other. This kind of service delivery provides opportunities to design for not only 1:1 interaction but also interaction across one clinician and multiple children with different impairments and therapy goals.

In recent years, there has been a rapid increase in SLPs' use of digital media (e.g., Youtube videos) and mobile technology (e.g., iPads) for therapy (Fernandes, 2011). It is estimated that more than 60% of SLPs in a U.S. state level survey reported using iPads in clinical practice (Edwards & Dukhovny, 2017), and during a therapy session, iPad-based therapy can occur up to 25% of the time along with a combination of physical and digital therapy materials (Cohen et al., 2017). Despite the increased use of digital technology at work, in literature across HCI, communication science and disorders (CSD), and media and disability studies, few researchers have examined how SLPs use these digital tools across different settings with their clients, and how children with disabilities interact with their clinician using digital media and technology during speech therapy.

Therapeutic Play and Meaningful Play

Prior to the age of mobile and video games, play-based assessment and intervention using toys and non-digital games (e.g., card games, board games) has been widely used during speech therapy (Linder, 1993; Bratton et al., 2005). Due to the nature of their disabilities, children with communication impairments often experience difficulties during symbolic, interactive, and social play with peers and adults very early in life and throughout their critical periods of speech and language development (Danger & Landreth, 2005). Many children with disabilities who are chronologically older may also demonstrate play skills at a younger developmental age. As a result, designing play in the clinical context also involves additional therapeutic planning to improve children's areas of deficits as a major outcome, rather than merely facilitating ludic activities of "playing" (Deterding et al., 2011). Although language and play are interconnected, SLPs pay more attention to the functionality of child-centered play as an effective strategy rather than critically analyzing whether the play leads to a meaningful interaction. To many clinicians, a higher-order goal may emphasize on "meaningful use of language" over "meaningful play experience". This notion of therapeutic play differs from perspectives on play from game designers, who seek to design play to first create meaningful experiences and then help players communicate an attitude towards their own course of actions (Salen & Zimmerman, 2004).

In the past few years, SLPs and clinical researchers have begun to explore opportunities to integrate playful activities such as games for speech therapy. Many have published case studies on how to use video game design principles and mobile games (e.g., casual games like *Angry Birds*) to improve therapy engagement while targeting both assessment and treatment goals (Folkins et al., 2016; Sweeney, 2017; Sweeney, 2014; Roehl, 2015). Constantinescu et al. (2017) suggest that by targeting the experience of game flow to "make deliberate practice more enjoyable and a habit," gamified health apps can be designed to facilitate patient adherence to swallowing exercises. Barbour (2015) and Tye-Murray (2016) anticipate that the future of aural rehabilitation could be delivered via automated and customized hearing exercise games beyond audiology clinic visits. Yet, how to apply game design principles and game play strategies to improve clinical success for specific impairments remains largely incomprehensible to clinicians, researchers, and designers.

Research Rationale and Questions

The motivation for this study originated from the author's own experience using mobile apps on the iPad for therapy as a pediatric SLP, who found limited to no research evidence and resources to evaluate and commercialized apps. This paper describes the preliminary results from an initial interview study of a research project, which includes interviews and surveys with three key stakeholders: (1) SLPs who use iPad apps for therapy, (2) SLPs who have used and designed their own apps, and (3) app designers and developers who have no background in speech therapy. The goal of the initial interview is to explore diverse practices of mobile app design and use by SLPs and app designers and developers. For the purpose of this paper, we only describe interviews with SLPs who are either app users or app designers and users, since interviews with app designers and developers are still being conducted at this time. This paper addresses the following research questions:

- (1) What types of mobile apps do SLPs use with children during speech therapy, where do they find these apps, and why do they use these apps?
- (2) What are some needs and challenges that SLPs encounter when using apps with children with communication impairments?
- (3) What heuristics best support the user experience of these apps for SLPs and children with communication impairments?

Research Methods

Participants

Using a snowball sampling technique from the lead researcher's professional network, initial recruitment emails were sent to SLPs between December 2017 and June 2018. Each individual received a copy of the study information sheet and a UCI-approved IRB protocol. To date, a total of 37 SLPs participated in semi-structured interviews, including 23 SLPs who have only used apps for therapy and 14 SLPs who have used apps and also designed their own apps. Participating SLPs come from 18 states in the U.S. (except three SLPs from China, Malaysia, and Sweden), have between two and 36 years of clinical experience, and provide therapy in-person and via telepractice for diverse settings (e.g., private practice, public school, children's hospital, university clinic, home health) to children across different ages in school (e.g., preschool, elementary school, middle and high school, and young adults).

Interview Protocol & Data Analysis Procedures

Interview questions were constructed using two domains ("intervention characteristics" and "characteristics of individuals") from the consolidated framework for implementation science (CFIR), a theoretical framework used by researchers across a wide variety of study objectives and settings to evaluate the implementation of an intervention (Olswang & Prelock, 2015). This framework offers opportunities to examine both characteristics of SLPs in terms of "personal attributes" and "individual stages of change" before and after iPad use, and the characteristics of iPad as an "intervention" method using these five specific domains for analysis: "sources, relative advantage, design quality and packaging, cost, and adaptability." All interviews were conducted via audio/video conference calls, and interview lasted one hour on average. The lead researcher audio-recorded, transcribed, and conducted preliminary data analysis of each interview and developed recurring themes within each individual interview and across interviewers based on specific stakeholder groups they belong to. Since data analysis is still in progress, for the purpose of this paper, we will discuss interviews from 23 SLPs (15 app users and 8 app designers).

Results & Interpretations

RQ1: What types of mobile apps do SLPs use with children during speech therapy, where do they find these apps, why and how do they use them?

To meet the learning needs of children with disabilities who have different levels of physical, cognitive, and linguistic abilities, all SLPs report they use a combination of traditional non-digital materials (e.g., worksheets, books, toys, board games) in conjunction with iPad apps. SLPs implement not only native apps (e.g., camera, voice memo, photos) but also a combination of children's educational apps, health and medical apps, apps for speech therapy, and casual games to capture and manage data, provide interactive instruction with multimodal and real time feedback, increase motivation and engagement, and facilitate carryover therapy exercises at home. When searching in the iOS store, besides using keywords that are related to target impairments or instructional content, SLPs also utilize parents and teacher referrals, in-person training and workshops, online search and educational blogs, and a variety of social media platforms (e.g., Facebook, Twitter, Instagram, Pinterest) to find apps.

Having the iPad as a clinical tool brings SLPs various affordances such as portability, social interactivity, context sensitivity, connectivity, and individuality (Klopfer & Squire, 2008), and also creates additional collaborative (Bardram & Houben, 2018) and motivational benefits (Zhang, 2008; Deterding, 2011). To some SLPs, the rich variety of mobile apps on the iOS store makes the iPad not only an instructional tool and a reinforcement tool for therapy, but also a medium to "create a culture of fun". For example, SLPs such as P19 love the ability to use a book creation app to work on social cognition and storytelling by making a book or journal with different ages of students. SLPs P4 & P30 shared ways of leveraging both the content and the context of the popular game *Angry Birds* for teaching articulation of speech sounds and functional language:

> I can infuse this Angry Birds game with one of these kiddos…on his articulation, the /r/ sound. I remember there was a RED bird and the RED bird was 'REALLY fast', and I would emphasize these sentences to this particular student. He would attempt to say these sentences back to me, while thinking about strategies of the /r/ sound that we did. And I was keeping data. And then once he was able to give me a certain amount of correct responses, I would say: 'Now let's play this app for like 2-minutes!' And while we play that app together…he was again verbalizing those same sentences that directly related to the articulation. So as he was swiping his finger, he was saying: 'Oh here I am. This is the RED bird.' And he would take his turn. So he was playing the game but he was still giving me

> data that I was collecting with regards to his articulation. And that was really a cool thing for me to see, how this tablet-based experience could exist in our therapy world in some capacity." (P4)

> I always recommend Angry Birds for language, but with support, with control, with guided access…So I always say 'pull, go, fly, pigs, oh my gosh' just to get verbalizations not letting them touch it until they say something…If you have Angry Birds on one device, and you have their AAC app opened, then you can do 'cool, fun, oh-no' and teach them how to do functional communication. So lots of great things. (P30)

Interestingly, although games can become a motivating tool for therapy, SLPs still create their own tangible materials (e.g., visuals aids based on games like *Angry Birds*). Students with disabilities often demand extra multimodal supports, therefore, it is common for SLPs to redesign and improvise materials as part of their daily practice, especially for students who are chronologically older but functioning at a younger age.

> People have designed really good self-regulation visuals that relate to Angry Birds…or just having them play hands-on games that are Angry Birds, like the ones with the real, physical catapults and stuff like that. Have a lot of self-regulation and executive function components to them, like they're supposed to look at this card and build that structure. (P19)

SLPs are also very skeptical about the utility of the applications and stress the value of implementing fundamental teaching techniques (e.g., modeling, prompting, scaffolding) when using apps and games. As P21 states: "the meaning comes from you (SLPs) showing your child the value of the tool…A lot of the value comes from guiding that whole experience." P28 also highlights the importance of determining the purpose of using these games: "how can we incorporate that game, make it fun for them (students), make it fun for us, and also work on their goals at the same time." These responses demonstrate that determining the meaning and values of technology use are intertwined with complex clinical decision making and consideration of how to create a meaningful therapy experience for their clients through using functional instructional and therapeutic tools.

RQ2: What are some needs and challenges that SLPs encounter when using these apps with children with communication impairments?

Due to limitations in resources in time and money and restrictions in clinical environments (e.g., privacy and security issues), most SLPs expect apps to be cost-effective, easy-to-use, and versatile, which lead them to use a range of free, commercially available game apps. Since children with communication impairments may have diverse abilities and user preferences, SLPs also found tensions between the interaction they provide as clinicians and the interactivity offered by apps. For example, there are many free games on the iOS app store, but most of them have distracting advertisements or background music. The visually appealing advertising leads to a particularly distractive gameplay experience for children with autism who seek visual stimulation, and the background music overwrites natural speech and language communication that can potentially occur between the child and the therapist. Several SLPs have voiced the need to minimize these types of distractions in order to offer more offline communication opportunities and better interaction, so children can focus on the therapy activities with the clinician rather than becoming overly engaged using apps. As P28 described:

> Sometimes you might want to look at a fun game like Angry Birds or something to use in speech therapy. Because I know with that one, during the game there's music, the birds are making a sound…as a speech therapist…I'm going to totally turn the volume off on it so I'll show them like: 'hey, we're gonna work on our sounds today and every time you say your sound you get to shoot a bird into the house'…we can minimize that distraction. I'll show them what we're gonna do and then I'll put it face down and I'll say, okay let's practice our sound; say this word, say this sentence. And when they do I'll flip it up and then they can shoot a bird across and then we're putting it back down but again we also turn the sound off…I think there's definitely ways we can utilize a lot of the apps we're not using.

Besides reducing distractions, some SLPs want apps to be "open-ended" without "language built into them" (P21) so that they can model diverse language use during therapy practice. They also need games that are "slow enough to foster communication" but "fast-paced" to play through using "short turns with a very definite beginning and end" (P19) due to the fast-paced clinical environment. These conflicting design requirements suggest that when creating apps for speech therapy, design features that stimulate children for immersive and engaging interactions may need to be controlled to account for communication that happens offline, as well as "the nature of the relationship between play and real life" (Schüll, 2012, p. 190), which in this case, between playing the games and engaging in therapy exercises.

While creative in their use of apps and games, many SLPs struggle to find apps that are specially designed for specific functions (e.g., apps for speech and language assessment, apps for behavioral tracking), specific skill domains (e.g., voice, fluency, and social skills), and specific patterns of play (e.g., creative play and collaborative play, rather than cause-effect play). In our interview, P28 observed that when given the chance to choose either games on the digital iPad or traditional board games, students may also select non-digital play with other peers because "they are getting that social interaction, they're getting that feedback and engagement with a peer and they're just happy and excited." Contrary to how Schüll (2012) illustrated in her ethnography work with gambling addicts who "seek a zone of reliability, safety, and affective calm that removes them from the volatility they experience in their social, financial, and personal lives" (p. 208), when provided with alternative choices from their adult clinicians to play with their student peers, many children actively seek for play that involves social interaction and competition.

In addition to play, there is also an emerging need to tie speech therapy apps to academic curriculum (e.g., science and social studies). Previous research has shown that play activities in virtual worlds foster scientific habits of mind in massively multiplayer online games (Steinkuehler & Duncan, 2008), but research on technology-integrated science curriculums is lacking in the field of special education. For instance, during clinical practice, P19 frequently uses a game app that invites children to combine elements such as fire, air, earth, and water to create new things (e.g., mud and steam). P19 argues that this chemistry game not only allows children to learn about scientific process but also help clinicians to target multiple speech therapy goals, including complex sentence formulation and using language to make predictions and inferences.

> STEM is a big push, but SLPs see that as not related to that. And particularly with the systematic minds we serve in the autism spectrum disorder population who will probably go into science, I think it would be really great if we leveraged that more strongly. That seems like a gap that hasn't really been served of apps that strongly explore the language of these content areas. (P19)
>
> P23 also reported a client with autism who started as nonverbal at age three, learned to use verbal language through speech generating apps on the iPad, and later experienced a burst of language development. Although this client still receives speech therapy to learn about social skills (e.g., initiating a conversation), he has grown to become a high-functioning boy with autism who has mastered organic chemistry as a first grader. His favorite app is a chemistry app, which is being used to destress for social demands at school. His therapist is unable to classify whether this atypical behavior should be classified as play or a form of learning, as his age-equivalent peers would rather relax after school with entertainment apps, such as Youtube Kids. Nevertheless, these empirical accounts suggest that given the diversity in children with disabilities, integrating STEM-curriculum when designing speech therapy apps may not only foster better digital play and language stimulating environments, but also bring long-term impact in academics and career development for young children with communication impairments.

Additionally, interviews with clinicians also reveal that large quantities of data are being produced when SLPs are interacting with children using the digital technology, which provides both opportunities for research and concerns about privacy. When dealing with children's data, depending on the functionality of individual apps, privacy and security regulations (e.g., the Children's Online Privacy Protection Rule, the Health Insurance Portability and Accountability Privacy Rule) may bring multiple levels of constraints that SLPs and app developers should both be aware of. Although SLPs reported using a mixture of both traditional paper-based data collection and digital data collection in the app, multiple forms of digital media data have been generated. In addition to artifacts co-created by clinicians and their clients (e.g., using books to create a story together), many audios and videos can be captured for both educational and therapeutic purposes, but this valuable and child-sensitive information is often deleted or shared through workarounds.

RQ3: What heuristics best support the user experience of these apps for SLPs and children with communication impairments?

Although individual preferences and needs may differ, all SLPs also use specific app selection criteria such as educational relevance, cost, usability, aesthetics, accessibility, and functionality (e.g., customization, relevance to therapy, multilingual features, and data collection capacity). Interestingly, although the lead researcher did not probe questions for specific mobile use heuristics, participating SLPs provided use scenarios that closely overlapped with previous research on mobile games heuristics. In the next section, we illustrate how quotes from SLPs relate to the playability heuristics for mobile games by Korhonen & Koivisto (2006). Although these heuristics are initially proposed to target pre-production and production phases of games, SLPs' post-production evaluation of their apps indicates that these heuristics can be applied beyond the production phase, leading to future feature designs. The three heuristics are: usability heuristics, mobility heuristics, and gameplay heuristics.

Game Usability Heuristics

According to Korhonen & Koivisto (2006), mobile games are considered software products, therefore, the user interface should be "convenient, reliable, and usable" for players, while also creating an enjoyable and fun gaming experience. The game usability heuristics (Table 1) also resonate with SLPs' clinical needs and their client's cognitive and linguistic abilities. Children with disabilities not only enjoy the audio-visual representations (GU1) and visually pleasing interface designs (GU2), they also need consistency of navigation and controls (GU6, GU7, GU8), as well as feedback and scaffolding (GU9, GU12) to support their app use.

No.	Game Usability Heuristics	Participant Quotes
GU1	Audio-visual representation supports the game	"I just like that it's fully usable, the graphics are good, the sounds are not too annoying. Background music is bad, plus it interferes with language if we work on expressive language. It's okay to have sound but background music is annoying." (P33)
GU2	Screen layout is efficient and visually pleasing	"Proloquo had a lot of fringe stuff that makes it more appealing, if the layout is more appropriate for them." (P1) "I love the different variations of colors and the fact how colors can truly elicit different types of feelings in a person." (P4)
GU3	Device UI and game UI are used for their own purposes	"Still one of the top paid apps in sports is this one called Coaches' Eye." It's basically a video modeling app for sports, but it allows you to visually annotate what's going on in the screen...annotating on screen could be a way to give someone feedback on what they did and what their communication looked like." (P19) "It's really easy to see when their little fingers are going to the exit button. I forget what it's called. There's a way they lock a certain app so they can't get out it." (P21)
GU4	Indicators are visible	"Identify the picture that demonstrates this preposition, identify the preposition in the sentence. Drag and drop the item to the correct location, identify the preposition, if the preposition indicates location time or movement, it's just given us four different activities to start that goal with that student, which is really awesome." (P28)
GU5	The player understands the terminology	"I download them and just mess with them a lot and I'll play with them to see if its user friendly, if there's any glitches." (P28)

GU6	Navigation is consistent, logical, and minimalist	"I try apps that I downloaded and if I can't figure out within about three minutes, I delete it." (P3)
GU7	Control keys are consistent and follow standard conventions	"LAMP, it works on motor planning principles, where the same word is in the same spot, and you can't and you really shouldn't modify anything." (P1)
GU8	Game controls convenient/flexible	"The games, I'd say, are more flexible in their use." (P1)
GU9	The game gives feedback on the player's actions	"And the iPad is helpful because apps are useful with cause and effect for everything, and visuals assist with everything." (P2)
GU10	The player cannot make irreversible errors	"We like things to be relatively errorless." (P19)
GU11	The player does not have to memorize things unnecessarily	"I like apps that allow some kind of structuring, like organizational language. So, not necessarily games, but apps that can foster oral language and writing...within spaces that help students see the connection between ideas. Lots of if-then sort of thinking." (P19)
GU12	The game contains help	"It's Restaurant Asia, and they can look at the cues and make the food, and then they can decide whether they would use it or not." (P2) "I think if people have more of a stronger rationale in how the app is helping them go through the steps of something that the children are internalizing, it's been more successful and more of an interest." (P19)

Table 1: Heuristics for Evaluating Game Usability

Mobility Heuristics

Mobility heuristics (Table 2) offers multiple contributions to the fast-paced and dynamic nature of speech therapy work. As we described in the background section, during group therapy, there are multiple students in a therapy session requiring individualistic attention and instructional support from a single SLP. This requires the SLP to be able to not only shift between students but also work around interruptions. Mobile devices such as the iPad offer portability, and apps on the iPad further accommodate the complex temporal (MO1), environmental (MO2), and contextual (MO3) needs during a therapy session.

No.	Mobility Heuristics	Participant Quotes
MO1	The game and play sessions can be started quickly	"That's me really evaluating: can this person do the thing that I want them to do in a quick manner. Because the quicker they can do it, the faster they can do the speech therapy and involve that app in the therapy." (P4)
MO2	The game accommodates with the surroundings	"I wanna create apps where my students can physically see their own backyard in the app. I wanna create apps that allow them to be able to take videos of themselves and in the process of them taking a video or taking a photo of themselves, we turn that into the digital therapy material." (P4)
MO3	Interruptions are handled reasonably	"That's a good thing about Subway Surfer and other games like that...you can pause it and when the student hit 'unpause', it gives them a 3-second countdown so it's not immediate…gives them a chance to get back into it." (P28) "You also have two or three students so it could be something as simple as you're giving them ten seconds like – how many coins can you get right now? And then you pause it and you're asking the group another question and that kid answers and you're like okay, ten seconds. How many coins can you get?" (P28)

Table 2: Heuristics for Evaluating Mobility

Gameplay Heuristics

Another unique affordance of game-specific apps is that SLPs also found that when giving children control of play (GP4) to work towards their own game play goals (GP1), it creates a better therapy environment where children are also intrinsically motivated to learn and work towards clinicians' therapy goals. It is worthy to note that clinicians are trained to provide engaging therapy experiences (GP6), but many clinical activities they implement may not have the sophisticated storyline or narrative grounding that games can offer (GP7). Due to the needs to balance gameplay and therapy experience, many clinicians not only want games to offer a reasonable amount of choices but also offer a slower pace so that they can also communicate with their clients during play (GP5). Furthermore, after extended therapy, traditional therapy materials and activities may lose novelty (GP8) for children with diverse play preferences and interests (GP10). However, with games, SLPs can leverage the game flow (GP11) to maintain continuity of activities, the visualized progress (GP2) for additional instructional support, and meaningful rewards (3) for motivation. Built-in creative play in some high-quality children's apps can further foster creative expressions (GP9) among these children.

No.	Gameplay Heuristics	Participant Quotes
GP1	The game provides clear goals or supports player-created goals	"But that definitely sells an app if the kid really loves it and it works towards their goals." (P1) "You can use them in other areas for language, so it has more purposes than just articulation, so it has more than one purpose." (P2)
GP2	The player sees the progress in the game and can compare the results	"But the other aspect of technology, speech and language pathology, and visual support, is just that we can make abstract things visual through technology for the kids. Whether that can be an engagingly typed agenda for the session, or a concept map, or vocabulary pictures in an app that lets us quickly bring up those types of visual supports.A place you can display ideas to scaffold understanding and scaffold kids talking about the idea." (P19) "When I'm looking at applications I'm trying to find one, which ones that are gonna help us target their goal, target students' progress." (P28)
GP3	The players are rewarded and rewards are meaningful	"I can just press it on that tablet...the kids I work with are just so excited about that routine that goes with it, and then they get to trace that letter on the tablet as they practice the sound." (P1)
GP4	The player is in control	"I'm letting you hold this to give you some control right now, but we're actually doing the task that I want to do." (P1) "Here again, touching musical instruments, it makes sounds, which I know that I determine the sounds…It just gives the students control." (P18)
GP5	Challenge, strategy, and pace are in balance	"Having too many choices on the screen would really distract the students...The lower the amount of options on there, the simpler it is for them to use it." (P18) "I think it's important for games to have a pace that allows for communication to take place outside the screen... I don't necessarily think that everything we do has to be errorless, but if it's a game, just pace is important and it being slow enough to foster communication." (P19)
GP6	The first-time experience is encouraging	"Stop, Breathe, & Think Kids, there's a kid version, and it frames it in terms of missions. So it gamifies it a little bit for kids and then it shows a video there, so they are mindfulness-based video resources that encourage practice of a particular skill." (P19)
GP7	The game story supports the gameplay and is meaningful	"Peekaboo barn, which once again can be more like I want you to maybe imitate the sound that the animal's making. Can you guess what animal it is?" (P1) "I feel like it's more of a productive type of problem solving. Something that could happen in real life. Like, don't eat raw chicken; you'll probably get food poisoning. That's why the character in the game didn't want to eat it because he was probably gonna get sick. It just lets us talk about more real-life scenarios, versus these other games about throwing birds at a house." (P28)
GP8	There are no repetitive or boring tasks	"Because I hate when I have sessions where in the middle of it, a student's like: 'Are we done yet? Are we almost done?' That just gives me a note like, OK, this one was a little sluggish. This one just didn't catch their attention. What can I do next time? Maybe I can incorporate an iPad game to make it more fun." (P28) "I have children that get tired of the toys that I have in my room, or maybe I want to find a new way to use it. With the iPad I can just download a new app." (P21)
GP9	The players can express themselves	"You hear the /r/ sound in that sentence, the app asks you to do that, so it's the clinician's role to maybe ask the child to say that sentence. And then, you would allow that child to act out that sentence." (P4) "They get really imaginative with it, and like 'oh I need this for dinner tonight, I need the chicken, and oh I'm gonna make fish sticks,' and they're just creating this dialogue and it's really cool to see. It's really interesting." (P28)
GP10	The game supports different playing styles	"I love when an app is designed to be used together with multiple people and allows for that so that it can easily be passed from person to person, and they could collaborate and work together on it." (P19) "Kids pick the items they're gonna sell and then someone is the cashier and then someone is buying stuff." (P28)
GP11	The game does not stagnate	"Sometimes the students can't do something until they do something else so it kind of pushes them to problem solve...There's one called Toca-Boo where the kid puts on a sheet and he scares his family. The kids love it when he scares them and they run away, but the only way they'll run away is if he hides somewhere in the room first." (P28)
GP12	The game is consistent	"So if it's working, I feel like…I consistently do that app with the child, if I see steady progress, even if it's just two, three, five percentage points from week to week or month to month." (P3)
GP 13	The game uses orthogonal unit differentiation	"I often am drawing more from content areas, and seeing what kids are doing in science and social studies, and what are the linguistic elements and underpinnings of those units that they seem to not get or not really be able to use. I think there is a big tie-in with the disciplinary literacy...correlates between language and disciplinary literacy, like the fact that science has lots of procedures, has lots of nominalization of turning verbs into nouns." (P19)
GP 14	The player does not lose any hard-won possessions	"For the little ones it has to be a more open-ended game. No competition." (P21)

Table 3: Heuristics for Evaluating Gameplay

Discussion

The increased adoption of iPad-based games and apps during speech therapy suggest that speech language pathology, as a profession, has begun to leverage the multifaceted affordance of mobile technology, and designers and researchers should recognize the needs for both of SLPs and children with disabilities. When children with disabilities receive speech therapy services, they engage in therapeutic learning of various communication-related skills using a range of applications under the guidance of their therapists. Although this collaboration is initially manifested through the form of therapy work that involves instructional strategies and interaction – teaching and learning, unpacking the play activities during this process can further help game designers and researchers to understand the discourse of meaningful play between clinicians and their clients. These can be achieved through building a shared understanding of play and collaborative research agenda. First, because of the complex interplay between language and play that happens offline, both clinicians and mobile game designers need to first recognize how functional communication and interaction may blossom during various forms of play. Since "the goal of successful game design is the creation of meaningful play" (Salen & Zimmerman, 2004), reconceptualizing the definition of meaningful play with a focus on evaluating different types of play in the context of speech therapy may shed light on future research in game design for children with disabilities. Second, researchers need to realize that SLPs may be experts in creating non-digital play experiences during an era where play-based therapy was delivered via toys or card and board games; app designers and developers may be skilled at creating innovative interfaces and interaction. Both groups need to establish a shared epistemology using design principles from multiple disciplines including instructional design, game design, and mobile interaction design. Third, there is a high value in involving SLPs in the early phases of design and research, as SLPs engage with children with special needs on a daily basis and can become resourceful informants as care professionals who support children's learning. When collaborating with SLPs, game designers should also find a fine balance between protecting children's right to play knowing that SLPs may have different values when integrating play during instruction and therapy.

One of the biggest challenges in creating mobile games and apps for speech therapy is designing for two users, the therapist and the child, who have different goals. By positioning children at the center of design with additional considerations to integrate SLPs' goal and workflow, mobile apps have the possibility to become a powerful educational and therapeutic tool that meet multiple purposes for instruction, reinforcement, and leisure play. Interviews with SLPs indicate a gap in the current market that lacks not only educational and therapeutic apps for children with communication impairments but also a shared knowledge of how to design for collaborative play-based therapy between SLPs and their clients. Additionally, during this interaction between clinicians and children, they create rich data that allows opportunities for in-depth qualitative and quantitative analysis (Chi, 1997) to monitor learning and therapy progress. Gameplay data also offers a context for future researchers to apply existing advancement in game analytics and building frameworks for recommending educational content. Leveraging potential advances in game research, it is possible that in the future, therapists can offer "objective measurement of user experience" based on their clients' demographics, personality, and preferences of play during therapy (Yee et al., 2011; Yee at al., 2012).

Additionally, interview results indicate additional opportunities to support advanced pedagogy skills among SLPs by teaching them principles of instructional and game design to create a student-centered experience using technology. Many existing educational apps in science and social studies can also foster more opportunities to connect communication to academic learning. Both SLPs and app designers and developers may have neglected the fact that language is closely connected to literacy skills and scientific knowledge. Utilizing SLPs clinical background, designers and researchers in educational technology may consider building additional support for functional communication and language learning to take place in games for science and social studies. Although individual SLPs have their own knowledge, beliefs, and practices using apps for speech therapy, they do not receive any professional training to systematically evaluate or critique iPad apps for therapy. SLPs were able to report observations of factors that link to increased engagement and motivation during app use, but many of them could not articulate what objective measures they used for engagement and motivation, nor to elaborate on research efficacy of app use in meeting speech therapy goals. This is consistent with ethnographic work from Alper (2014), who reported that "professionals who work in educational and therapeutic contexts with youth with disabilities rarely have a background in children's media use, are frequently ignorant about new media, and are in need of professional development…to support their own understanding of digital media and integrating technology into curriculum" (p. 14). This finding indicates another gap in knowledge and training for new media and technology among SLPs who use mobile technology to work with children with disabilities. With ongoing training and education from game designers and researchers on how to design meaningful play experience, SLPs can further educate and support meaningful technology use for other stakeholders (e.g., parents and teachers) for home and school environments.

Conclusion

This is the first known interview study to investigate pediatric SLPs who use and design commercial iPad-based apps for children with disabilities. By interviewing SLPs about mobile app use, evaluation, and design recommendations from their collective clinical experiences with children with disabilities, this paper investigate the deeper value of how and why mobile apps are integrated in the modern clinical practice a variety of apps for different purposes, including but not limited to instructional, assistive, and recreational. Based on descriptions of SLPs' current needs and challenges designing and using iPad-based apps, this paper brings multiple contributions: (1) helping researchers understand how SLPs' app use can foster meaningful play and communication among children who have impairments in these areas, (2) utilizing existing mobile game heuristics as guidelines to create mobile apps for children and clinicians in the context of speech therapy, (3) offering implications to design effective apps to facilitate these children's communication and interaction, and (4) providing direction for future research to educate the general public about the value of play and meaningful use of games, especially for children with disabilities.

Due to socioeconomic, technical, cultural-linguistic, and ethical constraints, there is a gap of knowledge across clinical and technical communities about best practices to design mobile games and apps that offer not only educational and therapeutic curriculum-based learning content but also intrinsic motivation for children to stay engaged for therapy. Interviews from SLPs demonstrate that mobile game heuristics may offer guidelines for designing mobile apps for speech therapy, however, these apps should be co-designed with domain experts such as SLPs to ensure educational and therapeutic values. Furthermore, mobile games, as a form of interactive medium, have gained appeal among children with communication impairments as well as SLPs who work with them, due to its multimodal presentation of instructional and learning content, and stimulation for complex situations that foster communicative opportunities to use oral communication in this particular clinical environment. Ongoing research should continue to investigate implications of using these mobile game heuristics to support the collaborative work between SLPs and children. This design approach not only can help designers and researchers reveal additional affordances for mobile technology, but also educate parents and teachers to understand the benefits of mobile technology and offer design knowledge that can shape the future human-technology frontier for special education and health. Our study also calls for attention to this marginalized group of children and clinicians who lack of high quality apps at a global scale, and additional research is crucial to support the design, development, and deployment of accessible mobile applications for an international audience who lack robust speech therapy resources.

Ethical issues

Although all participating SLPs report using iPad for clinical practice, individual SLPs may have different years of clinical experience and levels of technology implementation. It is important to acknowledge that the author intends to report research outcomes to reflect the needs of these individuals, rather than to critique their clinical practices. Due to the clinical and technical challenges of directly including children as part of the interview study, this study only reflected interviews with SLPs, but it is also important to note the lack of values and voices from children. Researchers should also consider including children who have received speech therapy services, as many students may still receive speech therapy services and are capable of becoming informants for future research. Future research also may consider including multiple stakeholders such as parents and teachers to across multiple communities.

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References

Alper, M. (2017). *Giving voice: Mobile communication, disability, and inequality*. MIT Press.

Alper, M. (2014). *Digital youth with disabilities*. MIT Press.

American Speech-Language-Hearing Association. (2017). ASHA summary membership and affiliation counts, year-end 2016. Retrieved from www.asha.org.

American Speech-Language-Hearing Association. (2016). Scope of practice in speech-language pathology [Scope of Practice]. Retrieved from www.asha.org/policy/.

Barbour, D. (2015). It's Game Time. *The ASHA Leader*, *20*(6), online only. doi: 10.1044/leader.APP.20062015.np.

Bardram, J. E., & Houben, S. (2018). Collaborative Affordances of Medical Records. *Computer Supported Cooperative Work (CSCW)*, *27*(1), 1-36.

Black, L. I., Vahratian, A., & Hoffman, H. J. (2015). *Communication Disorders and Use of Intervention Services among Children Aged 3-17 Years: United States, 2012.* NCHS Data Brief. Number 205. Centers for Disease Control and Prevention.

Bratton, S., Ray, D., Rhine, T., & Jones, L. A. (2001). Meta-Analysis of the Play Therapy Outcome Research from 1947 to the Present: A Brief Summary. *Association for Play Therapy Newsletter, 20*(4), 28.

Chassiakos, Y. L. R., Radesky, J., Christakis, D., Moreno, M. A., & Cross, C. (2016). Children and adolescents and digital media. *Pediatrics, 138*(5), e20162593.

Chi, M. T. (1997). Quantifying qualitative analyses of verbal data: A practical guide. *The Journal of the Learning Sciences*, *6*(3), 271-315.

Cohen, S., Mittelman, I., Pines, A., Prero, A., Zou, J., Vaynshteyn, I., & Kirshenbaum, R. (2017). *Speech-language pathologist's perception of the effectiveness of iTherapy in intervention with school-aged children & adults*. Poster presented at the American Speech Language and Hearing Annual Convention, 2017.

Constantinescu, G., Rieger, J., Mummery, K., & Hodgetts, W. (2017). Flow and Grit by Design: Exploring Gamification in Facilitating Adherence to Swallowing Therapy. *American Journal of Speech-Language Pathology*, *26*(4), 1296-1303.

Danger, S., & Landreth, G. (2005). Child-centered group play therapy with children with speech difficulties. *International Journal of Play Therapy*, *14*(1), 81.

Deterding, S. (2011). *Situated motivational affordances of game elements: A conceptual model*. Paper presented at the Workshop Gamification: Using Game Design Elements in Non-gaming Contexts, CHI 2011.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining gamification. In *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments*, 9-15. ACM.

Edwards, J. & Dukhovny, E. (2017). Technology Training in Speech-Language Pathology: A Focus on Tablets and Apps. *Perspectitves ASHA SIGs*, *2*(SIG 10), 33-48. doi: 10.1044/persp2.SIG10.33

Fernandes, B. (2015). Is the iPad revolutionizing Speech Therapy? From an SLP & App Developer. Retrieved from https://blog.asha.org/2011/06/07/is-the-ipad-revolutionizing-speech-therapy-from-an-slp-app-developer/

Folkins, J. W., Brackenbury, T., Krause, M., & Haviland, A. (2016). Enhancing the Therapy Experience Using Principles of Video Game Design. *American Journal of Speech-Language Pathology*, *25*(1), 111-121. doi: 10.1044/2015_AJSLP-14-0059.

Hiniker, A., Sobel, K., Suh, H., & Kientz, J. A. (2016). Hidden symbols: How informal symbolism in digital inter-faces disrupts usability for preschoolers. *International Journal of Human-Computer Studies*, 90, 53-67.

Hourcade, J. P. (2017). Participatory design with children in the autism spectrum. *Participatory Design for Learning: Perspectives from Practice and Research*, 111.

Ito, M. (2017). How Dropping Screen Time Rules Can Fuel Extraordinary Learning. Retrieved from https://blog.connectedcamps.com/how-dropping-screen-time-rules-can-fuel-extraordinary-learning/

Klopfer, E., & Squire, K. (2008). Environmental Detectives—the development of an augmented reality platform for environmental simulations. Educational Technology Research and Development, 56(2), 203-228.

Korhonen, H., & Koivisto, E. M. (2006). Playability heuristics for mobile games. In *Proceedings of the 8th conference on Human-computer interaction with mobile devices and services*, 9-16. ACM.

Linder, T. W. (1993). *Transdisciplinary play-based intervention: Guidelines for developing a meaningful curriculum for young children*. Paul H Brookes Publishing.

Mazurek, M. O., Shattuck, P. T., Wagner, M., & Cooper, B. P. (2012). Prevalence and correlates of screen-based media use among youths with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *42*(8), 1757-1767.

Morgan, P. L., Farkas, G., Hillemeier, M. M., Hammer, C. S., & Maczuga, S. (2015). 24-month-old children with larger oral vocabularies display greater academic and behavioral functioning at kindergarten entry. *Child Development*, *86*(5), 1351-1370.

Olswang, L. B., & Prelock, P. A. (2015). Bridging the gap between research and practice: Implementation science. *Journal of Speech, Language, and Hearing Research*, *58*(6), S1818-S1826.

Prelock, P. A., Hutchins, T., & Glascoe, F. P. (2008). Speech-language impairment: how to identify the most common and least diagnosed disability of childhood. *The Medscape Journal of Medicine*, *10*(6), 136.

Read, J. C., Horton, M., Clarke, S., Jones, R., Fitton, D., & Sim, G. (2018). Designing for the "at home" experience of parents and children with tablet games. In *Proceedings of the 17th ACM Conference on Interaction Design and Children*, 441-448. ACM.

Roehl, T. (2015). Turn Angry Birds Addiction into Education in 4 Simple Steps: Use the gaming apps students already play to create engaging sessions that boost treatment for all ages. *The ASHA Leader*, *20*(9), 40-41.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. MIT press.

Schüll, N. D. (2012). *Addiction by design: Machine gambling in Las Vegas*. Princeton University Press.

Squire, K., & Steinkuehler, C. (2017). The problem with screen time. *Teachers College Record*, *119*(12).

Steinkuehler, C., & Duncan, S. (2008). Scientific habits of mind in virtual worlds. *Journal of Science Education and Technology*, *17*(6), 530-543.

Sweeney, S. (2017). Joint Parent-Child App Play Can Bolster Language Development. *The ASHA Leader*, *22*(4), online only. doi: 10.1044/leader.APP.22042017.np.

Sweeney, S. (2014). App-titude: Zooming In on One Multitalented App. *The ASHA Leader*, *19*(1), 38-39. doi: 10.1044/leader.APP.19012014.38.

Tye-Murray, N. (2016). Better Hearing? Game On!. *The ASHA Leader*, *21*(12), 18-19. doi: 10.1044/leader.AEA.21122016.18.

Vatavu, R. D., Cramariuc, G., & Schipor, D. M. (2015). Touch interaction for children aged 3 to 6 years: Experimental findings and relationship to motor skills. *International Journal of Human-Computer Studies*, *74*, 54-76.

Wallace, I. F., Berkman, N. D., Watson, L. R., Coyne-Beasley, T., Wood, C. T., Cullen, K., & Lohr, K. N. (2015). Screening for speech and language delay in children 5 years old and younger: a systematic review. *Pediatrics*, *136*(2), e448-e462.

Yee, N., Ducheneaut, N., Shiao, H. T., & Nelson, L. (2012). Through the azerothian looking glass: Mapping in-game preferences to real world demographics. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*(pp. 2811-2814). ACM.

Yee, N., Ducheneaut, N., Nelson, L., & Likarish, P. (2011, May). Introverted elves & conscientious gnomes: the expression of personality in world of warcraft. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 753-762). ACM.

Zhang, P. (2008). Motivational affordances: Reasons for ICT design and use. *Communications of the ACM*, *51*(11), 145-147.

HOW WE CREATE AND EMBODY THE OTHER: IMPLICATIONS FOR DIVERSITY IN CHARACTER-CENTRIC GAMES AND MEDIA

Implications for Diversity in Character-Centric Games and Media

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Abstract

Any act of character creation is likely to entail stepping outside of the self. With regards to diversity and inclusivity in games and other character-centric media, the *outcomes* (e.g., whether certain media are sufficiently diverse, authentic, sensitive and inclusive) receive considerable attention from game designers and researchers; we think it critical to also study and glean insights from the *processes* of character creation. In this paper, we present two complementary studies focused on understanding the role of diversity and identity in character creation. First, we present a qualitative interview study (N=14) with individuals who are deeply involved in character creation processes across various domains. Next, we present a survey study conducted with a more general population (N=101) recruited from Amazon Mechanical Turk (AMT), in which participants were instructed to conceive of and describe a fictional character before completing a parallel self-description task. From this pair of studies, we observed that the ways in which people relate to, understand, and struggle with their characters are deeply intertwined with understandings of the self. Moreover, in defining themselves and others, participants included but often transcended demographic traits, with non-demographic traits such as personality or ways of thinking about the world often outweighing demographic traits. We discuss how our studies can enrich discussions of diversity in games and play, and outline next steps we will pursue in this research.

Introduction

In games, television, movies, literature, and other genres that include elements of play or storytelling, "diversity" is an oft-used buzzword. The term often evokes a sense of social responsibility for inclusive representation, and a need to shed light on or give voice to the marginalized, excluded, or misrepresented. In the context of the U.S., for example, certain identities and experiences have been found to be more prevalent in character-centric media than others, with characters who are white, without mental or physical disabilities, economically privileged, heterosexual, heteronormative, neurotypical, cisgender, or male potentially crowding out other voices and identities (e.g., Kafai, Richard, Brendsha, 2016; Shaw, 2012; Brooks and Hébert, 2006; McInroy and Craig, 2015; Holtzman and Sharpe, 2014).

In their annual Game Developer Satisfaction survey, the International Game Developers Association defines diversity in terms of "demographic characteristics such as sex, gender, race, ethnicity, sexual orientation, etc.," and found that 81% of developers felt that workplace diversity was "very important" or "somewhat important" (Weststar, O'Meara, and Legault, 2017). However, many researchers, members of the game industry, and game enthusiasts argue that industry practices and game production often do not reflect this value. Studies have highlighted the perils of a lack of diversity in both mainstream and indie games in that they exclude players belonging to minority demographics. For example, a lack of racial diversity in video games has the same impact as everyday racism on minority players (Hester, 2018; Passmore, Birk and Mandryk, 2018; Passmore, Yates, Birk and Mandryk, 2017). We see analogous issues of exclusionary representation practices in other media, such as "white-casting," in which white actors play characters that were written as other races (Chow, 2016), or limited publishing opportunities for writers belonging to minority demographic groups (Shapiro, 2018).

Much of the criticism of character representations in games and other character-centric media focuses on the end product: the character portrayal or representation. By default, the processes that enable problematic character representations are implicitly culpable. These can include hiring practices; if writers follow the adage "write what you know," then for example, an all-male team of game writers may be less likely to include nuanced representations of women. However, hiring practices aside, we argue that any act of character creation is fraught with challenges of representing "the other," a character who is different from oneself along one or multiple dimensions (Shawl and Ward, 2005). Even a large team of game writers, were they to hire one person to fit the demographics for every avatar permutation and non-player character available, could not guarantee authentic representation, or totally avoid misrepresentation or exclusion, as creators will almost always vary from the characters they are creating in any variety of non-demographic and demographic characteristics. Moreover, one person's authentic representation of their own experience of being, for example, black, gay, non-binary, or mentally ill, may be very different and thereby feel inauthentic to someone else who shares the same identity. To avoid speaking about diversity of characters in games and other media in vague brush strokes, we need to dig deep into the tangles of what it means to create characters that are other than the self, and the struggles, hesitations, and disagreements that this may involve. However, relatively little attention has been paid to exploring and understanding how creators and artists struggle with and make sense of character representations and embodiments.

To this end, we discuss the findings from two studies that aimed to shed new light on the process of representing the other via character creation: 1) a semi-structured interview study with character creators and embodiers (N=14), and 2) a survey study investigating character creation with a more general online population (N=101). First, in the interviews, we drew from a convenience sample of people deeply involved in the process of creating others, such as writers, actors, and game masters, designers, and players. Our participants shared their insights about what creating or embodying characters means to them, how they choose who to portray or not portray, what they struggle with, and in what ways they see their characters as similar or dissimilar to themselves.

To follow up on our interview findings, we next conducted a survey on Amazon Mechanical Turk (AMT), an Internet marketplace where employers, businesses, academic researchers, and others can hire contract workers (called "Turkers") for one-off jobs called "HITs" (Human Intelligence Tasks), such as surveys, audio transcription tasks, and image tagging tasks. We surveyed a general population that might not often directly confront issues of diversity in character creation to understand along what axes people may be inclined to create characters, and how character representations may relate to self-representations. In this survey, we primed participants to imagine crafting a character and a story setting, and then asked them to describe the characteristics that define their main character and themselves, and to evaluate the level of similarity between self and character along a variety of dimensions.

We grounded this work in the premise that, in the space of art and creation, there is no clearly and unambiguously "right" or "wrong" way to create a character that is different (or similar) to the self. Instead, the pair of studies aim to inform more nuanced ways to think about diversity and representation of the other in games and storytelling, from which we can extract takeaways to guide our understanding of how to support humans in creating characters that resonate, engage, and include. In what follows, we present related literature, the study methodologies, the results of both our interview and survey studies, and a discussion of their implications for games and related character-centric media.

Related Work

Our work is guided by literature on diversity in games and related media, on transportation and perspective-taking, and on the psychological and cognitive underpinnings involved in understanding others and the self.

Current Discussions of Diversity in Games and Related MediaGames scholar Adrienne Shaw defines diversity in games as interacting with representations of marginalized (demographic) groups (2010). Often, discussions center around race and gender, though some would argue that diversity does not just mean *if* certain groups are represented, but *how*, and according to what game mechanics (Anonymous, 2015). Meanwhile, many of the more "contentious" demographic markers, such as sexuality and religion, are usually ignored altogether in most existing games (Shaw, 2009). In other media as well, minority groups along axes such as race/ethnicity, gender, and sexuality are often under-, mis-, or negatively represented (Borum Chattoo, 2018; Groom, 2015; hooks et al., 2006; Okoye, 2016; Smith, 2009; Syed, 2016; Tsay, Frain, and Fedorova, 2015).

Although games and other entertainment media are often criticized for their lack of diversity, a number of existing games challenge industry norms, such as in their representations of queerness and non-normative power hierarchies (Jacose, 1996; Ruberg and Shaw, 2017). In their review and analysis of games that "thoughtfully incorporated diverse identities and perspectives, or that explored, challenged, and subverted normative identities" (To, McDonald, Holmes, Kaufman, and Hammer, 2018), media scholars categorize how these games tackle diversity as follows:

1. Tackling stereotypes through visual design elements, such as character aesthetics (Chance and Little, 2014; Cole, Shaw, and Zammit, 2017; Toma, 2015).
2. Using abstract character representations, such as genderless characters (Portal Games, 2012).
3. Subverting assumptions about dominant norms, such as heterosexuality (Game Grumps, 2017).
4. Designing in-game conversations in ways that preclude biased (e.g., transphobic) responses (Bioware, 2009, 2011, 2014).

5. Structuring game play and rules in ways that encourage the introduction of queer content into the game (Adler, 2012).

These promising examples of diverse representations provide starting points for how we might think about nuanced representations in character-centric media. In our survey and interviews, we explore how character creators grapple with the several of the above themes, such as subversion of dominant norms and tackling stereotypes.

Transportation and Perspective-Taking: On Why Diversity Matters

According to transportation theory, when we are immersed in a game or narrative world, we are more likely to identify with characters and view the world and its characters as authentic (Green, Brock, and Kaufman, 2004; Green, Strange, and Brock, 2003; Tesser, Wood, and Stapel, 2005). We also take on the perspective of others, achieve high levels of flow and enjoyment, and even change our beliefs (Berns, Blaine, Prietula, and Pye, 2013; Kaufman and Libby, 2012). However, for players that cannot identify with characters— for example, because the characters are stereotypical, exclude salient aspects of their identity, or misrepresent their identities— the benefits of narrative transportation and perspective-taking become weakened or altogether ineffective, thereby essentially excluding certain groups from fully engaging with and benefiting from games and related media (Gillig and Murphy, 2016; Ritterfeld and Jin, 2006; Slater, Rouner, and Long, 2006; So and Nabi, 2013). Such exclusion can have direct negative impacts; for example, the lack of diversity in video games has the same impact as everyday racism on minority players (Hester, 2018).

Meanwhile, nuanced or counter-stereotypical representations of minority demographic groups can buffer against stereotype threat for minority players (Marx and Roman, 2002). Benefits also accrue to players of majority demographic groups, such as decreasing stereotypes of others and find commonalities between themselves and others (Dasgupta and Greenwald, 2001; Davis, Conklin, Smith, and Luce, 1996; Galinksy and Moskowitz, 200; Kaufman and Libby, 2012). Moreover, interacting with characters that fall outside one's own personal identity, experiences, or social spheres can intensify affective perspective-taking (empathy) (Kidd and Castano, 2013; Mar, Oatley, Hirsh, dela Paz, and Peterson, 2006). The majority of research on perspective-taking focuses on media audiences, but some research has shown that the perspective-taking as part of the authorial process also has key benefits (Harris, 2000). In our present work, we shift the focus to the less-studied question of what processes, strategies, and struggles are involved in perspective-taking from the creator side.

Self-Other Understandings

As we consider how creators construct and relate to their characters, it is also important to understand the cognitive and psychological underpinnings of self-other understandings more generally. From neuroscience, we know that in general, different areas of the brain are activated in conceptualizing the self versus the other (Voegeley et al., 2001). However, for close others (people well known by an individual), the same areas of the brain can be activated (Murray, Schaer, and Debbané, 2012) and it appears humans have a common representation network for distinguishing between the self and other, such that self-awareness and agency are crucial to understanding and interacting with others (Decety and Sommerville, 2003). Indeed, from our infancy, our social interactions with others are rooted in awareness of the self, and "the implicit notion that others are like the self" (Decety and Chminade, 2003). In psychology, the self-expansion model posits that a central human motivation is to self-expand, and that one of the ways we seek to achieve this is through close relationships with others (Aron, Aron, and Norman, 2001). Related psychological research on self-other inclusion shows how people see more self-other overlap in people they feel particularly close to (Aron and Fraley, 1999), so much so that in rating the traits of themselves and both close and distant others, they will confuse the trait ratings they gave to close others with their own (and vice versa) (Mashek, Aron, and Boncimino, 2003).

Where perspective-taking research would suggest that we anchor on the self-concept in imagining or seeking to understand the other, this psychological and cognitive research suggests there may be a push and pull of projection versus internalization that character creators and embodiers must navigate. What remains unclear here— and what we explore in our two complementary studies— is *how* creators navigate the spaces between the self and others, along what axes they delineate and define ourselves and our characters, and how these processes of creation and embodiment relate to their understandings of and values around diversity.

Study 1: Interviews with Experienced Character CreatorsMethods

In Study 1, we conducted qualitative, semi-structured interviews, each lasting 40-70 minutes, with 14 individuals deeply involved in character creation, including novelists, short story writers, poets, journalists, television and game writers, actors, directors, and role-playing gamers, game masters, and designers (both tabletop and live-action role-playing games). Participants were not compensated for the interviews. These character creators, recruited with the help of professors in relevant departments at our local university, ranged in age from 19 to 62 (average of 45), and held education levels from "some college" to Ph.D. All spoke English as a primary language, and primarily were born and raised in the U.S. Eight identified as male, five as female, and one as non-binary; 11/14 identified as white, one as black, one as Native American, and one as Asian. Whereas some were full-time writers, videographers, professors of drama or literature, and game designers, others were involved in some form of character creation as a passion, hobby, or pastime while also holding another occupation, such as secretary, civil servant, human resources coordinator, or student. With university Institutional Review Board approval, we audio-recorded, transcribed, and qualitatively analyzed the interviews, using open-coding techniques to identify patterns across our participants' responses. One member of the research team coded the text independently, iteratively revising and refining the codes, then shared a sample of 20% of the responses with the other team member. After comparing and reflecting on code disagreements, she iterated on the coding schema, and shared a new 20% sample, and the other team member independently coded the excerpts again. Using Cohen's (conducted using R) to measure the inter-rater reliability from this subset, we measured a score 0.73, which is above the threshold of 0.70 deemed appropriate for exploratory research (Neuendorf, 2016). The final codebook is available in Table 1.

In the interviews, we asked our participants to describe their processes of creating or embodying their characters, what informs the development of their characters, on what axes they identify with or diverge from their characters, and what conflicts or hesitations they have in creating or embodying certain kinds of characters.

ResultsOur analyses revealed that participants' responses clustered around three high-level themes: 1) how creators orient themselves toward the process of character creation, 2) the specific ways in which creators define their characters, and 3) the ways in which creators navigate challenges in the character creation process.

Orientations toward the process of character creation

In approaching character creation, our participants demonstrated a constant bidirectional pull between self- and other-ness, with orientations and motivations toward excluding and including characters in the self, and vice versa, occurring simultaneously.

Many participants, regardless of their personal demographic identities, spoke to some level of social responsibility in regard to how and who they represent through their characters. At least in part, they felt a responsibility to "give voice to the voiceless" (p02), as a journalist participant explained. As one game designer and player noted, "When you're improving a character, it's so easy to slip into the idea that they are a straight, white, cis man. And you really have to push against that" (p14). In attempt to remedy this, p14 used spreadsheets to track the number of non-player characters (NPCs) present in their work, along a number of different demographic axes, such as gender, race/ethnicity, and sexuality. Participants who identified with a marginalized group expressed similar sentiments. For example, a director/actor participant who identified as African American felt a responsibility to show diversity in his casting, saying, "The theater is in a place that's not as diverse as I'd hoped…I feel very passionately about diversity and inclusion anyway, so I want to make sure that my cast has some color in it in different places" (p03). Likewise, a short story writer spoke of her tendency to write more female characters, explaining, "You would not believe just how many male characters are everywhere for everything in every single way" (p05).

Yet participants did not just represent out of a sense of responsibility; they also wrote about different characters in order to understand and connect to others. Many of our participants explained they had been drawn to their particular form of character creation by an innate curiosity about the experiences of others. As one participant explained, curiosity about others is essentially a prerequisite for anyone involved in character creation and storytelling: "The way you have to position it, emotionally, is you're kind of an open sponge. You're just soaking things in. I mean, you find people fascinating…everyone has a story." A role-playing participant explained how she gained insights into who her characters were, how they processed the world, and what their failures are by embodying them via the game (p08). Another game designer and player explained that it is through playing and directing games and characters that they are able to get close to other people in real life, explaining there are "very few people I managed to get emotionally close to without sharing games" with them (p13). Participants spoke of getting into characters in games and acting by constantly thinking about how their character would feel and react, so much so that they reported breaking into tears mid-game (p11), and they spoke of wanting to create characters in order to arrive at a better understanding of other people's motivations (p06).

In order to understand and connect to others, almost all our participants relied on notions of universality— seeing a commonality of traits or goals shared by everyone (p02) —to find themselves in others. As p06 explained, "I guess my ultimate goal is just to try to find the humanity in all my characters." Role-playing participants especially emphasized this process of finding the self in the other. As p12 explained, "I mean, it's not so much a question of playing something very different from you, as finding a part of you that can play that." A television writer participant emphasized that universality can transcend demographic variables, saying, "Well, I think, even if you're really extrapolating and writing a character that's not your gender, not your race, at the core, if you want these people to be realistic, living, breathing human beings, there has to be some part of you in these characters" (p07). Our participants projected themselves onto their characters, and also identified universal motivations and concerns in order to create characters they believed were authentic and respectful representations.

Through this process of connecting to the other via the self, participants also reported they learned about themselves. This was especially true for RPG players, game masters, and designers. For example, a role-player participant (p12) explained, "Every character is some lens on myself… There is always some authentic piece of myself in there. And a lot of what I value is dissociating from the self to learn about the self." For participants who had led, designed or played in RPGs, creating characters helped them cope with and process past trauma (p13), and deal with their own fears and insecurities, from issues with body image to extreme stage fright (p11). In this way, we can see that the characters people create and embody reflect back on the self, mirroring and interacting with self-identity and personal struggles.

Ways of defining the other

From out interviews, we also gained insights into the specific axes of identity on which creators choose to define their characters. We found that in defining their characters, more participants spoke in terms of personalities, traits, cognitive orientations, and experiences rather than demographics, with only about half of participants defining their characters in terms of demographics.

Many participants defined and chose characters according to how they think and process experiences. For example, one participant explained that her starting point for characters was considering how that character would react to different forms of suffering (p05). One role-playing participant said she tries to stay away from characters that over-think, as she herself often encounters "analysis paralysis" in real life and wants to avoid it in game environments (p11). Another role-playing participant, p08, explained that social expectations of games are often an inclusion issue; as a person with autism, she does not conceptualize characters via a set of traits or experiences. Rather, she determines whether a character is "play-able" by imagining whether she can project her emotions onto a given character.

Participants also defined and identified with characters according to shared experiences. For example, one participant spoke of his personal journey of going to the Indian Reservation on which he was born to meet his biological family, and his subsequent fascination with family-based stories, saying, "So that's where I start to get a lot of my story lines from. They're family-based, whether it's fictitious, or biographical" (p06). Another participant spoke of a character that shared her personal experience of dealing with a difficult conversation with an imprisoned relative (p05).

At the same time, we should note that demographics still factored into character definitions and how participants related to their characters. For example, p08 formerly did not allow herself to play Chinese characters, as she used to force herself out of her own identity. In more recent years, she realized, "I could design and play a character who's Chinese," and what she calls generally "classically me-favored type characters" (p08). Others looked to age as a defining feature, such as p03, who identified strongly with a character he had played in terms of age, occupation (professor) and general life experiences, saying, “[The play] was about a professor in his late 30s who had recently moved to a building in Chicago. Which was pretty much me at the time. Trying to kind of navigate his way through class.” We note that whether they were defining characters in terms of cognitive processes, experiences, or demographic traits, participants did so through a lens of the self, alternately drawing on the similarities and exploring the differences between self and other.

Tensions in character creation

As with ways of approaching and defining, non-demographic traits and experiences also featured prominently in creators’ struggles and apprehension with creating characters that are other. For example, in discussing their reservations about representing or embodying the other, participants said they had apprehension about writing antagonists and sexist characters (p05), and avoided playing confrontational characters, surfers, characters with super powers, or “pan sexual partiers” (p10), writing or playing villains (p09), and writing about characters with military experience (p07) or war experience (p04). These decisions stemmed from participants’ desires not to perpetuate certain narratives, or the realization that they did or could not connect with certain kinds of characters.

Along demographic lines, the fear was different; participants were afraid of “messing up.” For example, p01 felt very nervous about writing women so as to not misrepresent or stereotype, and p09 felt apprehension in playing characters from different cultures, as she did not want to overstep the line from cultural appreciation to cultural appropriation. One participant explained, “There is a lot of pressure to not appropriate cultures or to ‘write race right’” (p05). P11 expressed similar hesitation in role-playing characters of different gender, racial/ethnic and sexual identities, saying, “Hopefully I’m not being horribly insulting to anyone of that ethnicity or sexuality while playing them. I hope I’m not. I think I’m not. I think I’m doing it relatively sensitively” (p11). P01 explained there is disagreement over how to sensitively or “correctly” represent different demographic groups in creative communities. He spoke of a panel he participated in about TV representations of people of color in which many of the panelists were sharply divided on the questions: Is it okay for a character to be universal in identity, such that someone of a different race could conceivably play that character? Or ought characters be steeped in the specifics of their social identities and contexts?

Role-playing participants explained that this debate over what constitutes sensitive and appropriate representation along different demographic lines is often an integral and ongoing negotiation process in games. As p10 described, there are often limits to what forms of projection are allowable: “So generally, you can play any age … On gender, things are a bit different. So it’s called cross-casting. So if I am a man who wants to play a woman, for example, some games will let me do that. Some won’t. And then things get even more complex if a trans player comes along.” As any role-player will know, in most games, such boundaries and limits are defined and negotiated via a game social contract. As p12 explained, the expected norm for conflicts in role-playing game play is, “You gotta talk about it.” Such discussions and negotiations might result in substantial changes to the game and characters. As p14 explained, through discussions with game players, he came to realize that a game he set in Vietnam had elements that could be construed as culturally insensitive, and he therefore re-constructed the main character. Participants had personal limits and preferences about who they were willing to create or embody along non-demographic lines. Meanwhile, along demographic lines, they expressed uncertainty and fear about representing different types of “others,” and determining what representations were appropriate and authentic involved debate and negotiation.

These findings revealed that considerations and concerns of self-other overlap profoundly impacted participants' approaches to and philosophies of character creation. In order to build on these findings and shed explore how identity influences the definition of self and other, we conducted a follow-up survey with members of a general population,

Study 2: Character Creation Survey with General Population Methods

In this study, we constructed a survey (n=101) using Qualtrics software and deployed it on Amazon Mechanical Turk as a Human Intelligent Task (HIT). Participants completed the survey in 13 minutes, on average, and were compensated $3 for their time.

The survey asked participants to imagine they had been commissioned by a fiction publishing house to write a novel featuring any character they wanted, and set in any time, place, and genre they desired. In designing the prompt, we chose 'novel' because we reasoned that every participant would be familiar with the medium, and participants might already be primed to think of video games and movies in terms of character types associated with the most profitable or well-known titles, or to think more generally about box office and sales, and that this might skew how they approach the process of character creation.

In the survey, we first asked participants to conceptualize a main character, and then fill in five blanks for the sentence stem, "My main character is _____." On the following page, we asked them to repeat the same procedure for themselves, using the stem "I am _____." Next, using a Likert scale from 1 (extremely dissimilar) to 7 (extremely similar), participants rated how similar they felt to their characters. We included a demographics section at the end, asking participants to identify their gender, race/ethnicity, age, nationality, and level of education. The demographic placement was important, so as not to prime participants to be more self-aware when describing their characters; we wanted to observe how they relate to their characters without identity-related priming. We then asked participants which of those demographic characteristics they had considered when creating their characters, and, for each they reported having considered, asked them to rate their similarity levels to the character using the same Likert scale. Access to a full copy of the survey is available upon request.

Overall, participants were extremely thoughtful and creative in their responses, but there were a few participants who merely copied and pasted the questions they had been asked as their responses, appeared to use bots to submit random text scraped from the Internet, or had misunderstood the prompt; we excluded the data from these participants from our analyses, resulting in a final sample size of 101.

To analyze the survey, we used both quantitative and qualitative techniques. We hand-coded the data by categorizing words and phrases used to describe selves and characters into groups, used R for summary statistics and any correlational analyses, and used Python and the Natural Language Toolkit to assist with text and sentiment analysis. To conduct a sentiment analysis of the words participants used to describe their characters and themselves, we used a manually labeled, commonly used dataset called AFINN in which 2,477 words and phrases are rated from -5 (very negative) to +5 (very positive) (Nielsen, 2011). Code for our analyses can be made available upon request.

Results

We designed the survey to complement the insights we gained from our interviews. We aimed to investigate how a broader population orients fictional characters in relation to the self, and along which axes characters may differ or adhere to self-identities. As discussed previously, we primed our participants to consider character creation in the context of a novel, but view the results in the context of character creation more generally. The overarching research questions that guided our survey design and analyses are:

- **Axes of Definition.** Along what axes (e.g., demographics versus personality traits) do participants define their main characters and themselves?
- **Semantic Analysis of Descriptors.** Are there salient differences in the way participants describe their characters versus themselves?
- **Demographic Comparisons.** To what extent do participants think about demographics when defining characters, and how do those definitions relate to their own self-reported demographics?

In rating overall similarity, over half of our participants (N=64) saw themselves as slightly to extremely similar to their characters, suggesting many may be operating under the "write what you know" mantra. We now dig into the specifics of this finding.

Axes of Definition

First, we studied how participants described themselves and their characters by manually coding the words and phrases chosen, and separating them into categories such as non-physical adjectives (personality traits or abilities), physical appearance or style (not including standard demographics), and other demographic and non-demographic characteristics such as age, gender, race/ethnicity, family status, and nationality. The vast majority of respondents described both themselves and their characters using at least one non-physical adjective (93/101 for characters; 95/101 for participants). Other fairly commonly used descriptors included gender (16 for characters; 19 for participants), age (16 for characters; 13 for participants), and family status, such as being a father, mother, spouse, daughter, or son (9 for characters; 14 for participants). Demographics like race/ethnicity (3 for characters; 5 for participants) and nationality (1 for characters; 2 for participants) were much less commonly identified among the five traits. Overall, it appears there are not clear differences in the patterns by which participants defined themselves and others, with many of the numbers ostensibly similar (see Figure 1). That is, participants were not clearly defining their characters on different axes than they were defining themselves. To explore this further, we also ran two-proportion Chi-squared (non-parametric) tests of statistically significant differences, and for the most part, did not find statistically significant differences. We did however, find one statistically significant difference (p=0.02): occupation and/or life experience (13 for characters; 4 for participants). This may be because a) we surveyed a population working on Amazon Mechanical Turk, who may be less likely to identify via their occupation than those who work in more traditional employment settings and 2) the science fiction genre was most popular among our participants in terms of the stories they had in mind, with 32 choosing science f iction as one of the genres. This genre may encourage creators to think more in terms of futuristic or fantastical occupations and roles.

Semantic Analysis of Descriptors

Next, we moved from topical categories to semantics. We used sentiment analysis and the AFINN annotated sentiment dataset, as described in the methods section. After calculating and then averaging the sentiment scores in Python, we conducted a simple t-test, and found a statistically significant difference (p = 0.0013) between the sentiment scores for participants and their characters, with participants assigning to their characters words and phrases that yielded overall lower scores (mean of 2.03) than they did themselves (mean of 3.83) (see Table 2). Recall that these sentiment analysis scores can range from -5 (very negative) to 5 (very positive). In other words, overall, participants used fairly positive terminology to describe both themselves and others, but described themselves slightly more positively than they did their characters.

We next used a simple word cloud algorithm to identify the words most commonly used to describe the self and others. The full results can be seen in Figures 2 and 3. Here, we saw some overlap: word like 'smart', 'intelligent', 'funny', 'honest', and 'strong' commonly described both participants and their main characters. To gain further insight, we next turned to participants' open-ended responses about how they compare to the main characters they created.

A number of participants wrote of demographic features in comparing themselves to their characters. Many female-identifying participants, for example, mentioned their gender identity as a point of similarity with their character, but this was often in the context of other, non-demographic similarities or differences. For example, one participant wrote, "We are both females and what happened to her happened to me when I was that age," and another wrote, "Like me, she is an older woman who isn't happy with her life and she is disappointed in how things have worked out for her. Both of us have gone through shit, but she is much more capable of getting on with life than me."

We posit that the difference in sentiment scores (with characters having lower positive valence than participants) may stem in part from storytelling conventions; more conflicted characters may lead to more interesting stories. As one participant wrote, "I [like my character] am an intelligent doctor in the Midwest. However, I am somewhat typically boring and I would have to intentionally give the character more interesting character flaws to make them more compelling." However, there could be other reasons for making a character "worse off" than the self, such as a need for dissociation. As another participant explains, "We are both short statured and depressed (the character more than me). I wanted the character to be lonelier and slightly worse off than me so I can feel more detached from her if I were to write her."

As reflected in the overall Likert scale averages, many participants described their characters as similar along various axes, with personality and experience featuring prominently. As one participant explained, "I am basing this fictional character off myself. It may be just slightly exaggerated but it's not far from who I really am." Other participants more heavily emphasized personality traits, saying, "We are similar in that we are both not afraid to take risks when we believe in something. We are both willing to stand up for what is right and to do the right thing," and "Like my character, I have personality traits that make me feel attracted to the world and that make me want to hide from it." In a tongue-in-cheek response, another participant explained their similarities despite very different circumstances: "I share a few qualities with the character, such as being determined and good at bringing people together. However, I'm not being chased by zombies."

Demographic Comparisons

In the demographic section, we found that when conceiving of their main characters, participants had been thinking about age (n=69), and even more had gender in mind (n=87). However, they often were *not* identifying with characters along these lines. For example, 40/69 (58%) saw their own age as dissimilar to their character's age, and 67 out of 87 (77%) reported that their character had a different gender than their own. Meanwhile, the majority of respondents weren't even thinking of nationality, race, or education when coming up with their characters. For example, 70/101, 64/101, and 78/101 were *not* considering race/ethnicity, nationality, and education, respectively when creating their characters. We note that although 31 participants *did* consider race/ethnicity in defining their characters, as we saw previously, only three participants chose race/ethnicity as one of the five important ways to define their character in the first part of the survey, suggesting that other aspects of character identity may be more meaningful for character creators than demographics. Moreover, across the various demographic axes, we did not find any statistically significant connections (using Fisher's exact test) between participants' self-reported demographics and the level of reported similarity along that demographic axis. For example, based off our survey, we have no reason to believe that participants identifying as a minority race or ethnicity are more likely to create characters that share that race or ethnicity. See Table 3 for the participants' self-identified demographics, which we collected through open-ended questions to allow for non-standard responses.

Discussion

Taken together, our interview and survey studies emphasize three important themes that can inform the design of games, play, and other forms of entertainment with prominent character-based components, and can enrich discussions of diversity in gaming and playful experiences.

On (Not) Solely or Even Primarily Defining People and Characters through Demographic Markers

In both the interviews and the survey, we saw that character creators have desires and tendencies to write about the "other," and that although discussions of inclusion often center on demographic axes of diversity, this otherness is often expressed and manifested in terms of experiences, personality traits, and ways of thinking about and relating to other people and the world. When identifying who characters are and who we ourselves are, we identify primarily through personality traits and experiences, *not* physical appearance. So although discussions of diversity often hinge on demographic diversity as reflected in physical appearances, both deeply invested and layperson character creators alike placed a relatively low premium on these factors in conceiving of the other.

Of course, this by no means suggests that demographics are not important; far from it. For example, if we are to say that people identify by and with characters, and differentiate themselves according to their experiences, than we must also acknowledge that there are myriad ways in which demographic features can impact one's life experiences; race/ethnicity, gender, and sexuality, for example, can have tremendous cultural impacts on how we are viewed and treated throughout our lives. Discussions of difference and convergence in demographic terms emerged in both the interviews and the surveys. However, we think it is notable that demographics did *not* emerge as the most prominent differentiator. Thus, as we consider our relationships to characters, and what inclusivity in media can mean, we should keep in mind that demographics are not the sole definers of ourselves or our characters, and that inclusivity in terms of demographics may not signify inclusivity in other important areas. Giving a woman a female avatar in a game does not necessarily mean she can also see other aspects of her identity, such as beliefs or experiences, reflected in the game world.

On (Not) Solving Diversity Issues

In our interviews, we saw that there was great apprehension about creating characters that are "other," be that in terms of experience, personality traits, demographics, or other characteristics. As our character creators attested, diversifying characters along demographic lines does not necessarily make for more inclusive stories, as we may be creating inauthentic characters, or misrepresenting characters. In this paper we do not make any recommendations as to the "right" way to render stories, characters, games, and forms of more play and entertainment more "diverse" and inclusive, but we do hope to enrich the discussion on what needs to be done to promote diversity and combat the persistent issues of character representations stemming from the absence or misrepresentation of particular axes of identity in character-driven media.

Although conversations about diversity in games often center on demographics, issues of diversity may not be as neat and clean as increasing demographic diversity in hiring and development. We saw in both the interviews and the survey that even when creating characters ostensibly similar to the self along demographic lines, participants purposefully chose to diverge from their characters in other ways, or might recognize multiple ways in which they were still "other" in relation to their characters. In the survey, we saw that regardless of their personal demographic identities, participants often chose to create characters that differed along various demographic lines. Thus, in considering representation and industry hiring, it is important that we not rely on having members of certain groups present and involved as "solving" issues of diversity, or require that creators (writers, game designers, players, etc.) be forced into boxes where they must "represent" their particular demographic groups, particularly if they are a minority in the domain. Instead, we must be cognizant that any act of character representation is a creation, not a facsimile, or a reflection; regardless of demographics (even when creating characters that share one's demographics), people will be creating characters that are different than the self along multiple dimensions.

On Reflection through Character Creation

Lastly, our work builds on previous work that highlights the benefits accrued to character creators, including perspective-taking and empathy building. In digital and non-digital games and other playful media, the characters that are created are not necessarily outward-facing. For example, a role-playing game might take place in a small group that is not demographically diverse, or demographically diverse in some ways but not others, or demographically diverse in various ways but homogeneous in terms of traits, abilities, experiences, or predilections; the permutations are virtually without end.

We can look at character creation not in terms of diverse representation, but in terms of self-exploration and -reflection. When we initially implemented our survey, we expected to see patterns of self-other divergence in the survey, such as identifying the self primarily through personality traits, and identifying others (characters) primarily through demographics. However, what we actually saw is that participants defined the self and the characters in their stories along similar, primarily non-demographic axes, but that they also frequently created characters that were different from themselves along demographic axes like gender and race. In this way, there are opportunities to integrate reflections on how our characterizations of others reflect the self in game play. Here, we can draw from feminist film theory; bell hooks (1992) spoke of the oppositional gaze, by which black female spectators can derive pleasure and shift the balances of power by critically viewing and dissecting film representations of femininity and blackness— or the lack thereof— propagated by mainstream film. In a similar vein, in *Playing in the Dark: Whiteness and the Literary Imagination* (2017), Toni Morrison discusses how to change the critical gaze from the racial object to the racial subject, explaining that viewing U.S. literature from a lens of blackness is crucial to understanding U.S. literary identity, regardless of whether an individual text overtly deals with themes of race and racism. Although hooks and Morrison focus on race (specifically, black and white) and gender (specifically, female and male), we can also think in terms of other axes of identity, such as sexuality, other races and ethnicities aside from blackness or whiteness, and a larger range of gender identities. This also can include points of identity we may be more apt to ignore, including neurodivergence and neurotypicality, and non-demographic markers of identity, such as personality traits or ways of processing the world and connecting to others.

In game play and other interactive narrative and character creation media, where players may be both creators and audiences at once, the challenge then becomes twofold. First, as we critique media representations through a diversity lens, we can challenge ourselves to view representations in terms of the creator as object, analyzing and dissecting how creators reveal and define themselves through the characters they create, rather than focusing on the created manifestations. Second, from the perspective of self as both creator and player, we can add an additional layer of critique and self exploration; we can challenge ourselves to view what our own representations of characters that are "other" than the self have to say about the self, viewing our own character representations oppositionally. Again, using Morrison's framework and drawing inspiration from bell hook's notion of the oppositional gaze, the goal would then be to look at the creator-self as the object of critique and analysis, rather than the representation itself.

Limitations

Although this work provides insights about how we can think about diversity in character-centric media from more nuanced perspectives, our results and analysis are limited by our sample, our study methods, and our own cultural perspectives and biases. To start, we did not specifically recruit from minority perspectives along different demographic lines. In this way, more of our participants in both studies were, for example, white than non-white, and only one participant identified as non-binary in gender. Our findings may be more generalizable to how people as a whole create and embody characters, but may miss out on nuances of how members of demographic minorities approach the process. Moreover, in our survey and in the demographic questionnaire portion of our interviews, we chose to ask people about standard U.S.-based demographics, and almost all our participants were U.S.-based; although open-ended and interview components allowed participants to self-identify as they desired, our work may not adequately explore important identifiers such as sexuality, neurotypicality and divergence, employment status, or religion, to name a few, and our findings are more appropriately confined to a U.S. cultural context. The authors of the paper are also biased and informed by their own identities and experiences.

Next Steps

This interview and survey work is part of a larger exploration of inclusivity, otherness, and perspective-taking in character creation within games and storytelling media, especially digital media. In the next steps of this broader project, we look forward to doing some (and hopefully all) of the following:

- Developing and testing a pilot prototype character flagging tool to help character creators identify and remedy where they may be creating flat, inauthentic, and/or stereotypical characters.
- Incorporating storytelling techniques to create more meaningful experiences into modern platforms where it may be lacking, such as crowd work.
- Exploring how we can balance perspective-taking with both cognitive and affective understandings of the self and “others” in relatively new media like virtual reality.

As attested by the responses in both our interviews and our survey, issues of diversity and mis-representation or lack of representation of minority demographic groups, or otherwise minority, under-heard, or unprivileged perspectives in games and other character-centric media need nuanced critiques and reflections. Through this work, we hope to broaden the conversation about what diversity in character-centric media means and entails.

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References

Adler, A. (2012). Monsterhearts. [Tabletop game].

Anonymous. (2015, Sep). Video games have a diversity problem that runs deeper than race or gender. Guardian News and Media. Retrieved from https://www.theguardian.com/technology/2015/sep/10/video-games-diversity-problem-runs-deeper-than-race-gender

Aron, A., Aron, E. N., & Norman, C. (2001). Self-expansion model of motivation and cognition in close relationships and beyond. Blackwell Handbook of Social Psychology: InterpersonalPprocesses, 478–501.

Aron, A., & Fraley, B. (1999). Relationship closeness as including other in the self: Cognitive underpinnings and measures. Social Cognition, 17 (2), 140–160.

Berns, G. S., Blaine, K., Prietula, M. J., & Pye, B. E. (2013). Short-and long-term effects of a novel on connectivity in the brain. Brain connectivity, 3 (6), 590–600.

BioWare. (2009, 2011, 2014). Dragon age. [PC Computer, Console]. Electronic Arts.

Borum Chattoo, C. (2018). Oscars So White: Gender, racial, and ethnic diversity and social issues in US documentary films (2008–2017). Mass Communication and Society, 1–27.

Brooks, Dwight E., and Lisa P. Hébert. "Gender, race, and media representation." Handbook of gender and communication 16 (2006): 297-317.

Chance, T. R., & Little, N. (2014). Heroes Wanted. [Tabletop]. Action Phase Games.

Chow, K. (2016). Why won't Hollywood cast Asian actors? The New York Times, 22.

Cole, A., Shaw, A., & Zammit, J. (2017). Representations of queer identity in games from 2013–2015. Extended Abstract Presented at DiGRA.

Dasgupta, N., & Greenwald, A. G. (2001). On the malleability of automatic attitudes: combating automatic prejudice with images of admired and disliked individuals. Journal of Personality and Social Psychology, 81 (5), 800.

Davis, M. H., Conklin, L., Smith, A., & Luce, C. (1996). Effect of perspective taking on the cognitive representation of persons: a merging of self and other. Journal of Personality and Social Psychology, 70 (4), 713.

Decety, J., & Chaminade, T. (2003). When the self represents the other: A new cognitive neuroscience view on psychological identification. Consciousness and Cognition, 12 (4), 577–596.

Decety, J., & Sommerville, J. A. (2003). Shared representations between self and other: A social cognitive neuroscience view. Trends in Cognitive Sciences, 7 (12), 527–533.

Galinsky, A. D., & Moskowitz, G. B. (2000). Perspective-taking: decreasing stereotype expression, stereotype accessibility, and in-group favoritism. Journal of Personality and Social Psychology, 78 (4), 708.

Games, P. (2012). Robinson Crusoe: Adventures on the Cursed Island. [Tabletop].

Gillig, T., & Murphy, S. (2016). Fostering support for lgbtq youth? The effects of a gay adolescent media portrayal on young viewers. International Journal of Communication, 10, 23.

Green, M. C., Brock, T. C., & Kaufman, G. F. (2004). Understanding media enjoyment: The role of transportation into narrative worlds. Communication Theory, 14 (4), 311–327.

Green, M. C., Strange, J. J., & Brock, T. C. (2003). Narrative impact: Social and cognitive foundations. Taylor & Francis.

Groom, K. (2015, Jun). A call to arms: Bite the hand that feeds you. Retrieved from http://quaintmagazine.com/a-call-to-arms-bite-the-hand-that-feeds-you/

Grumps, G. (2017). Dream daddy. [PC Computer]. Game Grumps.

Harris, P. L. (2000). Understanding children's worlds: The work of the imagination. Oxford Blackwell.

Hester, B. (2018, Jan). Report: Lack of diversity in games has same impact as racism. Rolling Stone. Retrieved from https://www.rollingstone.com/glixel/news/report-lack-of-diversity-in-games-has-same-impact-as-racism-w516170

Holtzman, L., & Sharpe, L. (2014). Media messages: What film, television, and popular music teach us about race, class, gender, and sexual orientation. Routledge. hooks, b. (1992). The oppositional gaze: Black female spectators. hooks, b., et al. (2006). Black looks: Race and representation. Academic Internet Pub Inc.

Jagose, A. (1996). Queer theory: An introduction. NYU Press.

Kafai, Y. B., Richard, G. T., Brendesha, M.: Editors: Diversifying Barbie and Mortal Kombat, Intersectional Perspectives and Inclusive Designs in Gaming , ETC Press (2016).

Kaufman, G. F., & Libby, L. K. (2012). Changing beliefs and behavior through experience-taking. Journal of Personality and Social Psychology, 103 (2), 1–19.

Kidd, D. C., & Castano, E. (2013). Reading literary fiction improves theory of mind. Science, 342 (6156), 377–380.

Mar, R. A., Oatley, K., Hirsh, J., dela Paz, J., & Peterson, J. B. (2006). Bookworms versus nerds: Exposure to fiction versus non-fiction, divergent associations with social ability, and the simulation of fictional social worlds. Journal of Research in Personality, 40 (5), 694–712.

Marx, D. M., & Roman, J. S. (2002). Female role models: Protecting women's math test performance. Personality and Social Psychology Bulletin, 28 (9), 1183–1193.

Mashek, D. J., Aron, A., & Boncimino, M. (2003). Confusions of self with close others. Personality and Social Psychology Bulletin, 29 (3), 382–392.

McInroy, L. B., & Craig, S. L. (2015). Transgender representation in offline and online media: LGBTQ youth perspectives. Journal of Human Behavior in the Social Environment, 25(6), 606-617.

Morrison, T. (2007). Playing in the dark. Vintage.

Murray, R. J., Schaer, M., & Debbané, M. (2012). Degrees of separation: A quantitative neuroimaging meta-analysis investigating self-specificity and shared neural activation between self-and other-reflection. Neuroscience & Biobehavioral Reviews, 36 (3), 1043–1059.

Neuendorf, K. A. (2016). The content analysis guidebook. Sage.

Nielsen, F. Å. (2011, 3). Afinn. Informatics and Mathematical Modelling, Technical University of Denmark. Retrieved from http://www2.imm.dtu.dk/pubdb/p.php?6010

Okoye, S. (2016). The black commodity. Retrieved from http://cas.nyu.edu/content/dam/nyuas/casEWP/documents/mercer2016/okoyeblack.pdf

Passmore, C. J., Birk, M. V., & Mandryk, R. L. (2018). The privilege of immersion: Racial and ethnic experiences, perceptions, and beliefs in digital gaming. In Proceedings of the 2018 CHI conference on

Human Factors in Computing Systems (pp. 383:1383:19). New York, NY, USA: ACM. Retrieved from http://doi.acm.org/10.1145/3173574.3173957 doi: 10.1145/3173574.3173957

Passmore, C. J., Yates, R., Birk, M. V., & Mandryk, R. L. (2017). Racial diversity in indie games: Patterns, challenges, and opportunities. In Extended Abstracts Publication of the Annual Symposium on Computer-Human Interaction in Play (pp.137–151). New York, NY, USA: ACM. Retrieved from http://doi.acm.org/10.1145/3130859.3131438 doi: 10.1145/3130859.3131438

Ritterfeld, U., & Jin, S.-A. (2006). Addressing media stigma for people experiencing mental illness using an entertainment-education strategy. Journal of Health Psychology, 11 (2), 247–267.

Ruberg, B., & Shaw, A. (2017). Queer game studies. University of Minnesota Press.

Shapiro, L. (2018, 1). What the job of a sensitivity reader is really like. Vulture. Retrieved from http://www.vulture.com/2018/01/sensitivity-readers-what-the-job-is-really-like.html

Shaw, A. (2009). Putting the gay in games: Cultural production and GLBT content in video games. Games and Culture, 4 (3), 228–253.

Shaw, A. (2010). Identity, identification, and media representation in video game play: An audience reception study (Unpublished doctoral dissertation). University of Pennsylvania.

Shaw, A. (2012). Talking to gaymers: Questioning identity, community and media representation. Westminster Papers in Communication and Culture, 9(1).

Shawl, N., & Ward, C. (2005). Writing the other. Seattle, Washington: Aqueduct Press.

Slater, M. D., Rouner, D., & Long, M. (2006). Television dramas and support for controversial public policies: Effects and mechanisms. Journal of Communication, 56 (2), 235–252.

Smith, Z. (2009). Speaking in tongues. The New York review of books, 26, 1–16.

So, J., & Nabi, R. (2013). Reduction of perceived social distance as an explanation for media's influence on personal risk perceptions: A test of the risk convergence model. Human Communication Research, 39 (3), 317–338.

Syed, J. (2016). Oscars So White: an institutional racism perspective. Counterpunch.

Tesser, A., Wood, J. V., & Stapel, D. A. (2005). Building, defending, and regulating the self: A psychological perspective. Psychology Press.

To, A., McDonald, J., Holmes, J., Kaufman, G., & Hammer, J. (2018). Character diversity in digital and non-digital games. In Transactions of the digital games research association.

Toma, E. (2015). Powerful elderly characters in video games: Flemeth of dragon age. Journal of Comparative Research in Anthropology and Sociology, 6 (2), 51.

Tsay, T., Frain, K., & Fedorova, S. (2015). Best & worst literary moments of 2015. Retrieved from https://www.theblueshiftjournal.com/single-post/2016/01/02/Best-Worst-Literary-Moments-of-2015

Vogeley, K., Bussfeld, P., Newen, A., Herrmann, S., Happé, F., Falkai, P., . . . Zilles, K. (2001). Mind reading: neural mechanisms of theory of mind and self-perspective. Neuroimage, 14 (1), 170–181.

Weststar, J., O'Meara, V., & Legault, M.-J. (2017). Developer satisfaction survey –International Game Developers Association (IGDA). IGDA. Retrieved from http://www.igda.org/?page=surveys

Tables and Figures

Table 1

Code and Explanation

differentiatingSelf: Discusses the concept of creators purposefully distinguish characters from themselves, and the importance to them of self-differentiation.
charDemographics: Identifying who characters are through demographic variables.
charPersExpCog: Identifying who characters are through experience, personality, cognition (e.g., way of thinking about or experiencing the world).
app_persExpCog: Expressed some hesitation about or discussed avoidance of writing/creating different due to gaps in personality, cognition, and/or experience.
limitationsOfFeedback: Discusses types of feedback received (on character creation), and ways in which that feedback might be lacking in certain ways.
app_dems: Hesitates in or avoids writing/creating different due to not sharing the same demographics (e.g. race, gender).
negotiatingCharacterBoundaries: Includes determining what is allowed, how people interpret differently (e.g., in scripts, games), and how characters are re-shaped.
divisionsWritingOther: Discussion of ways in which people directly disagree about limits of writing the other, how characters should be written, etc.
socialResponsibilityRepresentation: Discusses ideas of duty, obligation and guilt regarding broadening representation along demographic and socioeconomic lines.
selfExplorationThroughCreation: Discusses ways in which creators modeled character using self, told own story, or otherwise explored the self through creation.
understandingAndExperiencing: Uses imaginative perspective/experience taking to explore what it means to be someone else, or to become closer to other people.
humanityAsUniversal: Espouses the attitude of there being universal aspects of humanity, such that no experience or person in inaccessible.
groundingThroughResearch: Conducts research to make characters more authentic.

Full codebook used for interview analyses

Table 2

T-statistic	Degrees of freedom	P-value
-3.26	199.54	0.0013**
Mean SAS: characters	**Mean SAS: participants**	**95% Confidence Interval**
2.03	3.83	-2.89 to -0.71

*T-test results for differences in sentiment analysis scores, abbreviated as "SAS," averaged per participant (for character traits and participant traits, respectively) **Indicates statistical significance at the 0.05 level, meaning we can reject the null hypothesis that there is no difference between the two average (mean) sentiment scores. Sentiment analysis scores range from -5 (very negative sentiment) to 5 (very positive sentiment).*

Table 3

Age	
Average: 35.9; Median: 33	Range: 23-63
Gender	
Female: 43	Male: 58
Nationality	
non-U.S.: 9	U.S.: 92
Race/Ethnicity	
Multiple or non-white: 30	Caucasian or white only: 71

Overview of participants' demographics. Note: Eight of the nine non-U.S. participants came from India; 1 identified nationality as simply "Asian." For race/ethnicity, 7 identified as black or African American, 4 as Hispanic or Latin@, 11 as Asian, 2 as Native American, and 5 as other/preferred not to answer.

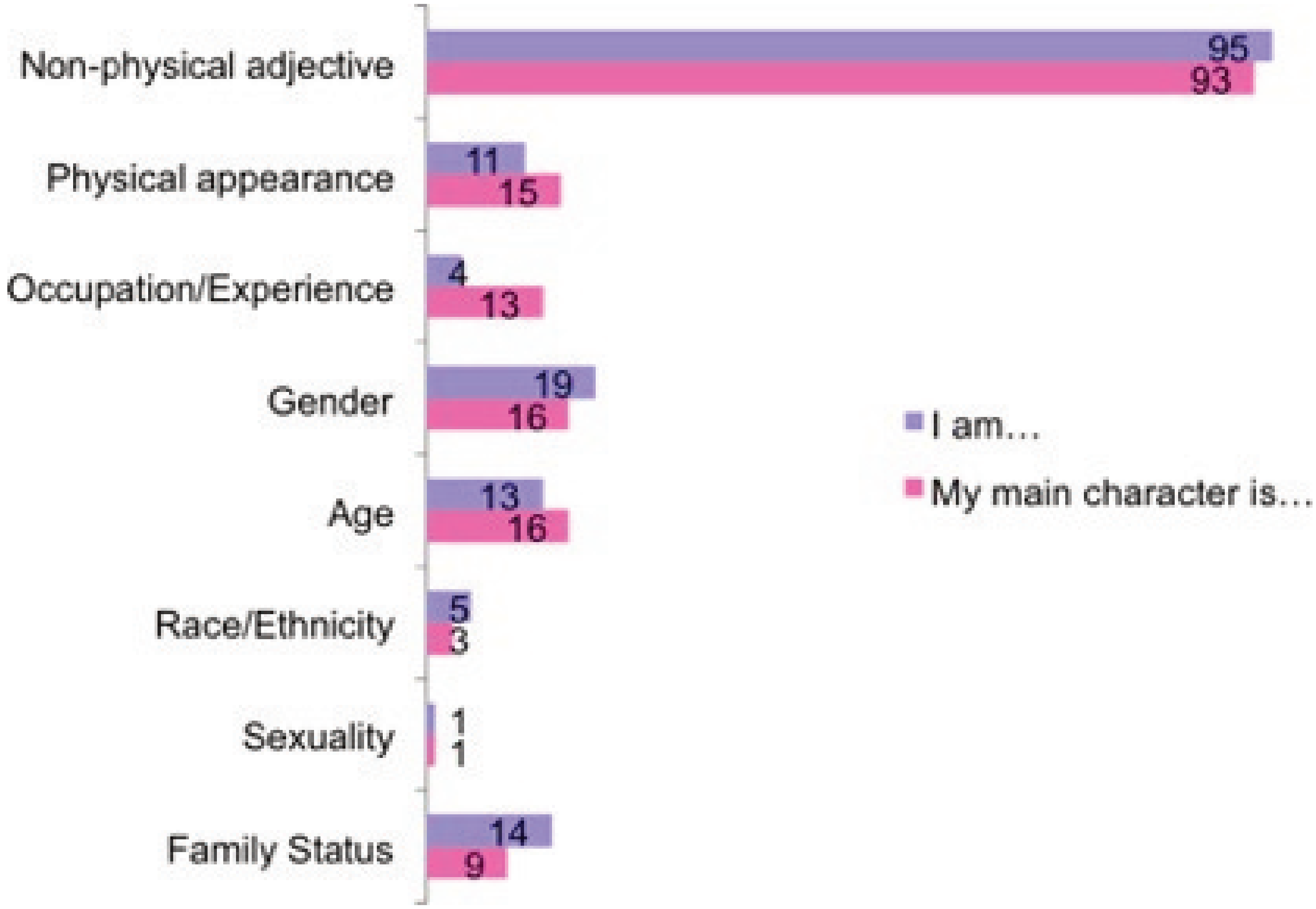

Figure 1. Number of participants choosing one or more words of the following categories to describe themselves and others (not exhaustive)

Figure 2. Characters: Most common descriptors used

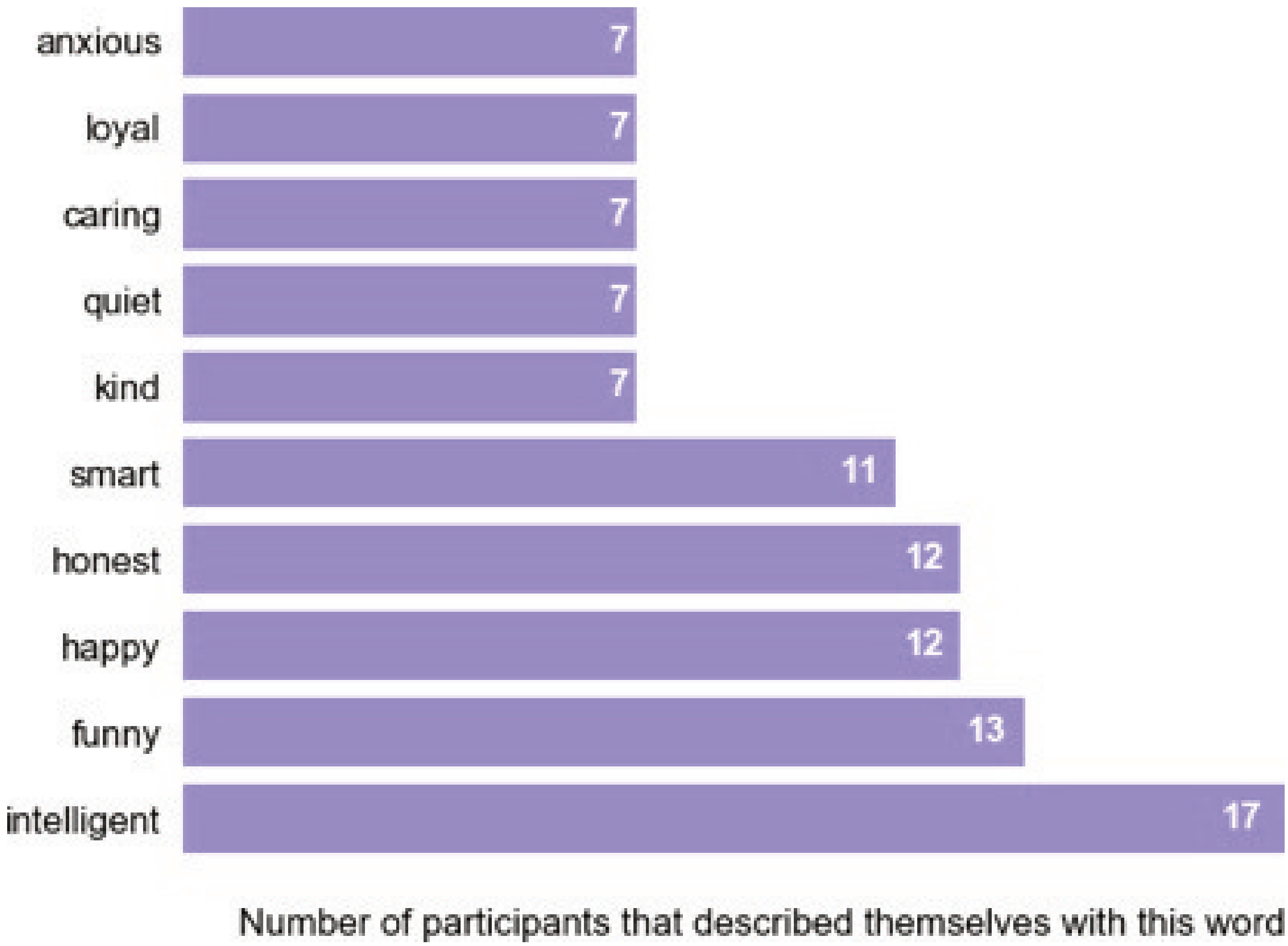

Figure 3. Participants: Most common descriptors used

"SHE'S JUST LIKE ME!": HOW TO DEVELOP CHARACTER DESIGNS REFLECTIVE OF DIVERSE CHILDREN

How to Develop Character Designs Reflective of Diverse Children

MOMOKO HAYAKAWA, LINLIN LI, AND LAURA BEUKEMA

Extended Abstract

Educational game development is a complex design process. Early collaboration between educational researchers and producers of educational games is important to ensure the products' academic potential and quality, as well as the diversity of media representation of characters. As games are perceived through the characters, the characters themselves act as a window for the game players to experience the world and events in the games. Therefore, characters need to have a connection with the game players in order to evoke engagement and learning. This is particularly true for games that are developed to be played in different educational settings. Therefore, it is important for the character designs to reflect the actual characteristics of the children playing the educational game for children to be engaged with their avatars.

Twin Cities PBS is developing educational games for a new property, "Hero Elementary (w.t.)," supported by the U.S. Department of Education Ready to Learn grant. As the targeted audience for the games are located in low-income communities, we want to ensure that the character designs are relatable to these children. Numerous studies have indicated that racial minority group members are underrepresented in the media – regardless of the specific ethnic subgroup examined (i.e. Asian, African, American, Native American, African-American) (e.g. Klein & Shiffman, 2006). Furthermore, when minority characters appear in the media, they are depicted in minor roles, compared to their Caucasian counterparts (e.g. Klein & Shiffman, 2006).

As children are exposed to animated characters at an early age, many studies have shown the influence of media on children's attitudes and beliefs about racial groups (Keys, 2016), the accuracy of representations among diverse characters is critical. Although the representation of minorities in the media have improved in recent years, there still remains grossly biased stereotypical portrayals of minority characters (Keys, 2016). Children must be able to not only see themselves reflected in the character designs, but also see their lived experiences and communities reflected in the designs. To this extent, character designs must depict both a variety of social statuses as well as diversity in race, because it has been shown that these two attributes have disparate influences on perceptions of characters, depending on the ethnicity of the audience (Hoplamazian, 2013).

This paper describes our iterative and interdisciplinary methodology used to design and test superhero characters that represent diversity in various educational settings. We developed our

character appeals protocol in collaboration with our independent evaluation partner, WestEd. Our superhero characters represent diverse kids (Black, biracial: Asian-American and White, Mexican-American and White) who solve problems through the power of science, and will be used across multiple digital and analog games as well as other transmedia products. We summarize our findings from three iterative testing sessions and provide concrete recommendations for testing children with character designs.

Methodology

Our iterative and interdisciplinary method of conducting character design and test focuses not only on visual aspects of the design but also psychological aspects. In particular, our character design and tests address (1) the appearance of the characters and (2) the children's connections with the characters.

The target demographic of our educational games include: low-income, Latino, English Language Learners, and children with special needs. In order to develop character designs that engaged and reflected our target audience, we specifically sought out children matching our target demographic in our character testing. We recruited participants from an urban area of the West Coast, as well as participants from a mid-size city in the Midwest region.

At the beginning of each round of testing, children were read a brief summary of the biographies of each character to provide context (e.g. "This is Maika. She is a 7 year old girl and her superpower is flight- but sometimes she's afraid of heights and gets dizzy while she's flying!"). This step provides children with an opportunity to meet the characters and form a connection. Following the description, children were shown the art designs and were asked specific questions about the character, as well as the character designs.

The first round of character appeals testing occurred with 83 kindergarten-second graders, that attended an urban school located in a low-income community. The demographic of this sample included: 40 boys, 68 free and reduced price lunch eligible, 60 English Language Learners, 67 Latinos, 7 Asian Americans, 6 Caucasians, 1 African American, and 5 identified as "other."

In Round 1 of testing, all designs were presented on a single sheet of paper. Initially, children were asked to independently mark their favorite character design. Next, children were asked to vote on their favorite design in front of their peers by raising their hands. Children then explained their preferred in choice in front of their peers.

The objective of this testing session was to narrow the artist from a wide selection of artists and identify an artist that was able to illustrate engaging characters that had high appeal to a diverse audience. Children were encouraged to connect themselves with the characters and were presented with seven versions of Character S to express their opinions about the following series of questions. Further testing during the same round followed an identical protocol with seven versions of Character E.

Questions pertaining to character preferences:

> *"Which character is most like you?"*

"Why is this character most like you?"

"Which character is your favorite character?"

"Why is this character your favorite?"

"What games would you want to play with the character?"

Questions about the compatibility of specific character designs:

"Among the characters, which of these two characters are friends?"

"Why do you think they are friends?"

Questions about personal interest in genre:

"If you were a superhero, what powers would you want to have?"

The subsequent round of character appeals testing (Round 2) was built on the previous round of testing. The second round of character appeals testing occurred with 112 kindergarten-second graders, that attended an urban school located in a low-income community. The demographic of this sample included: 59 boys, 59 FRPL, 50 ELL, 65 Latino, 20 White, 14 Asian American, 4 African American, 12 identified as "other."

In Round 2, the designs for each character were organized and presented across separate sheets – one sheet per character. Children, once again, were asked to independently select their favorite character design by circling their favorite choice. Next, they were asked to vote on their favorite character by standing up. Children were then asked to explain their choice in front of their peers.

The objective of this testing session was to further narrow the character designs, as well as identify specific attributes that children preferred, in order to understand which characters had the most appeal to children and why. Four separate versions of Character S and four separate versions of Character E were tested. Additionally four versions of Characters S and E playing together as friends were tested. Children were presented with the following questions for the three sets of art:

Questions pertaining to character preferences:

"Which character is your favorite character?"

"Why is this character your favorite?"

"Which character is the same as you?"

"How is this character the same as you?"

"Which friends would you want to play with?"

"What games would you play with them?"

The final round of character appeals testing was conducted on 54 children across kindergarten-second grades. The demographic of this sample included 33 boys, 33 FRPL, 34 ELL, 35 Latino, 10 White, 4 Asian American, 3 African American, 2 identified as "other."

The objective of this testing was to identify specific details that children liked or did not like and to understand whether or not children saw themselves reflected in these characters. We were also interested in identifying areas of improvement for each character design. Therefore, we tested one version of the five main characters developed for the property. The following questions were asked:

Questions pertaining to character preferences:

> "Which character is your favorite character?"
>
> "What games would you play with these characters?"
>
> "(For each character) What do you like about this character?"

Question pertaining to design dislike:

> "If you could change anything about how this character looks, what would you change?"

Results Round 1

The initial round of testing provided insights for creating a developmentally appropriate protocol. When asked about preferences, first and second grade children were engaged throughout the session and discussed their opinions with each other. Contrary to this, kindergarteners had difficulty focusing on the task. Kindergarten children experienced fatigue much earlier compared to first and second grade children as researchers prompted feedback on all 7 character designs. Thus, kindergarteners were unable to respond to all of the questions.

All children were able to successfully select their favorite character(s) on the character sheet. However, when asked to vote for their favorite character, children either did not vote, or discussed their choices among their peers, prior to selecting their favorite character.

Responses to questions pertaining to preferences. While all children were presented with the same images in the same order, first and second grade preferences for character design were similar, unlike kindergarteners who voted across all designs evenly.

Across all children, specific attributes for each character resonated with the individual, and they commented on similarities between them and the character.

> "I have a really strong mind, and he has a really strong mind" (2nd grade boy referring to Character S's super power of thought projection)
>
> "Because we like to do messy science" (1st grade girl)

First and second graders were able to provide specific feedback on attributes they liked about a design. This feedback provided us with concrete points to address in the subsequent revisions to the art. However, kindergarteners struggled to understand the task and while they were able to vote about preferences, had difficulty describing why they chose a specific design.

"She has long hair" (1st grade girl)

"I like science and she has the same hair as me" (1st grade girl)

"She is strong and I am strong" (2nd grade boy)

Responses to questions about the compatibility of specific character designs. First and second grade children were able to identify and articulate specific designs and characteristics of the character art that implied that the characters belonged together.

"They both like chemistry because the one has a chemistry shirt and the other is doing chemistry and they are both girls" (2nd grade girl)

"They have big heads and small bodies" (1st grade girl)

Responses to questions about personal interest in genre. Children's reactions to this question indicated that they were all familiar with the superhero genre. First and second grade children were interested in the superhero genre and provide many different superpower ideas that reflected their own interests.

"Friendship and love, because that's the power of all things" (1st grade girl)

"Teleport and jump really high and go really fast" (2nd grade boy)

"Walk through walls so when you're playing tag, they can't get you" (1st grade boy)

Round 2

The second round of testing provided an opportunity to further refine the protocol in order to efficiently use the limited time classrooms provided researchers, particularly with the kindergarteners. We reduced the number of questions which allowed kindergartener to answer all of the questions in a class period. In addition, we refined the protocol to encourage children to independently vote their preferences by standing up to avoid the peer discussion before the voting, thus biased votes were mitigated. After the independent voting, children were encouraged to share the reasons about their preferences with their peers.

Responses to questions pertaining to preferences. Children's preferences for the character designs varied greatly by grade level. Kindergarteners equally preferred three unique designs, of which one of the designs was highly preferred by the first grader. This same design, however, was least popular among the second graders.

When children were asked the reason they preferred a character, all grade levels were able to articulate detailed design elements that they liked.

"It looks like she can teleport and using her ring to read people's minds" (kindergarten girl)

"I like the twisty thing coming out of her ring" (kindergarten boy)

"She has a ring and it looks like the ring has power" (1st grade boy)

"Looking at her legs, she looks like she is teleporting" (2nd grade boy)

From the same set of character designs, children selected characters that looked like themselves. Kindergarten through second graders, to varying degrees, were able to articulate which design attribute reflected themselves. Many of these included physical characteristics and the design's reflection of a potential ability.

"She is strong and I help my dad carry stuff" (kindergarten girl)

"I always wear my hair down at home and I always do that pose when I have a ring" (1st grade girl)

"She looks like she is ready to run fast and I run so fast now" (1st grade boy)

"The height is the same' (2nd grade boy)

Round 3

The third round of testing was implemented to further refine the character designs based on children's interest, and to identify design elements that children did not like. The number of questions were further reduced to ensure complete participation from all children and more in depth discussion on each item.

Responses to questions pertaining to preferences. In the third round of testing, Kindergarten through second grade children unanimously selected the same characters as their top choices. Although some drastic changes to the images were implemented since Round 2, children were able to identify the character designs as representing the same characters from the previous round of testing.

"He cut his hair!" (1st grade girl)

"Ooooh, I like his, he got the hair cut" (kindergarten boy)

Children were selected specific design elements as reasons for their preference for the character.

"Because he's the only black dude!" (2nd grade boy)

"I like his hair-line" (2nd grade boy)

"I like because she has two ponytails" (2nd grade girl)

Furthermore, children remembered the characteristics of the characters beyond their physical appearance and commented on them:

"I like when she flies but when she looks down, I don't like that" (2nd grade girl)

"Because he can make a lot of things" (kindergarten boy)

"She's like 'What's up, y'all? I'm stronger than you at the gym" (kindergarten girl)

Responses to question pertaining to design dislike. In the third round of testing, children were also asked to comment on attributes of the character they would change. Many children provided comments that reflected age-appropriate current trends.

> "What I think you should change about M is his hair. I want it to be blue. To dye it" (1st grade girl)
>
> "I'll change her hair because it kind of looks like rock and roll hair" (2nd grade boy)
>
> "I want her hair to be like this (points to own hair, which is in a pony-tail)" (1st grade girl)

Discussion and Recommendations

Our three rounds of character tests reflect the interactive design and testing process. Results from Round 1 testing provided recommendations for characters' refinement and also informed the focus and modifications for Round 2 testing. Round 3 testing used the effective elements of Round 2 testing, but also emphasized on how to help refine and polish character designs based on children's feedback. Below, we list our recommendations based on the results of our multiple rounds of testing.

- Due to the limited cognitive capacity a young child can handle before reaching fatigue, numbers of artists presented to children must be limited and organized. If testing multiple artists, it is important to group all designs created by each artist, and then display and test all designs of each artist at a time. If needed, conduct separate test sessions for different artists. Also, ensure that the designs tested are similar in color and quality (e.g. all line drawings, all in color)
- Young children are overwhelmed by choices. Limit the number of choices they have to select from. For instance, if testing different character designs by the same artist, limit options to a maximum of 5 options per question. This reduces decision fatigue. Moreover, test the characters in the same poses (e.g. all characters standing and smiling) to reduce bias.
- Limit the number of questions to approximately four to six items. As children's (particularly kindergarteners) attention span is limited, limit the questions to ensure sufficient time for children to process the question, formulate their answer, and articulate their responses.
- Ask the most critical questions in the beginning. Children may not have the ability to sustain their attention on the task and may not get to the last questions. The ordering of the question is important – from most critical to least critical. Furthermore, ensure that all questions are developmentally appropriate (both in form and diction).
- When asking children questions about the specific designs, make a large copy of the image available to the children. In Round 1, children could not remember the names of the characters when asking questions about the designs. Printing out enlarged illustrations of the character designs and placing them on the wall for everyone to see helped remind children about all of the design options.
- Ask questions that children can better understand and connect with themselves. For instance, we found that children have difficulty with the Round 1 question of "Why is this character most like you?" We modified the question in Round 2 by asking "How is this character the same as you?"

- Test children in small groups to reduce bias. Larger groups of children have a higher chance of discussing reactions with each other and influencing each other's choices.
- Encourage independent voting and then provide opportunities for discussion to avoid biased selection and enhance shared opinion as a group. For instance, we encourage children to Identify preferences through standing up to vote, versus raising hands to reduce bias. Based on the results from Round 1 testing, where children discussed their character design preferences, in Round 2, we asked children to stand for their preferred character design. This reduced the frequency of children discussing their preferences with each other and limited influences on one another. Following the independent voting by standing, we provided opportunities for children to share why selected designs were their preference one by one in a group setting.

Future Directions and Conclusions

The present study explored variations among the character appeals testing protocols and procedures through an iterative process. Each session was built on knowledge gained as a result of the previous session. Many of the refinements in the protocol and procedure were constrained by the time /attention span of the young children. Future research may explore character testing protocol differences in parents, teachers, and adults, in comparison to testing with children. Perhaps the iterative process would be truncated and in-depth interviews would be possible with audiences that have a larger capacity for focus (i.e. adults).

Moreover, while our studies focused on the feedback from children, we do not know whether the protocol used for young children would spur the same type of feedback from adults. Next steps can determine whether there are attributes that adults are sensitive to that were not considered when testing children. What are characteristics that adults find critical when seeing themselves reflected in the design of characters?

Overall, our experiences testing with diverse children has demonstrated the importance of testing the character designs with the target audience. The feedback provided by the kindergarten through second graders uniquely reflected their perceptions and preferences of the character's attributes which were not considered by the adults involved in the development of the character designs.

Our findings are based on static art and therefore may need further investigation with animation. Developing and testing characters represented in movement adds an additional layer of complexity to game design. For example, the clothes that have a lot of movement (e.g. cape, light skirt) may complicate animation when characters are dancing, flying, etc. Also, different embellishments on an outfit (e.g. parts that move, shine, etc.) can provide complexity to the animation (especially in games). However, the findings from the present set of studies and the resulting recommendations inform the protocol that the researchers should considering implementing when testing for the appeal of moving and movement in character designs.

References

Keys, J. (2016). *Doc McStuffins* and *Dora the Explorer*: Representations of gender, race, and class in US animation. *Journal of Children and Media, 10*(3), 355-368, DOI: 10.1080/17482798.2015.1127835

Klein, H., & Shiffman, K. S. (2006). Race-related content of animated cartoons. *The Howard Journal of Communications*, *17*(3), 163-182.

Hoplamazian, G. J. & Appiah, O. (2013). Viewer responses to character race and social status in advertising: Blacks See color, whites see class. *Journal of Current Issues & Research in Advertising, 34*(1), 57-76, DOI: 10.1080/10641734.2013.754709

ACTIVE LEARNING AND GAMIFICATION IN GAME DESIGN COURSES

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Abstract

Engineering instructors often rely on the traditional lecture model where they lecture on a topic, with or without a slideshow, to a classroom of students. In this model, student engagement is low or non-existent with students neglecting to engage with the material until an assessment (i.e. an assignment or examination) is due. Further, students often do not get much practice with the soft-skills that are critical for successful professional interactions in industrial practice and future academic work in these passive learning environments. However, there have been alternative approaches proposed to help address the engagement and skill gaps. We describe our experiences in revising two game design courses at the University of Michigan – Dearborn where we replaced a traditional, lecture-heavy, course delivery model with one involving active-learning, role-play, and gamification. We track a cohort of students through a two-course game design sequence and report our findings from daily and term assessments.

Introduction

Engineering instruction typically follows the traditional lecture model throughout higher-education. This model is based around long periods of instruction which in some classes contain as much as three hours of nearly non-stop instructor-to-student presentation of course material. Pure lecture provides little opportunity to help engineering students develop soft-skills (i.e. inter-personal, communication, and other social skills) necessary for successful careers in industry and academia. These issues are further complicated because of student distraction caused by using electronic devices during class time (Risko, Buchanan, Medimorec, & Kingstone, 2013). However, other methods such as active learning have been proposed to help fix the engagement and skills gap (Prince, 2004).

The University of Michigan – Dearborn offers a two-course undergraduate sequence, CIS 487 and 488, in game design (CIS 487, 2017; CIS 488, 2018). These courses traditionally involved a weekly three-hour lecture of material with slides and involved little in-class interaction between students. In our experience following students throughout the two-semester sequence, the majority of the students spent the time more engaged with their laptops than with the course material. We wanted to change the structure of the course to better engage the students with the course material. We describe our experiences in altering the course to include active-learning, role-play, and gamification as well as student feedback from daily and term assessments.

Literature Review Active Learning

According to Prince (2004), active learning is broadly defined as “any instructional method that engages students in the learning process” (p.223). Further, Prince (2004) outlines the core requirements of active learning: student activity, student engagement, and those students think critically about the activity. The University of Utah’s College of Engineering (2016), which references the University of Minnesota Center for Teaching and Learning, makes it clear that active learning does not include the traditional lecture model of instruction which stands as the antithesis to active learning.

Active learning, as stated by Samavedham and Ragupathi (2012), is regarded by many engineering institutions, instructors, and governmental bodies as the best method to teach the next generation of engineers that are arriving ill-prepared for professional environments post-graduation. Techniques for active learning focus on complementing or entirely replacing lectures with numerous alternatives that engage students with the material and encourage the development of soft skills such as problem-solving, reasoning, and analytical skills that are necessary for successful post-graduation employment (Prince 2004).

Role-Play

Simkins (2015) defines role-play as simulating the real world in environments where consequences can be mitigated safely. Role-play allows students to get hands-on practice with concepts and practice the soft-skills that make for successful professional engineers: communication, problem-solving, and analytical skills. We believe this makes role-play a critical tool in the active learning engineering classroom. Numerous researchers have investigated the use of role-play in the software engineering classroom with success.

Moroz-Lapin (2009) and Seland (2009) used role-play in human computer interaction courses to engage students with the requirement engineering process in order to better understand system behavior from the users’ point of view. Similarly, Zowghi and Parvani (2003) also investigated requirements engineering using role-play to have their students understand the process of requirements gathering from both the client and developer perspective. Role-play was used by Börstler (2005) to teach students object-oriented programming concepts with class-responsibility-collaborator cards. Vold and Yayilgan (2013) achieved greater student engagement with role-play in an information technology course. Further, we draw inspiration from a study that used the Second Life (Linden Labs, 2018) online virtual world as a platform for students to role-play a fictional company for enterprise resource planning (Rudra, Jaeger, Aitken, Chang, & Helgheim, 2011). Other on-line role-play simulations focus on students taking the role of project managers with students receive immediate feedback on their decisions (Nakamura, Maruyama, Takashima, & Sambe, 2012; Maxim, Kaur, Apzynski, Edwards, & Evans, 2016; Navarro & Hoek, 2004).

The redesign described in this paper builds upon the work of Maxim, Brunvand, and Decker (2017), which used role-play in the re-designed game design course, CIS 488, at the University of Michigan – Dearborn. We re-use this work with some slight modifications as the second course in our two-course game design sequence. The course from 2017 had the students role-play as developers of a failing game company with the goal of simulating concept to release creation of 3D computer games using Unreal Engine 4 (Epic Games 2018) (Maxim, Brunvand, & Decker, 2017). The failing game company backstory used to motivate the role-play in our course is discussed further in Decker and Simkins (2016). Decker and Simkins provide the framework we used to build and adapt our role-play modules. These modules emphasize industry best practices for the technical game development work and soft skills development as well as the introduction of secondary learning objectives based in business and legal concerns that naturally arise during the role-play (Maxim, Brunvand, & Decker, 2017). The decision was made to continue to use the term long role-play activities created CIS 488 since those students had a good grasp of software engineering and game design from the pre-requisite course CIS 487.

Gamification

Gamified learning or the gamification of learning has been defined as the use of game design elements in non-game settings to increase motivation and attention on task (Domiguez, 2013; Simoes, 2012). Using active-learning in the authors' experience may lead to issues with group-participation and motivation if students do not feel the need to work outside of class. Adding gamification elements to the active learning can help mitigate this problem.

James Gee (2014) has identified thirty-six learning principles that are present in good games. These learning principles provide the backbone for good game design and, in turn, can be used as guiding principles when designing a gamified learning environment. For instance, good games provide players with information when they need it and within the context in which the information will be used (Gee, 2003). Effective game design includes challenging players so they are routinely working at the edge of their abilities and knowledge, also known as their zone of proximal development (Vygotsky, 1978). Having students, or players, operate within this optimal learning zone helps keep them engaged and encourages them to learn more in order to meet the demands of the next challenge.

According to Gee (2003), games can promote collaboration and skill building, if players are required to share knowledge and skills to be successful. Games that reward teamwork can have a positive impact on the development of prosocial skills (Granic, et al., 2014). Gee contends that well designed games are motivational specifically because of the different learning principles outlined previously (Gee, 2003). Working at the limits of their abilities keeps players engaged as they continue to take on new challenges (Ott and Tavella, 2009). Gee refers to this process as a cycle of expertise, which requires players to constantly learn, act, revise and learn again in order to demonstrate mastery and be successful in a game (Gee, 2014).

In addition to the motivational aspect of the cognitive element of games, Lee and Hammer (2011) suggest that the social and emotional aspects of rewards and consequences earned in gaming environments contribute to motivation as well. However, there needs to be a balance between positive and negative outcomes to prevent discouraging or overwhelming the students (Dominguez et al. 2013). A well-designed game can also motivate players to stay engaged by enhancing the value of the task or tasks being completed (Yang, 2012). This is particularly beneficial with educational games focused on school related subjects that students might not otherwise choose to immerse themselves within. Toth and Kayler (2015) created a role-playing game that made use of quests to motivate students' assignment completion.

Gamification can be used as a means of promoting rewards for completing tasks. Students can be rewarded for compliance to software process steps and for taking the initiative to improve their "soft skills". In this way, the authors hope to resolve some of the discrepancies in personal efforts that are often present in student project work. We designed numerous tasks covering the gamut of game design and process engineering and assigned them point values for successful completion. Students were allowed to negotiate their own tasks within their team structures while also being encouraged students to work on a variety of different tasks in order to earn points towards their final course grade. These tasks encouraged development of soft-skills through team communication, planning, and problem-solving. Allowing students to negotiate the nature of their activities and rewards up front often goes a long way to ensuring that all students are engaged for the entire semester. It is our expectation that, by providing more diverse learning opportunities, our students will be better equipped for the engineering profession upon graduation. The authors are using student feedback and their lessons learned to plan the next iteration of our game design courses.

It is important to acknowledge the debate that centers around gamification. There are critics such as Ian Bogost who colorfully proclaim, "Gamification is bullshit" and that it is little more than a marketing term for exploitative practices (Bogost, 2011). A more nuanced criticism from Casey O'Donnell argues that gamification at its heart is a form of algorithmic surveillance that provides data of dubious merit and use (O'Donnell, 2014). However, as we show with our course designs, gamification can be accomplished in a non-manipulative and non-exploitative manner where the goal of the gamification is to provide different opportunities for involvement in the courses thereby increasing student agency by allowing students to work on what interests them the most.

Course Design Course Overview: CIS 487 Computer Game Design I

The purpose of CIS 487 is to introduce students to the technology, science, and art involved in the creation of computer games. The course meets once a week for three hours over a fourteen-week semester. Before the Fall 2017 semester, this course split time between lectures on game design principles and Unity 2D and 3D game engine video tutorials (Unity, 2018). The revisions to this course focused primarily on introducing active-learning activities on game design as an alternative to the lecture heavy focus for presenting course content.

The weekly class was split in to three principal components. The first component was a short interactive presentation on the game design material for the week. These presentations were reduced to approximately 30-45 minutes on average. These presentations were then followed by the second component, an activity designed to engage the students more deeply with the material. Finally, the third component was a 30-minute, live, Unity engine tutorial on a particular topic usually related to the game design content for the week. These live demonstrations provided the opportunity for student interaction and questions not possible with the video tutorials that were previously used for the course. Table 1 shows a week-by-week listing of the topics for the course.

CIS 487 Syllabus	
Week	*Class Content*
1	Video Game Evaluation Criteria, Intellectural Property
2	Game Design, Story Telling Puzzle Design, Unity Basics
3	Game Evaluation Presentations
4	Game Play, Balance, Paper Prototyping, Design Documents
5	Sprite Animation, Movement, 2D Physics
6	User Expereince Design, Agile and SCRUM
7	2D Design Document Technical Review
8	Terrain Construction and Level Design
9	2D Game Festival
10	Prototype 2, Game Artifical Intelligence
11	3D Game Concept Presentations
12	Playtesting, Alpha Prototype Demos
13	Team Organization, Game Production and Marketing
14	3D Game Festival

Table 1

The students were evaluated on the completion of five projects, four of which were team-based assignments and one which was an individual assignment. The group assignments involved the use of gamification to reward differential student project contributions that were broken down into elective components each with its own point value. Students could select any number of electives from the assignment to complete to earn a maximum amount of points on the assignment. Table 2 provides a list of activities covered during the semester. The gamification strategies used in the courses is discussed further after the course overviews.

The first project was an individual review of a professionally produced computer game. Students prepared their reviews of the game and their critiques in a PowerPoint. They were then required to present them to the class. The reviews were to cover the basic information of the game (i.e. title, type, price, authors), a summary of the game, which was to include items such as the story, gameplay, user interface, etc., and their thoughts on a number of questions such as the quality, fun, comparison to similar games, design mistakes, strengths, and weaknesses. The reviews are available at the University of Michigan – Dearborn CIS course website: http://groups.umd.umich.edu/cis/course.des/cis587/reviews/game.html.

Week	Activities
1	Bartok Rule Changes Exercise Copyright Card Games
2	Storyline Exercise Shocking Puzzle Design
3	Paper Prototype for First Person Shooter Brainstorming new game feature storyboard
4	Ideation and One Page Creation Create Game Pitch for One Page Game Tradeoff Analysis for Feature Addition to Game
5	Analysis of 3 Dot Game Scrum Trigger Film Process Improvement Game (PIG) Contest
6	Skit using 2D Games Sounds Only Create new 2D Game level outline
7	Peer Review 2D Pitch Document
8	Design Finite State Game AI to add to 2D game Gender Mag Persona Creation Exercise
9	Peer Review 2D Game Prototype
10	Cognitive Walkthrough of Persona for 3D Game
11	Peer Review 3D Game Concept Presentations Playtesting Paper Prototypes
12	Peer Review and Playtesting of 3D Alpha Prototypes
13	Marketing exercise for 3D game
14	Peer Review and Playtesting of 3D Beta Prototypes

Table 2

Projects two and three were completed by a group of two with the same students completing both projects together. Students selected their own partners for the projects. The two projects were comprised of a 2D Unity game pitch and the production of the game itself. The game pitches involved creation of a pitch document that outlined the game story, game play look and feel, and the development specifications. The 2D game required a playable game with at-least one playable character, one level transition, and some rudimentary physics and AI.

The fourth and fifth projects were also team-based but the students were required to form teams of three to four individuals. The students again could choose their own partners but were not required to work with the same partner from their 2D game. The fourth and fifth projects were to design and implement a 3D game alpha and beta prototype. The game requirements were like those for the 2D game with the expectation of a more polished and complete game.

Course Overview: CIS 488 Computer Game Design II

The CIS 488 course design builds on our previous work (Maxim, Brunvand, & Decker, 2017). The course contains a semester-long role-play in which the students act as the employees of a struggling game company. Also, the course makes use of gamification and active-learning elements similar to those described for its predecessor, CIS 487. We made one major alteration from the previous revision based upon student feedback. When the course was redesigned in 2017 we no longer included instruction on the Unreal game engine. In order to assist students in becoming familiar with the required engine we added back in instruction on it for the 2018 version of the course in the form of live, interactive demonstrations of 30-45 minutes duration each class period. These demonstrations focused on the class topic of the day. Students reacted very positively to this addition stating in reviews the "in-class instructions were very helpful. They were informative, plus having [them in class] allowed questions to be answered as they occurred." Table 3 shows a summary of the week-by-week topics of the course.

CIS 488 Syllabus	
Week	*Activity and Content*
1	Course Intro, Role-Play Intro, Intro to Unreal 4
2	Game Pitch Presentations
3	Teams Formed - Brainstorming Game, Studio Process Model Definition, Unreal Level Editing
4	Cubicorn Games - Consultants Presentation, Game One-Page Presentation, Intro to Unreal Blueprints Programming
5	Game Treatment Presentations and Market Analysis
6	Elevator Pitches, Unreal Materials / Lighting / Terrain
7	Two Pitch Swaps, Matinee and Bot Navigation in Unreal
8	Alpha Release Presentations, Play Testing
9	One Sheet Evaluations, Unreal Scripting and AI
10	Intellectual Property, Unreal Actors and Characters
11	Beta Release Presentations, Play Testing
12	Sequel Creation, Unreal Interfaces and Particle Effects
13	Team Management, 3D Game Marketing Presentations
14	3D Project Game Festival

Table 3

Gamification of Assignments

A problem the authors have observed in many student project classes, including but not limited to this course, is that some students contribute very little meaningful effort to the final work products. Sometimes students feel their individual contribution to the final work products was not reflected in their final grades. Students in both courses work on teams to create the milestone documents and prototypes delivered as part of their project work. In previous courses the instructor asked each student to grade the participation of each team member (including themselves) using a score of 0 to 5. Students were also expected to create a bulleted list of the tasks completed by each team member. The average of these scores was added to the team score. The instructor penalized people who failed to make significant contributions. Often the loss of 2 or 3 points on an assignment was not enough to encourage students to be active team contributors.

In the CIS 488 course offered Winter 2017, a gamification framework was created, where the points for the team artifacts became part of the core or required work for everyone and the individual work products become part of the elective work. The individual work included the peer evaluations, individual presentations, attendance, programming, level design, testing, project management, and art asset creation. In keeping with the spirit of allowing students to customize their course experience, students were allowed to pursue the game production activities which were of greatest interest to themselves. The students in each class determined the relative point values (5, 3, or 2) for these activities based on the perceived importance to the goal of completing a working game. These point values are shown in Table 4.

Points	Tasks
5	Programmer, AI Programmer, UX Programmer, 3D Prop Builder, Character Animator
3	Level Designer, 2D Texture Artist, Project Management, Document Manager, Repository Manager
2	Audio Designer, Test Engineer, Cinematic Artist

Table 4

These points were mapped to a time card where the maximum points the students earned for their individual prototype work matched the maximum number of points awarded to the team documents submitted for that turn in. The students were required to earn at least 10% of the time card points from a programming category. Pair programming was allowed with each member of the pair splitting the points earned for completing a user story. The completed time cards were submitted to the team leader for approval and then forwarded to the instructor for grading.

In some cases, these activities were further refined. For example, level designers were awarded separate points for completing story board and level design templates in addition to hours spent editing a game level. Test engineers were rewarded for writing test cases, executing test cases, and documenting the test results. Programmers were not credited with work completed unless a user story satisfied its acceptance criteria. Some tasks such as asset creation or management tasks were better rewarded on an hourly basis. Typically, 1 point an hour was awarded for these tasks.

The gamification framework was implemented using the Gradecraft class management system (Gradecraft, 2018). This allowed the implementation of a leaderboard and provided access to a grade predictor tool. A badge system was also initiated to recognize outstanding achievement in many categories (leadership, game development, marketing, creative activities). The time card system and gamification framework were adapted for CIS 487 in Fall 2017 and refined for CIS 488 in Winter 2018.

Evaluation

The two courses were both evaluated using daily assessment and term assessments. The assessments followed the same format as those initially designed in our previous study (Maxim, Brunvand, & Decker, 2017). The daily assessments were given to the students at the end of each class period and used to assess the students' views of that day's lecture and activity. The term assessments were given at the last class period and consisted of two online questionnaires. The first questionnaire was the standard course assessment form for the University of Michigan – Dearborn. The second form was a custom questionnaire we designed to more properly assess the students' views on the active learning and gamification components of the course and follows from the questionnaire originally derived for our previous study (Maxim, Brunvand, & Decker, 2017). A summary of the term assessments of the courses can be found in Table 5.

The two classes consisted of a mix of students at the undergraduate and graduate level. CIS 487 had twenty-four undergraduates and one graduate student enrolled. Of those students, twenty-three were male and five were female. CIS 488 had twenty-one undergraduates and two graduate students enrolled. Of those students, nineteen were male and four were female. In both courses, all students except one were from the College of Engineering and Computer Science. However, for the purposes of the assessments we only considered in-class, undergraduate student responses. We did not ask for identifying information which means that we cannot break down our responses based on the demographic data of the course enrollment.

From the term assessments we observed that students in CIS 488 were overwhelmingly (with a 4.5/5 average score) choosing assignments based on interest level. We believe this contributed to the high quality of the games produced by the students during the semester. We suggest this was due to an increase in motivation caused by being permitted to pursue their individual interests. As one student wrote reflective of multiple other comments, "I'm more driven to do a good job, since I choose to do it". Meanwhile, another student commented "This inspires creativity and forces students to solve real world problems, along with delivering a full product". Interestingly, the point valuation seemed less important to the students when picking an assignment even if it meant fewer points were awarded. This contrasts a bit with the previous study where interest level, time to complete, and point value all seemed to be significant factors (Maxim, Brunvand, & Decker, 2017). However, this assessment's students seemed to agree with the previous year's students that they put more effort in to assignments, felt they had more control, and could work on what interests them all with fairly high agreement (Maxim, Brunvand, & Decker, 2017). Also, of interest, is that both the CIS 487 and CIS 488 students had high agreement with the same sentiments (i.e. the last 5 statements from Table 5), which we interpret to mean that the gamification additions to the course are working as intended.

Term Assessments			
CIS 487 Mean Score *n = 10*	**CIS 488 Mean Score** *n = 12*	**Mann-Whitney U Test Ustat** *Ucrit = 40 @ 0.10*	**When picking assignments for this course what criteria was important when deciding which assignment to complete?**
			1 = not very important, 5 = very important
3.6	2.8	41	How easy an assignment appeared to be
4.0	2.8	31	How long I thought it would take me to complete the assignment
4.2	4.5	47.5	How interested I was in doing the assignment
3.5	3.3	52	Whether I had the necessary prior knowledge and skills to complete the assignment
3.9	3.2	41.5	How many points I could earn by doing the assignment
3.1	3.3	53	How much the assignment allowed me to collaborate with my classmates
			Which of the following had an impact on your ability to complete assignments in this class?
			1 = very little impact, 5 = very big impact
3.9	4.4	47.5	The amount of time required to complete an assignment
3.5	4.0	51	The complexity of the assignments
3.3	3.4	58	Your understanding of the assignment guidelines and expectations
4.2	4.3	58	Your ability to manage your time successfully
			Please indicate your agreement with the following statements.
			1 = completely agree, 5 = completely disagree
2.2	1.8	47	I put more effort into the assignments for this class than I normally do for the courses I take.
2.1	1.6	52.5	I felt like I had more control and choice over the assignments I completed for this class than I normally do.
3.1	3.8	43	I did what I had to, but I didn't feel like it was really my choice.
1.9	1.6	50	I picked assignments based on what interested me.
2.1	2.1	59	I feel I had control over how I demonstrated my understanding of the course material.

Table 5

The standard course assessment forms at University of Michigan – Dearborn have five questions of interest that are relevant to assess the course redesign. Tables 6 and 7 show the assessment results for CIS 487 and 488 respectively. For CIS 487, the results between 2016 and 2017, the old course and new course, are very close with a slight preference for the new version of the course. The new course had slightly higher rating on four of the five categories. We suspect the course ratings of the new course are similar to the previous version of the course because this is a popular elective course that students look forward to taking since their entry into the computer and information science and software engineer programs. The CIS 488 assessments are more interesting. Table 5 shows that between 2016 and 2017 there is a nearly full point difference in between most scores. We believe this is due to the course redesign which occurred between these years and the fact that students went from a non-gamified, lecture heavy course for CIS 487 in Fall 2016 to the active-learning and gamified second course in the sequence in Winter 2017. The numbers decreased slightly from 2017 to 2018 but remain higher than 2016, which was the non-gamified version of the course. We suspect that this could be due to the students being previously introduced to the active-learning and gamification in the previous course and therefore were not as pleasantly surprised as the 2017 students at the changes in the course.

CIS 487 Selected Course Assessment Questions **1 = strongly disagree, 5 = strongly agree**	2016 N = 17/31	2017 N = 19/24
Course fulfilled my needs	4.3	4.5
Course objectives were clear	4.3	4.4
Course was challenging and interesting	4.6	4.6
Course never repeats other course material	4.4	4.5
Overall course rating	4.5	4.7

Table 6

CIS 488 Selected Course Assessment Questions **1 = strongly disagree, 5 = strongly agree** ***11/20 Respondents**	2016 N = 8/23	2017 N = 11/21	2018 N = 12/20
Course fulfilled my needs	4.1	4.9	4.4
Course objectives were clear	4.2	4.9	4.3
Course was challenging and interesting	4.1	4.8	4.7
Course never repeats other course material	4.0	4.8	4.3*
Overall course rating	4.0	4.8	4.6

Table 7

Conclusions and Future Work

We were encouraged by the enthusiasm that students exhibited while working with the active learning modules. Engagement is hard to measure, but students rarely had their laptops open during the class activities unless the group activity was facilitated by their use. It was interesting to observe that the students did not lose momentum from CIS 487 to CIS 488. This was the first year that no incomplete grades were awarded in either class. The use of time cards and badging seemed to be having their desired effect of encouraging students to work beyond the maximum points allowed for the assigned projects. The number of students completing the on-line course assessments is lower than desirable. Perhaps additional gamification elements might be helpful. The addition of the game engine Q&A sessions in both CIS 487 and 488 were welcomed by the students this year.

Experience from the Fall 2017 course delivery of CIS 487 is being used to revise the next offering of this course and the corresponding active learning materials. We will revise the module instructions and address the completion time issues. We need to introduce the use of gamification before the project work begins in CIS 487, which means we need to revise the gamification framework created in Gradecraft. The revised gamification elements added to CIS 488 during Winter 2018 were well received and Gradecraft was used a little more regularly by students than in Winter 2017. It may be desirable to add some gamification elements to both courses to reward students for coming to class with the assigned homework completed. This suggests we may need to find a way to reward viewing tutorial videos before coming to class. We plan to study student engagement and participation patterns in more systematic manner in our next active learning course offerings.

References

Bogost, Ian. (2011) "Gameification is Bullshit". http://bogost.com/writing/blog/gamification_is_bullshit/, Retrieved 30 August, 2018.

Börstler, (2005) "Improving CRC-card role-play with role-play diagrams," in *Companion to the 20th annual ACM SIGPLAN conference on Object-oriented programming, systems, languages, and applications* (OOPSLA '05). ACM, New York, NY, USA, 2005, pp. 356-364.

CIS 487/587 Syllabus (2017), http://www-personal.umd.umich.edu/~bmaxim/cis487/syl487-587-f17.pdf, Retrieved June 22, 2018.

CIS 488/588 Syllabus (2018), http://www-personal.umd.umich.edu/~bmaxim/cis488/syl488-588-w18.pdf, Retrieved June 22, 2018.

Decker, A. and Simkins, D. (2016) "Leveraging Role Play to Explore the Software and Game Development Process," *Proceedings of 46th IEEE Annual Frontiers in Education Conference*, Erie, PA, October 2016, pp. S3F6-S3F10.

Domínguez Saenz-de-Navarrete,J., de-Marcos, L., Fernández-Sanz, L., Pagés, C. A.& Martínez-Herráiz, J. J. (2013) "Gamifying learning experiences: Practical implications and \outcomes," *Computers & Education*, 380–392. Retrieved from https://portal.uah.es/portal/page/portal/epd2_profesores/prof23288/publicaciones/GamifLearningExperiences_pre-review_v3.1PreprintFinal.pdf

Epic Games (2018) https://www.epicgames.com/site/en-US/home Retrieved June 22, 2018.

Gee, J. P. (2014) *What Video Games Have to Teach Us About Learning and Literacy. Second Edition*. St. Martin's Press, 2014.

Gee, J. P. (2003) "What Video Games Have to Teach Us About Learning and Literacy," *Computers in Entertainment*, 1(1), October 2003, pp.1-4.

Granic, I. Lobel, A. & Engels, R. (2014) "The benefits of playing video games," *American Psychologist*, 69(1), 2014, pp. 66–78.

Gradecraft (2018) Gradecraft Home Page, https://www.gradecraft.com/, Retrieved April 11, 2018.

Lee, J. J. & Hammer, J. (2011) "Gamification in education: what, how, Why Bother? Definitions and uses." *Exchange Organizational Behavior Teaching Journal*, 15(2), 2011, pp.1–5.

Linden Labs (2018) https://secondlife.com/ Retrieved June 22, 2018.

Maxim, B.R.; Decker, A.; and Brunvand, S. (2017) "Use of Role-play and Gamification in a Software Project Course", *Proceedings of 47th IEEE Annual Frontiers in Education Conference*, Indianapolis, IN, October 2017 (T3D1-T3D5).

Moroz-Lapin, K. (2009) "Role play in HCI studies," in *Proceedings of the 2009 international conference on HCI Educators: playing with our Education (HCIEd'09)*, British Computer Society, Swinton, UK, 2009, pp. 12-12.

O'Donnell, C. (2014) "Getting Played: Gamification, Bullshit, and the Rise of Algorithmic Surveillance." Surveillance & Society, 12(3), pp. 349-359.

Ott, M. & Tavella, M. (2009) "A contribution to the understanding of what makes young students genuinely engaged in computer-based learning tasks," *Procedia – Social and Behavioral Sciences*, 1(1), 2009, pp. 184–188.

Prince, M., (2004) "Does Active Learning Work? *A Review of the Research", Journal of Engineering Education*, Vol. 93, 2004, pp. 223-231.

Risko, E. F., Buchannan, D., Medimorec, S., and Kingstone, A. (2013) "Everyday attention: Mind wandering, and computer use during lectures", *Computers and Education*, Vol. 68 (2013): 2275-283.

Rudra, A., Jaeger, B., Aitken, A., Chang, V., and Helgheim, B. (2011) "Virtual Team Role Play Using Second Life for Teaching Business Process Concepts," *System Sciences (HICSS), 2011 44th Hawaii International Conference on*, Kauai, HI, 2011, pp. 1-8.

Samavedham, L. & Ragupathi, K. (2013) "Facilitating 21st Century Skills in Engineering Students," *The Journal of Engineering Education,* XXVI(1), 2013, pp.1-11.

Schell, J. (2015) *The Art of Game Design: A Book of Lenses*. CRC Press, 2015.

Seland, G. (2009) "Empowering End Users in Design of Mobile Technology Using Role Play as a Method: Reflections on the Role-Play Conduction," in *Proceedings of the 1st International Conference* *on Human Centered Design: Held as Part of HCI International 2009 (HCD 09)*, Masaaki Kurosu (Ed.). Springer-Verlag, Berlin, Heidelberg, 2009, pp. 912-921

Simkins, D. (2015) *The arts of larp: Design, literacy, learning, and community in live-action role play*. Jefferson, NC: McFarland, 2015.

Simões, J., Redondo, R. D. & Vilas, A. F. (2012) "A social gamification framework for a K-6 learning platform," *Computers in Human Behavior*, 29, 2012, pp. 345–353.

Toth, D. & Kayler, M. (2015) "Integrating Role-Playing Games into Computer Science Courses as a Pedagogical Tool," in *Proceedings of the 46th ACM Technical Symposium on Computer Science Education (SIGCSE '15)*. ACM, New York, NY, USA, 2015, pp. 386-391.

Unity (2018) https://unity3d.com/ Retrieved June 22, 2018.

Utah College of Engineering (2016) Promoting Active Learning, https://utah.instructure.com/courses/148446/pages/active-learning, retrieved February 25, 2018.

Vold, T. and Yayilgan, S. Y. (2013) "Playful participation for learning in higher education — The introduction of participatory role play simulation in a course at Hedmark University College," *Information Technology Based Higher Education and Training(ITHET), 2013 International Conference on*, Antalya, 2013, pp.1-4.

Vygotsky, L. S. (1978) *Mind and society: The development of higher mental processes*, Harvard University Press, 1978.

Yang, Y. T. C. (2012) "Building virtual cities, inspiring intelligent citizens: Digital games for developing students' problem solving and learning motivation". *Computers and Education*, 59(2), 2012, pp. 365–377.

Zowghi, D. & Paryan, S. (2003) "Teaching Requirements Engineering through Role Playing: Lessons Learnt," in *Proceedings of the 11th IEEE International Conference on Requirements Engineering (RE '03)*. IEEE Computer Society, Washington, DC, USA, 2003, pp. 233-241.

ABJECT PLAY

STEPHANIE JENNINGS

Extended Abstract

Throughout the last two decades, a vast body of game studies scholarship has examined and critiqued representations of women in video games. It has steadily expanded, incorporating approaches from a variety of disciplines into its ever-growing bulk, proving gaming's pervasive sexism, racism, and heteronormativity. Many pieces in this body of scholarship have drawn connections between the "negative" portrayals of women in video games and the supposed stagnation of women's further involvement in video games and gaming cultures. And in turn, numerous studies have suggested solutions to this problem that involve "better" representations of women (Friman, 2015), often by speculating on or analyzing answers to the question "What might women want to play?" (Brunner, Bennett, and Honey, 1998; Nakamura and Wirman, 2005).

But in response to the preponderance of literature dealing with representation, another body of research has arisen to outline the limitations of such work, its underlying assumptions, and its potentially damaging implications. Some have pointed to the resulting commodification of stereotypical feminine tastes (Cassell and Jenkins, 1998); some have asserted the prospective violence of its identity politics (Shaw, 2014); and some have noted that the overemphasis on representation limits how we understand the experience of actually playing a video game, which therefore overlooks a defining quality of the medium (Daviault and Schott, 2014).

In this paper, I endeavor to complicate the question of "What might women want to play?" by investigating my own affinity for Edmund McMillen's The Binding of Isaac: Rebirth (Nicalis, 2014). Representationally, Isaac appears as a game that would be outright revolting to both feminine and feminist sensibilities. It's gross-out, gory, and appears decidedly hostile towards women, playing on the well-worn Freudian Oedipus conflict with all its misogynistic anxieties of monstrous wombs and castrating mothers. As discussed in a number of previous analyses (Zachary, 2012; Dwan 2015; Batti 2015), Isaac appears closely related to Julia Kristeva's (1982) theories of the abject and Barbara Creed's (1993) related notion of the monstrous-feminine. However, in these analyses, the game's exemplification of abjection relates primarily—if not exclusively—to its representational aspects. The conclusion that Isaac is misogynistic would be the product of one way of examining the meanings that the game may generate through its representation of abject femininity—but it is certainly not the meaning of the game.

To interrogate and account for my own engagement with Isaac as a feminist and subversively feminine experience, I suggest that abjection is not only a way to examine a game's representational or mechanical elements. Rather, it can be an approach to play: a subversive way of playing a game that may directly challenge designer-intended meanings and oppose expected readings and audiences.

In Understanding Counterplay in Videogames (2015), Meades describes playing abjectly as a form of transgression. Transgressions, he explains, "can be understood as violation of rule or moral principle. These principles often demarcate important boundaries within society, such as between the sacred and profane, the normal and the abject, the compliant and the criminal" (p. 28). While my interest is also in the demarcation and violation of boundaries in acts of play, I do not regard abject play as objectionable or inappropriate, as Meades seems to suggest. Rather, I view it as a playstyle in its own right, as a resistant disposition that players may adopt in their engagements with video games.

Abject play occurs in the spaces between representation and mechanics, between game and player. Kristeva (1982) explains that the abject is that which "does not respect borders, positions, rules. The in-between, the ambiguous, the composite" (p. 4). The abject is thus both what constitutes and threatens borders and order: social, cultural, individual, systemic. It establishes these boundaries even as it destabilizes them. Hence, by playing Isaac abjectly, I threaten and tear apart incoherent patriarchal narratives of feminine bodily order and regulation, even as I recognize and enact them by playing within the game's representational and rule structures. But I do not change the game's rules or representations. I need not materially alter the game to transgress it. Even so, I disturb its order and the order that Western patriarchal culture has imposed on women's bodies.

Through my abject play, I reappropriate and reconfigure what has been simultaneously attributed and denied to femininity. I engage with Isaac's Biblical references to examine how Western patriarchy has connected femininity to sinfulness, evil, and filth at the same time that it has demanded the purification and sanctity of feminine bodies. I recast the figure of the demon and the meanings of sin and good as channels for feminine resistance. Feminine temptation to sin, I conclude, is the temptation to resist and expel hegemonic masculine rules. It is the temptation to not do as I am commanded, to refute my subjugation. It is the temptation to eat the fruit from the tree of the knowledge of good and evil, and then to discover that, under patriarchy, "good" is oppression and "evil" is feminine liberation.

Ultimately, the way that I experience Isaac is not an interpretation of it alone. It is not a counter-reading of the game's representational or procedural systems. Instead, abject play is a gendered performance: playing with the abject, abjectly, from a position of abjection. During every run, I can enact and experiment with femininity in ways that question, destabilize, and subvert the borders, orders, and norms prescribed to me. The meanings of my play emerge in the collisions and interminglings of my ever-unfinished identity formation with the game's structures.

To associate with demons—to be a demon, to be evil—in these spaces is therefore not a condemnation of my femininity or myself. My abject play is a protest against order, a critical action against structures of domination. It is a performance against oppressive perceptions of gender. Abject play issues an acknowledgment of my abject position in Western culture—but it allows me to formulate a position against it. It is an articulation against subjugation, a strategy of struggle.

References

Batti, B. (2015). “That of being opposed to I”: On video games, the horror genre, and the gendering of abjection. Not your mama’s gamer. Web log. Retrieved from http://www.nymgamer.com/?p=12455.

Brunner, Bennett, and Honey. (1998). Girl games and technological desire. In J. Cassell & H. Jenkins (Eds.), From Barbie to Mortal Kombat: Gender and computer games, pp. 72-89. Cambridge, MA: MIT Press.

Cassel, J. and Jenkins, H. (1998). Chess for girls? Feminism and computer games. In J. Cassell & H. Jenkins (Eds.), From Barbie to Mortal Kombat: Gender and computer games, pp. 2-45. Cambridge, MA: MIT Press.

Creed, B. (1993). The monstrous-feminine: Film, feminism, psychoanalysis. New York, NY: Routledge.

Daviault and Schott. (2014). Looking beyond representation: Situating the significance of gender portrayal within gameplay. In C. Carter, L. Steiner & L. McLaughlin (Eds.), The Routledge Companion to Media and Gender, pp. 440-449. New York, NY: Routledge.

Dwan, H. (2015). Slicing up eyeballs: Abject in gaming. Loser City. Web log. Retrieved from http://loser-city.com/features/slicing-up-eyeballs-abject-in-gaming.

Friman, U. (2015). From pixel babes to active agents—how to fix the lack of diversity in female digital game characters. Well played, 4(3), pp. 11-25. Retrieved from http://press.etc.cmu.edu/files/WellPlayed-v4n3-15-web.pdf.

Kristeva, J. (1982). Powers of horror: An essay on Abjection (L. S. Roudiez, Trans.). New York, NY: Columbia University Press.

Nakamura, R. and Wirman, H. (2005). Girlish counter-playing tactics. Game Studies 5(1). Retrieved from http://www.gamestudies.org/0501/nakamura_wirman/.

Meades, A. F. (2015) Understanding counterplay in video games. New York, NY: Routledge.

Nicalis. (2014). The binding of Isaac: Rebirth. Playstation 4. Nicalis.

Shaw, A. (2014). Gaming at the edge. Minneapolis, MN: University of Minnesota Press.

Zachary, M. (2012). Isaac and the “grotesque body of horrors.” The slow down. Web log. Retrieved from http://www.slowdown.vg/2012/03/03/isaac-and-the-grotesque-body-horrors/.

“BUILDING CHARACTER”: A NON-DIGITAL EFL CLASSROOM GAME TO TEACH GLOBAL CITIZENSHIP

A Non-Digital EFL Classroom Game to Teach Global Citizenship

JANINE BERGER

Abstract

This paper describes a 16 week-long, live-action experimental game in which English language learners at Universidad de los Hemisferios, a university in Quito, Ecuador, design an avatar and place him/her in an ethical dilemma. The aim of this game is to persuade students to have tolerance and empathy for those in different circumstances. Ian Bogost (2007) says that “procedural rhetoric” involves persuading by having people interact with a rule-based system. The challenge is to see whether the students are able to keep all aspects of the avatar’s identity in mind while role-playing the final game, for only in so doing can they make the leap from their own perspective to that of the “other”.

Introduction

The main question in this paper is “Do the game-rules provided enable students to create a non-digital avatar and respect all of its parameters throughout the game?”

The main concept on which this approach is based is Ian Bogost’s (2007) definition of *procedural rhetoric as* “the art of persuasion through rule-based representations and interactions rather than the spoken word, writing, images, or moving pictures” (p9). “Procedures” are parameters of action with rules saying what can or cannot be done in the context. “Rhetoric” refers to the art of defending, explaining or persuading someone of an idea. Thus, procedural rhetoric, according to Bogost, is the art of teaching through a rule-based medium such as, in this case, a serious game.

The players in this game are students at an Ecuadorian university in Quito. Though the country has a large number of indigenous groups, Quito itself is approximately 83% “mestizo” (citypopulation, 2017), and the university itself has very few people from other countries or other cultures. This game aims to allow students to explore ways in which people differ from themselves in terms of national, cultural and professional backgrounds as well as values, abilities and interests, and to consider how these people might act in a fictional setting.

Additionally, Ecuador is a developing country whose youth is only now beginning to aspire to travel and study abroad. Thus, they are aware that the study of English as a global language is now becoming more relevant and necessary, but many of these students will have had limited exposure in their formative years, and that mainly with teachers who themselves had little training in English language teaching. As of 2016, the country claimed to have only 8,000 qualified English teachers for 100,000 primary school aged children (noticias.universia.es, 2016). Many of the students in this study claim to feel anxious, bored and unmotivated by textbook-based courses; this project is an attempt to address that concern.

Therefore, the following sub-questions will be addressed:

1. *Do students use all of the characteristics of their avatar in the final course project? If not, which ones do they tend to focus on least?*
2. *Do students feel they improve their communicative competence in English through this type of course?*
3. *Do students find this type of live game more motivating than a "traditional" textbook-based course?*

Literature Review

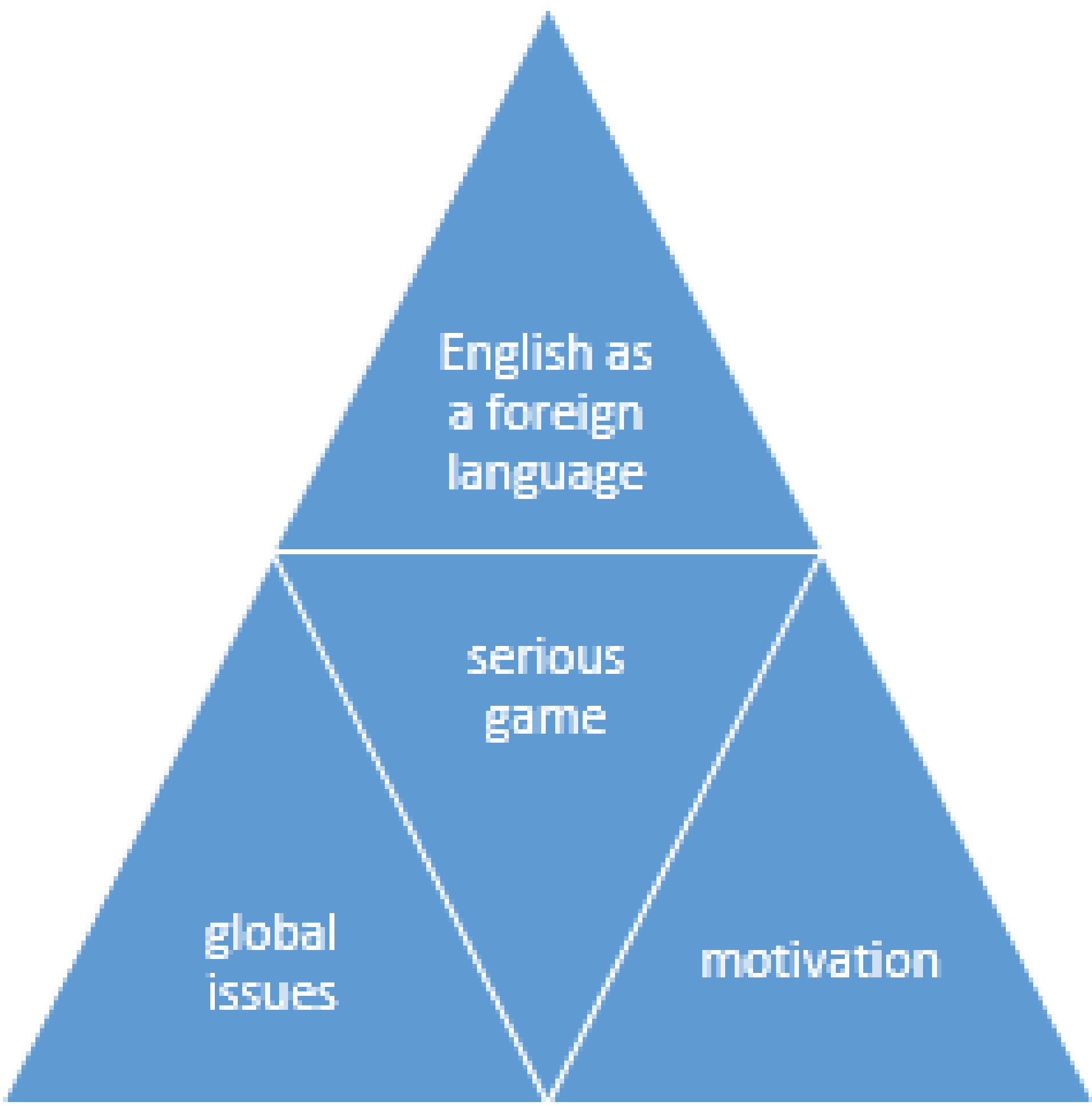

Diagram 1

The diagram above shows the connection between the different elements of this project. The three outer triangles are all connected in the following ways. Motivation is necessary for learning English as a foreign language. English is a global language and hence an ideal vehicle for discussing global issues. Global issues are themselves intrinsically fascinating to students at this university, in particular issues related to identity and tolerance, and thus increase their motivation to learn.

Serious games, at the center of the triangle, are a well-documented approach to teaching. Teachers of English as a Foreign Language (EFL) have long "gamified" their classrooms in various ways; more recently, organizations such as Games for Change (Games for Change, s.f.) have proposed that games, as interactive media, can make global issues come alive in ways that other media may fall short. Indeed, games do seem to fulfill much of the "best practice" criteria established by educational scholars such as Ken Bain (2004), including the ideas that "knowledge is constructed, not received" (p26), and "caring is crucial" (p31)

The serious game, though not a learning aim in itself, therefore forms the unifying point of the triangle, providing the vehicle to bring together the other three elements, because a well-designed game can be motivating as well as educational. Thus, the aim of this game is to address all three aspects of the triangle by means of a serious game. Therefore, in this section, games will be addressed first, followed by the others in turn.

Serious Games

Serious games are a branch of gaming that belongs less to the entertainment industry than the field of education. Such games are not necessarily "fun" in a frivolous sense (though there is no harm in their being so). Clarke Abt (1987), who developed the term *serious games* noted "…these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement" (p9). However, to students used to "traditional" teaching methods involving lectures, workbooks and tests, a serious game may be perceived as more interesting simply by virtue of the fact that a game is by definition interactive.

Motivation

By implementing a game-like approach to the teaching method, the students can be intrinsically motivated to learn English and enjoy class. According to Edward Deci and Richard Ryan's Self-Determination Theory (1985), the three essential elements without which intrinsic motivation cannot exist are a sense of autonomy, competence and relatedness. Since these elements are key to the "avatar" teaching method, let us examine them briefly.

Autonomy: Salen and Zimmerman (2004) define play as "the free space of movement within a more rigid structure" (p304). In the game described in this paper, the player/student has a certain amount of autonomy to make decisions within the space of possibility limited by the rules.

Competence: Standardized tests aim to compare students, whether within the classroom, or globally as in the case of international examinations such as the TOEFL. This can leave advanced students feeling overly complacent regarding their own abilities, while under-achieving students can experience discouragement and even "English anxiety". Educators would do well to emulate game designers by providing interesting challenges for those who are able while simultaneously encouraging weaker students to achieve.

Relatedness: English is not merely a set of grammar rules or vocabulary lists to be memorized, it is a tool for communication. As such, it behooves language teachers to facilitate a sense of relatedness among the learners by ensuring that the work of one is crucial to the work of the other. This is the idea behind Communicative Language Teaching (CLT), which Scott Thornbury (2006) explains as "*strong* form of CLT (which) led to the development of task-based learning with its emphasis on "deep end" communication" (p37)

Self-Determination Theory, then, is closely linked to the development of creativity, collaboration, communication and critical thinking which are the four skills proposed by Partnership for 21st Century Learning as being key for the future. In this project, students are encouraged to use their creativity to develop their avatar in any way they want within the given requirements. The other three skills come into play as they imagine their avatars interacting with each other in situations of their own invention.

The aim of this project is not merely to increase motivation however, for the novelty of the approach alone may be sufficient to achieve that. The other two aims of the project are to help the students improve their level of English and to consider concepts related to identity and empathy. A brief outline of these aims follows.

English

The first element this game aims to teach is the English language itself. The aim of the university is to have all students achieve a B2 level. However, the Common European Framework of Reference (CEFR) definition of B2 is quite deliberately broad (Council of Europe), for different learners have different learning needs, particularly in a case such as this one where students are all following different programs of study and meet only for this class. The CEFR refers more to what the students can do with the language than with any specific knowledge sets. The approach to language teaching taken in this course is therefore accordingly broad. Rather than planning learning aims for grammar or vocabulary, the idea is to design a course where there is wide exposure to audio and visual texts and ample opportunity for speaking and writing practice. Therefore, the game requires the students to read, watch videos, and do other forms of research in order to synthesize the information in a clear, coherent writing style. Scott Thornbury (2005) and Guy Cook (1989) both present the idea of teaching discourse as going beyond the sentence in order to produce meaning in a context. It is precisely for this reason that the game is non-digital: on a computer-based platform such as Second Life (2003), the avatar is created and shared using visual media, without the need for language. Thus, the medium is essential to the learning.

Identity and empathy

The second game objective is to teach the idea of identity and empathy. The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines Global Citizenship education as having "a sense of belonging to a common humanity, (…) empathy, solidarity and respect for differences and diversity" (2015).: In order to achieve these goals, particularly those related to "interconnectedness" and "belonging" it is worth examining the related concepts of identity and empathy.

Chris Weedon (2004) says that "identity presupposes identification, often in relation to what one is not". He cites Louis Althusser (1971) who points out that states maintain control by teaching people that their roles within the society are natural. Michel Foucault (1981) further affirms that since the self is a social construct rather than a fixed idea, the self is in continuing discourse with others; in other words, we learn to fit into society by emulating those who are similar to us while distancing ourselves from those we perceive to be different. "Any attempt to define the right to identity must begin with a nuanced understanding of the concept of identity itself. While there is no prevailing legal definition of identity, scholars of law, social science, and philosophy emphasize the importance of an individual's personal and social realities in the formation of a stable yet dynamic identity." (International Human Rights Law Clinic, 2007) Conceptualizing identity as a social construct rather than as a "natural" way of being can lead not only to tolerance of others who may think differently but also empathy for how they perceive the world.

Procedural rhetoric

Bogost states that video games teach or persuade through procedural rhetoric. However, if the rules cannot be imposed, it follows that the idea cannot be taught through those means. This project is an attempt to apply procedural rhetoric to a non-digital language class game which poses the following two challenges in particular.

Avatar identity: In a video game, the rules are built-in and can't be broken (other than by hacking or other illegal behavior). Thus, if the avatar has wings, it can fly, if it doesn't, it can't. At a more complex level, it is possible for the designer to create non-player characters (NPCs) that can respond in a specified way to the avatar to help shape the avatar's identity. For example, NPCs can be programmed to react in ways that demonstrate racism toward the avatar such as by using slurs.

Language: In text adventure games, such as Zork (1977), correct use of language is essential. In massively multiplayer online role-playing games (MMORPGs), players from different countries and with different languages often quest together and must find a way to communicate. Since that language is often English, it becomes a *de facto* requirement to have enough communicative competence to play.

The English language classroom environment in which this project takes place is different in both cases.

Avatar identity: The avatar is purely imaginary rather than visually accessible as a digital image. This means that every aspect of each avatar must be kept in the minds of every player. This can be a challenge if the avatar is too different from the player. It is hard to imagine one's Ecuadorian classmate as Chinese or African without resorting to using potentially offensive stereotypes of accent or clothing. If the player does not act the role properly and consistently, it can be equally difficult to imagine her in a wheelchair or autistic. This means that some aspects of identity are easier to role-play than others.

Language: The students in this study are all Ecuadorian Spanish speakers. This means that the use of English as a means of communication is artificially imposed by the teacher, since they could all communicate in Spanish. Moreover, in a live game, there are other forms of communication: for example, friends have ways of communicating a great deal with very few words or gestures.

There are many role-playing games (RPGs) in which the players take on alter-egos during the game, from the classic non-digital Dungeons and Dragons (1974) to MMORPGs such as World of Warcraft (2004). However, these are commercial entertainment games. Therefore, to conclude this section, let us examine three examples of games where this approach is put to educational purposes, which in turn have inspired the project set forth herein.

PeaceMaker (2007) is an in-depth look at the Israel-Palestine situation (Burak & Parker, 2017). A two-state solution is envisioned as the winning state (by the designers' choice). The game is complex and includes such issues as honor, religion, history, land, opportunity, and relative military power among others. The perspective taken by the player is either that of the Israeli Prime Minister (a fictional character not based on anyone currently or previously in that position) or of the Palestinian authority (also fictional). Each decision the player takes in this role will be lauded by some and decried by others, and will often lead to violence. PeaceMaker inspired the idea for having students deliberately create characters that were substantially different from themselves (though not quite as radically so as in the case of Israelis and Palestinians) in order to learn empathy.

Second Life (2003) is not a game *per se* but a platform. Michele Ryan (Ryan, 2008) is conducting a study on the potential uses of Second Life in pedagogy, among which she includes role-play "as a way to practice the skill by taking on a role (…) However it can also be used to give a more tacit understanding of the course material. In this case the role playing activities are intended to provide an experience" (p4). As mentioned above, however, it is not only through the role-play itself that learning happens, but also through the act of developing the character, which is why a digital platform would effectively take that experience away.

Another interesting approach is the "Scottish Storyline" approach originally used with primary children in Scotland, and now all over the world (Mitchell-Barrett, 2010). This approach involves providing parameters within which children develop a clear story including setting, character, plot and episodes during the course of which they consider key questions meant to incorporate the elements of the national curriculum. The project outlined in this paper aims to operate along similar lines, though in this case the teacher's role is to provide the framework of the character through the instructions as well as assistance with English, but not to intervene directly in the development of the story.

The challenge, then, in a project of this nature is to design a clear set of rules, which will permit the learning aims to be achieved. In the following sections, the game rules will be outlined. Following that, samples of the student's work will be analyzed to determine to what extent the parameters of the avatar were kept to in the final game. Based on this, plans for a future game can be developed.

Study

Context: In previous semesters, there had been seven groups of English learners at our University. This semester, it was decided to bring the three highest (B1-B2) levels together in order to have one mixed-ability group rather than three. The students are still required to take all of the credits corresponding to the original levels, thus, a student who is in the lower level this term will continue with another project next term. One group (60 students) met Mondays and Thursdays from 11am-1pm, while the second (20 students) met at the same hour on Wednesdays and Fridays.

The course is usually divided into three partials, each covering approximately one third of the semester with 30% of the final grade awarded in the first partial, 30% in the second and 40% in the third. For this project, grades are awarded according to a binary format: if all of the work is completed and corrected by the specified deadline, and a student has a minimum specified attendance record, that student will receive 100% for the partial, otherwise 0%. There are no other tests or forms of grading.

Instructions

The structure of the course followed the division of the semester into three partials. In the first, the students created and developed their avatar in pairs. In the second partial, the class was regrouped so that the pairs were split up. During this period, each group selected and researched a sub-culture to which their avatar would belong. In the final partial, the same groups helped each other make short videos in which each avatar was faced with a moral or ethical reason to either stay within the subculture or leave it. Each student then showed the videos to classmates outside of their own group. The viewers had to decide whether the character should stay or leave. (For the complete set of instructions given to the students, please see Appendix C.)

Analysis and Discussion

Research approach and methods

This project is an action research study, which means that it will be systematically planned, acted on and reflected on (Kemmis & McTaggert, 1992). *This project is the first in a series of experiments in which the teacher creates the parameters for student-created avatars.*

Motivation and response to the new method: survey results

Students were asked to compare this avatar method with the textbook-based methods used in other courses using the following chart. The numbers refer to the number of comments coded according to each category (see Appendix A)

	Previous methods	*Our method*
Positive	40	78
Negative	45	31

Table 1

Discussion: From this chart, it can be noted that this new method was generally well-liked and preferred to the more traditional teaching method. Many of the negative comments related more to the excessive group size than to the teaching method itself. Many of the positive comments related to greater autonomy and creativity. The results are generally encouraging and it does seem that students enjoyed the approach.

Improvement in English: survey results

Students were asked to evaluate their own gains in terms of English learning. The questions were designed to be deliberately wide and the answers were coded as follows. (Please see Appendix B)

Discussion: Many students claimed that their language skills did improve. This is corroborated by teacher observation, which took into account both performance in class as well as improvements in writing during the period in question. It must be noted that certain cultural expectations of a language course, such as the idea that it be primarily grammar-based, self-contained lessons, were not met. This is deliberate on the part of the teacher, as explained above, however, given that this novelty made some students uncomfortable and may have impacted their motivation, it may be worth incorporating more in the way of traditional grammar lessons in the future.

Analysis of the avatars

In this section, the focus will be on the first and third partials, specifically the characteristics the students chose for their avatar and whether or not these were evidenced in the final video. For this study, the assignments of ten percent (8) students were chosen randomly by selecting the first four male (M) and four female (F) students alphabetically by first name. The name of the avatar is in italics as is the avatar's gender. In the chart below is each characteristic of the student's avatar along with a Y (yes) or a N (no) to show whether the characteristics were evidenced in the video. (Please see Appendix C for an example of a student's written work.)

	CAREER	INTELLIGENCES AND TALENTS	ETHNIC OR CULTURAL HERITAGE	DISABILITY
Alexandra (F) *Breannona (f)*	Unemployed poor and lonely (Y)	Playing carnival games and sports (N)	Hillbilly (N)	Attention déficit hyperactivity disorder (Y)
Camila (F) *Emma (f)*	President of a Company (Y)	Piano, drawing (N)	Jewish (N)	Autistic (Y)
Cristian (M) *Marco (m)*	Commerical artist (N)	Microbiology (N)	Greek (N)	Addition to tattoos (N)
Diego (M) *Pepe (m)*	police officer (Y)	Spatial (Y)	Arab (N)	Mental illness (N)
Erick (M) *Elizabeth (f)*	Fashion designer (N)	Problem solver (Y)	Malaysian (N)	Deaf (N)
Emilia (F) *Willow (m)*	Artist (Y)	Linguistic and interpersonal (Y)	Turkish (N)	Addiction to marijuana (Y)
Gabriela (F) *James (m)*	Actor (N)	Excellent memory (Y)	Finnish (N)	AIDS (N)
Isaac (M) *Antonio Nijinsky (m)*	Pilot (Y)	Cello, believes in animal rights (N)	Danish (N)	Work addiction (Y)
Juan Carlos (M) *Dapa (m)*	Emergency service patrol (N)	Created a poetry magazine (N)	Arab (N)	Deaf (N)

Table 2

Discussion: The most interesting point to note is that cultural heritage played no part in the eventual development of the game. There may be several reasons for this, the most obvious being that the final game was acted out by the students themselves in short videos filmed with cell phones; thus, in the absence of using makeup, costume, and/or accents to enact stereotypes (which, to their credit, the students didn't even suggest) there seemed no way to incorporate ethnicity. Therefore, the fault seems to lie more in the design of the course than in the students' intentions. Options to resolve this include requiring students to include an element of their avatar's geography or culture in resolving a problem. Children's stories such as *The Rescue Princesses (Harrison, 2012)*, or the *Geronimo Stilton* (Dami, 2000) books do very well at incorporating elements of a culture into the plot of the story, whether it's as simple as hiding behind Chinese fans or as complex as returning captured wildlife to their natural habitat. Students in this project are not children, however, they may enjoy quoting cultural proverbs or explaining a solution to a problem with phrases such as "when I was young, my grandfather taught me…" This solution will not in and of itself teach the complexities of cultural identity, but it may raise awareness of elements of ethnicity and perhaps spark an interest in learning more.

Jobs and special talents did not seem to figure prominently in the final work, but perhaps these are not always essential components of a person's individuality.

Disabilities, particularly physical disabilities as in the example of deafness above, proved very difficult to incorporate. Addictions seemed easier and more fun. There may be a number of reasons for this, however one may simply be that a *dis*-ability is taken to mean the absence of an ability rather than a different way of using one's body to inhabit space. For example, few hearing people truly understand how deaf culture has a linguistic richness all its own. It may be that this game is not a good space to explore these ideas and is better left out of future projects.

What seemed to end up happening in the videos the students' made was that they invented ethical dilemmas and had their avatars resolve the issue on its own merits rather than taking the avatar's identity into account. For example, one student had her character consider leaving a feminist group due to a disagreement over abortion. The character was made to give reasons regarding the rights of the fetus versus the rights of the mother, but without taking into account ways of perceiving the nature of a woman's role during pregnancy in different societies (Catholic, Jewish, Chinese, etc.). In other words, the students demonstrated the ability to see two sides of a question, but not the fact that a person's identity may mean there are more possible ways to perceive the issue.

Conclusions and Further Study

This approach to teaching seems worth pursuing and refining. The students seem more motivated to learn by doing this type of project as compared to more traditional textbook-based courses. This 16-week course incorporates the 21st century skills of creativity, communication, collaboration and critical thinking. And, students' communicative competence in the English language is notably improved. Therefore, these objectives need few adjustments to be reached.

The challenge for future iterations of this course seem to lie mainly in the question of what elements of identity to incorporate into the project. There are better ways to have the students incorporate national and cultural heritage into the development of their avatars, and these should be attempted. The question of illnesses and disabilities would need to either be addressed far more carefully so that the students can truly consider the lives of those with special needs, or, alternatively, abandoned altogether.

The key challenge remains: if the "rules" according to which the avatar operates, in other words, the character's way of being cannot clearly be visualized at every step of the game, then the procedural rhetoric of the project will fail. If, on the other hand, the students can demonstrate awareness that the character's identity impacts its subsequent actions in the game, then the aims will have been achieved.

Bibliography

Abt, C. (1987). *Serious Games.* Lanham, Maryland: University Press of America.

Althusser, L. (. (1971). On Ideology and Ideological State Apparatusses: Notes Toward an Investigation. En L. (. Althusser, *Lenin and Philosophy and other Essays* (págs. 121-173). London: New Left Books.

Bogost, I. (2007). *Persuasive games: the expressive power of videogames.* Cambridge, Massachussets: MIT press.

Bourn, D. (2015). *The Theory and Practice of Development Education: a pedagogy for social justice.* Oxon: Routledge.

Burak, A., & Parker, L. (2017). *Power Play: How Video Games Can Save the World.* New York, NY: St Martin's Press.

citypopulation. (23 de 06 de 2017). *www.citypopulation.de.* Obtenido de https://www.citypopulation.de/php/ecuador-admin: https://www.citypopulation.de/php/ecuador-admin.php?adm2id=1701

Cohen, L., Manion, L., & Morrison, K. (2011). *Research Methods in Education.* Oxon: Routledge.

Cook, G. (1989). *Discourse.* Oxford: Oxford University Press.

Council of Europe. (n.d.). *Common European Framework of Languages: Learning, Teaching, Assessment.* Strasbourg: Cambridge University Press. Retrieved from www.coe.int/t/dg4/linguistic/Cadre1_en.asp: http://www.coe.int/t/dg4/linguistic/Cadre1_en.asp

Dami, E. (2000). *Geronimo Stilton.* Milan: Scholastic.

Deci, E., & Ryan, R. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior.* New York: Plenum.

Foucault, M. (1981). *The History of Sexuality: Volume One, An Introduction.* Hammondsworth: Penguin.

Harrison, P. (2012). *The Rescue Princesses: The Secret Promise.* New York, NY: Scholastic.

International Human Rights Law Clinic. (2007). Right to Idenitity. *Organization of American States*.

Kemmis, S., & McTaggert, R. (1992). *The Action Research Planner 3rd ed.* Victoria: Deakin University press.

Mitchell-Barrett, R. (2010). *An analysis of the Storyline method in primary school; its theoretical underpinnings and its impact on pupils intrinsic motivation.* Durham: Durham University.

National Education Association. (2002-2017). *Preparing 21st Century Students for a Global Society: An Educator's Guide to the "Four Cs".* Washingtin D.C.: Nationa Education Association. noticias.universia.es. (5 de 10 de 2016). *www.noticias.universia.es.* Obtenido de noticias.universia.es/ practicas-empleo/noticia/2016/10/05/1144259/ecuador-necesita-3-000-profesores-ingles: http://noticias.universia.es/practicas-empleo/noticia/2016/10/05/1144259/ecuador-necesita-3-000-profesores-ingles.html

partnership for 21st century skills. (s.f.). *www.p21.org*.

Ryan, M. (2008). *16 WAYS TO USE SECOND LIFE IN YOUR CLASSROOM: PEDAGOGICAL APPROACHES AND VIRTUAL ASSIGNMENTS.* Lancaster.

Salen, K., & Zimmerman, E. (2004). *Rules of Play: Game Design Fundamentals.* Cambridge, Massachussetts: MIT Press.

Terkel, S. (1972, 1974). *Working.* New York: The New Press.

The United Nations Educational, Scientific and Cultural Organization. (2015). *Global Citizenship Education: Topics and Objectives.* Paris: UNESCO.

Thornbury, S. (2005). *Beyond the Sentence: Introducing Discourse Analysis.* Oxford: MacMillan.

Thornbury, S. (2006). *An A-Z of ELT.* Oxford: Macmillan.

Weedon, C. (2004). *Identity and Culture: Narratives of Difference and Belonging.* New York, NY: Open University Press.

APPENDIX A: MOTIVATION SURVEY

	Previous methods	*Our method*
Positive	Likes it x2	Learn to work in groups x5
	Prefers one levelx2	Work without a book x2
	More organized x6	More didactic x2
	More grammarx20	Interesting x6
	Easierx5	Dynamic x9
	Using a book	Real language x3
	More time to work	Fun x4
	More readings x2	Learn together x7
	Work by yourself	More speaking and listening x13
		More writing
		Creative x5
		Different topics
		Learn grammar in context x5
		More vocabulary x3
		Personalized learning x1
		No homework x2
		Speaking in public
		Apply what you learn
		You choose to learn or not
		Relaxing
		Really learning x2
		I hate English but with your method I like it a lot x2
		No stress about grades
Negative	Memorizing grammar x7	Too many ss x13
	Boring x16	Don't know exactly what I'm learning x4
	Too much work	Messy x2
	No speaking x6	Difficult to adapt to new method
	No learning x2	Too strict on grading
	Too slow x2	Fast x2
	Test focused x2	Difficult to understand more advanced students x2
	Book focused x6	Not enough grammar x2
	Not personalized	More complicated
	Too theoretical	Not enough grammar
	Writing summaries and essays	Long activities
		Activities were too young

Table 2.

APPENDIX B: LEARNING SURVEY

What do you feel you have learned in this course? (This question is to help students clarify their own gains during the course)

Speaking x29, vocabulary x17, teamwork x9, writing dialogues and paragraphs x7, improvise, listening x7, grammar x21, general knowledge/history/culture x3, organization, creativity x6, pronunciation x3, that people are complex, research, not be shy x5, think in English

What do you wish you had learned more about? (This question allows the teacher to plan improvements for the next cycle of study)

Grammar x13, vocabulary x7, movies, theoretical learning x2, listening x4, pronunciation x4, essay writing x4, formal letter/application writing, speaking x2, interacting more with classmates, fluency, informal English

APPENDIX C: INSTRUCTIONS

First partial: Instructions *(Note: These instructions were handed in written form to the students as they appear here. The* book *refers to a grammar handbook written by the teacher containing short descriptions and explanations of grammar points with emphasis on those presenting particular difficulties for Spanish speakers.)*

In pairs

1. The teacher will give you a text from "*Working: People Talk About What They Do All Day and How They Feel About What They Do*" by Studs Terkel (1974). This will tell you a bit about your avatar's career and his/her opinions about it. You may change the name and/or gender if you wish. **Agree on your ideas**. Then you will **each** write about this in your own words in 5 sentences. Use 2 new words or phrases you found in the text. Use any two grammar tenses from the book.
2. Choose two numbers between 1-7. The teacher will give you two texts about special talents and intelligences, which you will apply to your character. **Agree on your ideas**. Then you will **each** write about this in your own words in 5 sentences. Use 2 new words or phrases you found in the texts. Use any two grammar tenses from the book not used in point 1.
3. Choose a letter of the alphabet. The teacher will give you an ethnic and cultural heritage beginning with that letter. You must research the country of origin and the religion, plus two interesting facts about the culture. **Agree on your ideas**. Then you will **each** write about this in your own words in 5 sentences. Use 2 new words or phrases you found in the texts you researched. Use two grammar tenses from the book not used in points 1 and 2.
4. Choose a letter between A-E. The teacher will ask you to research a particular disability. Consider how this disability manifests in your avatar. **Agree on your ideas**. Then you will **each** write about this in your own words in 5 sentences. Use 2 new words or phrases you found in the texts you researched. Use two grammar tenses from the book not used in points 1, 2 and 3.
5. Find the Myers-Briggs Personality test online at https://www.16personalities.com/free-personality-test Do the test together and invent answers for your avatar. **Agree on your ideas**. Then you will **each** write about your avatar's results in your own words in 5 sentences. Use 2 new words or phrases you found in the personality test. Use two grammar tenses from the book not used in points 1, 2, 3 and 4.
6. Find 10-15 images related to your avatar. Create a 2-minute minimum video showing your avatar doing something he or she likes. Find a new partner. Watch each other's videos, look at each other's collages, and read each other's work: write a short essay about what you learn about your partner's avatar from the video, collage and text.

Part 2: Instructions

Work in groups of 4-5 students. You may NOT work with the same partner as in the first partial.

1. As a group, choose ONE of the following subcultures: *Ana Mia, Punk, Hell's angels, LGBT, Feminist, Gamer, Survivalist, or Hippie.* Individually write 2-3 sentences explaining why you chose that subculture and what you find interesting about it.
2. Research your subculture. You are required to use *Google, Facebook* and *Twitter* for your research. Keep a bibliography with the link and the date you retrieved it. You may work together to share your information, then individually describe the subculture in 5 sentences.
3. Find an online forum for people belonging to your subculture. The forum may be on any social media site. Take at least 10 screenshots of real conversations and discussions on these sites. Share your screenshots with your group. Based on the screenshots, discuss the values and anti-values of your subculture with your group. As a group, describe these values and anti-values using quotes from the screenshots. Individually, keep a record of 10 new words or phrases you find, along with their explanations.
4. Individually, write a short essay comparing these values and anti-values with those of your avatar.
5. Explain how and why your avatar got involved in this subculture.

Part 3: Instructions

1. As a group, you will help each member to create and perform (ie:speak) in three live-action cell-phone videos of 3-5 minutes each. Each set of three videos will be about one avatar, though naturally there may be several actors. (Therefore, if there are 4 members in the group, the group will have a total of 12 videos in which every group member performs or helps to film)

Video 1: Your avatar's values will come into conflict with the values of the subculture. At the end of this video the avatar will be faced with a choice to stay or leave the subculture.

Video 2: The avatar decides to stay. Show why he/she decides to stay and the consequences of that decision

Video 3: The avatar decides to leave. Show why he/she decides to leave and the consequences of that decision.

2. Video listening task: for each video, answer the following questions:

- Why did the character consider leaving the subculture?
- What was his/her final decision and what were the consequences?

3. Writing task: answering the following question: *In your opinion, what were the three most important values shown in the videos?*

APPENDIX D: EXAMPLE OF AVATARS

First partial:

Task 1

Emma is working in American Corporation. She feels frustrated, because she doesn't have any challenge in her work. Also she is a woman that thinks that values are very important in all aspects of life, because of that she feels impotent in her work, because she notices that people don't care about it. Finally she likes to work alone and hates being useless.

Task 2

Emma has many talents, one of them is that she has been playing the piano for two years. Also she likes to paint pictures about nature, because of that last month she was painting a picture of an apple tree. Another talent is that she is good at inventing new things, therefore she is making a new magazine. Finally she is an artist that likes to dance.

Task 3

Emma's religion comes from Israel. Her grandmother was Jewish, therefore she is Jewish too. Al Rosh Hashanah (New Year) she is going to eat apple and honey, because that represents the wish for a sweet new year. She celebrates Shabbat, that that starts on Friday evening and ends on Saturday night. She couldn't eat pork, because in her religion they aren't allowed to eat pig or seafood.

Task 4

Emma is able to learn many things, despite her autism. Also she has problems to express her feelings. She has had problems to communicate with her employees. Sometimes she has problems to socialize with people. For that reason she has continues conflicts with her boyfriend and that will make them break up.

Task 5

Emma is a logical person. She is a person who likes to plan, because she always knows what she is going to do. Also she always analyzes things before doing them. She should be more outgoing to relate to people. She will have more confidence in herself, if she socialize more with people.

Task 6

1. She is from England.

Image 1

2. She is the president of American Corporation.

Image 2

3. She is Jewish.

Image 3

4. She has autism.

Image 4

5. She likes to work alone.

Image 5

6. She is a logical person.

Image 6

7. She is very intelligent.

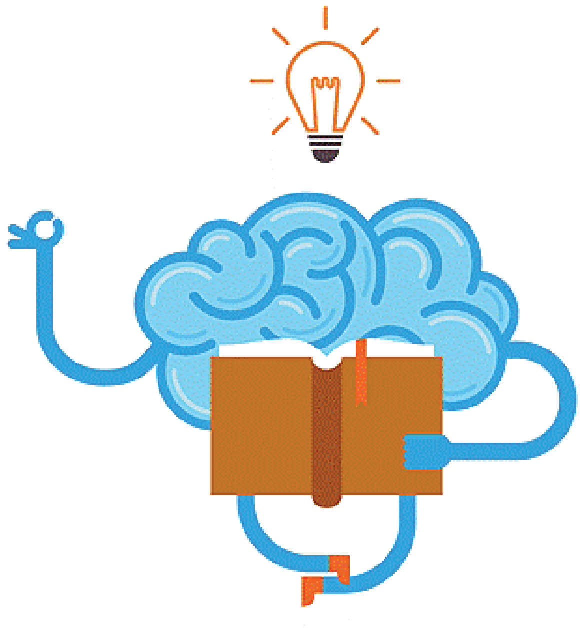

Image 7

8. She has problems to express her feelings.

Image 8

9. She is shy.

Image 9

10. She has a boyfriend.

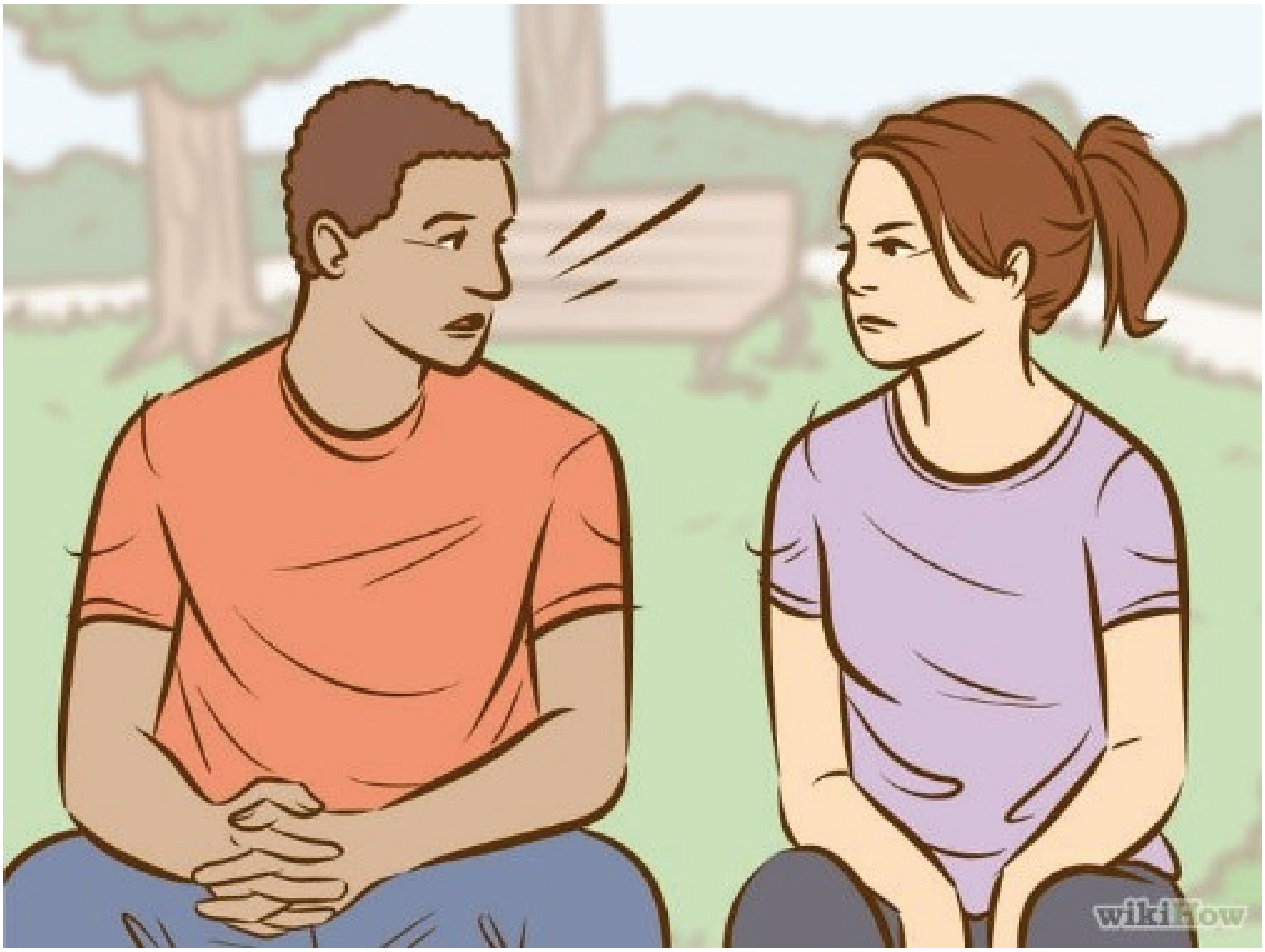

Image 10

11. She has a lot of money.

12. She is very creative.

Image 12

13. She plays the piano.

Image 13

14. She likes to dance.

Image 14

15. She couldn't eat pork or seafood.

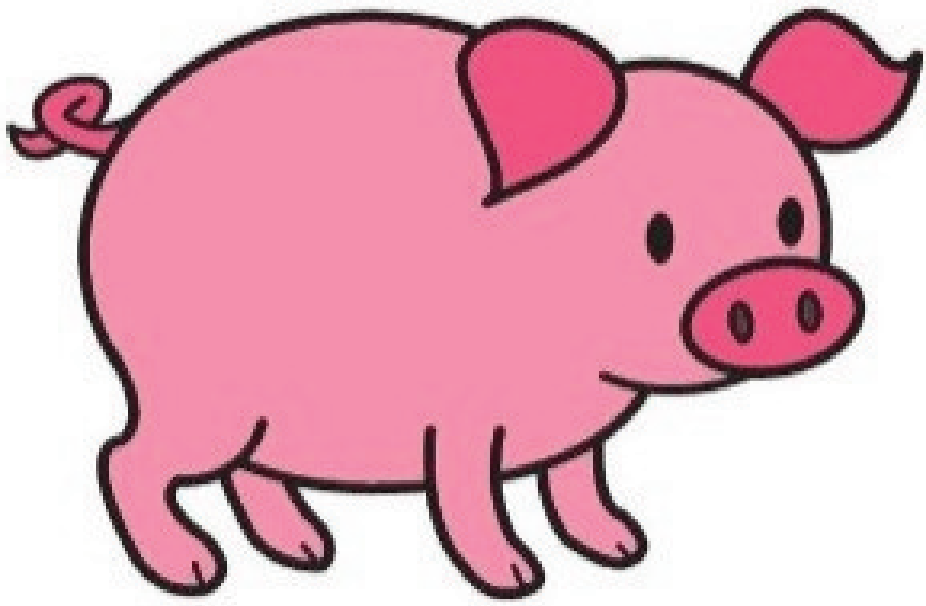

Image 15 A

Image 15 B

Second partial

- **Task 1**

They are a subculture that support the idea, of the bulimia. They don't think that bulimia and anorexia are an illness. Also they use the media like blogs, songs, and poems to transmit their idea. To occult this culture they become vegan.

- **Task 2**

This culture promotes the idea that girls should be skinny. They use web sites to give to the girls some tips to lose weight. They use natural medicine or drugs to lost weight. In most of the cases the girls pro Ana Mia hide their culture from their parents and their doctors. Anorexia is a psychiatric illness characterized by have a low weight, caloric restriction and people don't be satisfied with their body. On the other and Bulimia is an eating disorder which is characterized because people eat a lot of food and they lose the control to do it, but later they vomiting it or use laxatives to eliminate this food for their body.

The web sites pro Ana Mia talk about the anorexia and bulimia, and they think that those are eating disorders but also anxiety disorders. Also they said that the eating disorders have the highest mortality rate of any mental illness. Finally the pages of pro Ana-Mia take inspiration form advertising that shows that the girls look better when they are skinny.

BIBLIOGRAPHY

Facebook: https://rachaelplant.com

Twitter: #ProAna/ #ProMia

Google: https://www.medlineplus.gov

- **Task 3**

Anti-values

1. **Intolerance** Karen: How dare you call this disease cowardly? You jealous girl! Your comment is disgusting! https://missanomia.worpress.com/tips-pro-mia/
2. **Superb** Deven Marie: My therapist wrote "I am in control" in my mirror. She doesn't know I'm Pro Ana and Pro Mia haha! https://www.facebook.com/Deven.MarieTorentira
3. **Frustration** They've been having me alone and letting me diet but I can't voice my felling of failure or tell any of them that I haven't eat all day. https://www.myproana.com
4. **Irresponsibility** I only eat one piece of fruit a day. https://www.twitter.com/proanorexia1/with_replies
5. **Hate** It's our body we can do what we want with it. https://thinintentionsforever.blogspot.com

Values

1. **Willpower** I eat in breakfast a light babybel and a big cup of green tea. https://www.myproana.com
2. **Happiness** Being anorexic is positive, bones are beautiful. https://twitter.com/proanorexia1/with_replies
3. **Proud** We are gorgeous, you not. https://twitter.com/proanorexia1/with_replies
4. **Perseverant** We are trying to be thin. https://thinintentos.forever.blogspot.com
5. **Privacy** It's our body we can do what we want with it.https://thinintentos.forever.blogspot.com

- **Task 4**

Emma is very tolerant with people, because she is working in a corporation and she has to understand her employees. She is very responsible because she has been working as a president of American Corporation for 2 years, therefore she needs to have all the things inn order, but on the other hand the people of the group Ana Mia are very responsible too, because they have an extreme control of what they eat, therefore they have a strict order in their life. On the other hand Emma and the and the Ana Mia group feel frustrated because they can't achieve what they want, because for one Emma was working at the same job for 2 years, therefore she wants a new one, which be more comfortable to her, and for the other hand the people of the group Ana Mia things that they are fat, for that reason they want to lose more weight. Emma has had problems to relate to people, because she doesn't like to talk about her privacy things with people and the group Ana Mia agree with this idea, because they don't want that people opine about their health. Finally both of them are perseverant to achieve what they want.

- **Task 5**

Emma is a busy woman, because she has to prepare a lot projects for her work, for that reason most of the time she can't eat well, because she has little time to do this activity. In the morning she is going to eat a piece of fruit and nothing else, because she has to start working at 6 pm, therefore she starts to search on internet about recipes that will give her more energy and wouldn't be high caloric, and she can find it in the Facebook page of the group Pro Ana Mia. Later of that Emma stars chatting with one of the members of this group who's call Andrea, and they made friends. Andrea starts to job at American Company, in which Emma is the president and in the break time they went to eat together and Andrea told Emma if she wants to continue be skinny, she doesn't have to eat things that have more than 55 calories. Emma said to Andrea that is very difficult to her to follow that rule, but Andrea told her that she knows a group call Ana Mia which could help her and that Emma should be part of them. Emma accepted Andrea's preposition and she starts to be part of this group and after joining them, she lost 15 pounds.

DRIVING THE BUS: DESIGNING EDUCATIONAL ALTERNATE REALITY GAMES FOR REUSABILITY

Designing Educational Alternate Reality Games for Reusability

KATHRYN KACZMAREK FREW, ELIZABETH BONSIGNORE, DEREK HANSEN, KARI KRAUS, ANTHONY PELLICONE, AND SKYLAR HOFFMAN

Abstract

Because alternate reality games (ARGs) are so time- and cost-intensive to produce, educational ARGs must be designed for reusability. We present a design framework for reusability centered on the objectives of adaptability, extensibility, and replayability. We then illustrate the use of this design framework with a case study of our ARG *The Tessera*, a ghost story designed to teach teenagers computational thinking skills and dispositions. By including an online multiplayer leveled structure and in-game communication for adaptability, an extensible participatory narrative, and the ability to replay levels to collaborate with and coach peers, *The Tessera* enables players to “drive the bus” of their own learning.

Introduction

Alternate reality games (ARGs) are “immersive, interactive experiences where players collaboratively hunt for clues, make sense of disparate information, contribute content, and solve puzzles to advance a narrative that is woven into the fabric of the real world” (Bonsignore, Hansen, Kraus, & Ruppel, 2012, p.25). While games are increasingly incorporated into education, the use of alternate reality games has not kept pace. Because most ARGs are designed as one-time experiences and require a great deal of money, time, and labor to design, they are a challenge for educators to incorporate into their curriculum. An effective educational ARG design must address reusability so educators can use these games with multiple classes year after year.

Few researchers have addressed the issue of reusability in alternate reality games (Martin, Thompson, & Chatfield, 2006). In his chapter “Games beyond the ARG,” Jeff Watson critiques the way the emphasis on “top-down” transmedia storytelling limits accessibility, replayability, and sustainability of ARGs. He proposes that “For media companies, educators, and activists alike, one way around this problem of expense is to develop replayable games that engage participants in repeatable practices rather than the consumption of additional layers of curated narrative” (Watson, 2017, p. 206).

In our experience designing educational alternate reality games, we have encountered several challenges relating to reusability: namely, how to better support independent learning for players joining the game at different times, as well as mitigating the learning curve for educators facilitating the game. This paper illustrates how we applied our previously published design framework for reusability (Hansen, Bonsignore, Ruppel, Visconti, & Kraus, 2013) to the architecture and mechanics of our ARG *The Tessera* to address those specific challenges. Through a case study of *The Tessera*'s structure and analysis of its successes and challenges we further the design literature for future educational ARGs to make them more accessible, cost-effective, and engaging.

Overview of Design Framework for Reusability

The design framework for reusability of ARGs focuses on the core design objectives of adaptability, extensibility, and replayability (Hansen et al., 2013).

Adaptability reflects the potential for the game to be modified to meet the needs of a specific player, group, or context, such as location or time. For example, the party game *Apples to Apples* often ends up with "house rules" that disregard the competitive play point system and privilege opportunities to play for fun, or to lobby for the card you submitted. In educational games, adaptability draws on the pedagogical concept of scaffolding: providing guidance in the right way and at the right time (Vygotsky & Cole, 1981; Wood D., Bruner J.S., & Ross G., 1976). There are multiple methods of scaffolding learning in games, such as using the interface to prompt players, moving from a guided instruction or tutorial into an open-ended project or challenge, or collaborating with other players or gamerunners who provide learning resources (Pellicone et al., 2017, p. 87).

Extensibility refers to the ability to add to the game in an authentic way while transforming it to do something else. Even if a game is not entirely reusable, aspects of it, such as characters, mythology, content, or mechanics, might be extensible to new contexts. For example, sandbox games like *Minecraft* allow players to become developers and add their own content to the existing game engine (Duncan, 2011). Writers often extend the narratives of existing games through creating their own fan fiction around the existing characters or writing new characters into the existing game world. For educational games, the ability to extend the game towards a player's individual interests can create intrinsic motivation for learning (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). Indeed, the participatory narrative aspect of alternate reality games invites players to extend elements of the interactive storylines and to take responsibility for collaborative sense-making around the game challenges.

Replayability allows a player to experience the game multiple times, or the game to be reused for a new group of players. When replaying a video game like *MarioKart*, even though the mechanics and narrative of the game are the same, the social interaction among players is different, which motivates them to replay (Montola, Stenros, & Waern, 2009). For educational purposes, games can be replayed to cement concepts, refine skills, and allow players to experience multiple ways of solving the same problem, as in the math game *24.* Because ARGs are so time- and resource-intensive to create, it is vital for educational ARGs to be replayable by multiple classes, year after year.

Case Study of *The Tessera* ARG

Brigham Young University, the University of Maryland, and Tinder Transmedia have collaborated with the Computer History Museum to design *The Tessera*, an educational ARG for teaching teenagers computational thinking skills and dispositions. The Tessera is co-designed with teenagers and funded by the National Science Foundation. Instead of being a "learn to code" exercise, its goal is to introduce teens to foundational computing concepts like problem decomposition, pattern recognition, and abstraction as they explore an interactive ghost story.

The Tessera's story revolves around a mysterious collective of historically significant innovators, known as "The Tessera," hunted by the inscrutable, sinister "S." Players navigate real-world and online computational thinking puzzles with the help of the ghosts of these famous men and women who are trying to save everything their think-tank stands for from S's destructive tendencies. *The Tessera*'s structure contains several transmedia components: an online game called *The Tessera: Light in the Dark*; a live experience at the Computer History Museum, called *The Tessera: Ghostly Tracks*; a pair of Twitter accounts for our main characters, Ada Lovelace and the nemesis called S; an external wiki, where players could post biographies of Tessera members, fan art, memes, and sightings of S; and 2 card games—a competitive game and a party game—that can be played from a single deck.

Many ARGs struggle to be adaptable to different groups in different locations or at different times, because they are one-time events and some people may come "late" to the party. Late arrivals may miss essential narrative information and the opportunity to solve the earlier puzzles. The online multiplayer leveled structure of *The Tessera: Light in the Dark* lets players join at any time. When they enter, players only get access to the beginning of the story, so they don't see spoilers or join the party after everything has been solved. This also helps players "have to" play through it all—unlike many ARGs where only a handful of players may solve a puzzle and the entire player community moves on to the next puzzle. This means, for example, that different school classes could play *The Tessera* at different times and not "mess up" each others' play.

An added advantage of using an online multiplayer leveled structure similar to a video game was making it easier for players to understand the ARG as a new genre by reducing the learning curve (Bonsignore, Hansen, Kraus, Visconti, & Fraistat, 2016; Pellicone et al., 2017). Familiar game structures such as a scavenger hunt and escape-the-room experience can be adapted for new narratives tailored to educational goals (Nicholson, 2016). By blending traditional ARG elements with escape-the-room elements in both our location-specific and online parts of *The Tessera*, and video game elements in the online *Tessera* game, we enable players to jump into participation more easily, without questions about "how do I play this?" or "where's the game?"

We also designed scaffolding in *The Tessera* to reduce player dependency on a facilitator. The ghost of Ada Lovelace serves as the player guide through the online game, issuing calls to action. We narratively integrated more detailed instruction for solving the puzzles through a red "caretaker's log" visibly placed in each of the levels. Players quickly realized they learned as much from reading the instructions as from doing the puzzles; many pointed to the binary number system as a concept they learned from *The Tessera,* and one even compared it to "speaking a different language." Finally, we created architecture for gamerunners and players to assist each other through synchronous chats and an asynchronous forum. By including multiple layers of assistance, we allow players to "drive the bus" of their learning by selecting what level of help they need to progress; some may be able to solve the puzzles just with the caretaker's log, while others may need the links to walkthrough videos posted in the forum to complete the challenges.

To address extensibility, we presented two separate narratives within the same *Tessera* universe. Offering a live experience called *The Tessera: Ghostly Tracks* at the Computer History Museum, we used the resources of our knowledge partner to create a physically immersive experience that also served as an entry point into the online *Tessera* game. In *Ghostly Tracks*, teens get clues from ghosts of Tessera members through the Actionbound app on an iPad. They then go on a scavenger hunt to find artifacts of significance for the ghosts in the museum exhibits, and solve computational thinking puzzles using the exhibits, digital clues, and physical props to ultimately reveal the identity of their ghost.

Another extensible feature of ARGs is the participatory narrative. An external wiki allowed players to add their personal story to the game universe, describing the ways in which S has interfered with their daily activities (Kaczmarek Frew, 2017). Players also interacted with in-game characters through social media to reinforce the sense that the gameworld has spilled out into the "real world." The mystery narrative provided one of the most prominent motivations for playing, with one player remarking in a post-game review, "My favorite aspect was the meaning of Tessera how you trace S. You really don't know who S is but it cool how you can see some parts like clues and other things about S." Gathering information about S from these different media and making sense of it are just some of the 21st century literacies that ARGs facilitate, along with the creation of original content (Bonsignore, Hansen, Kraus, & Ruppel, 2012). For example, another player described "getting to work with my classmates and learn new things about the game and different conspiracies that we all had about the game…was also one of my favorite things," showing the joy of this extensible collaborative storytelling.

Replayability is an essential element of educational ARGs that makes efficient use of resources when designing for learning. *The Tessera: Light in the Dark* online game emphasized the collaborative nature of problem-solving by adding the ability for current players to repeat previous levels and help newer players (Steinkuehler, 2004). This structure minimizes the role of a facilitator so players can "drive the bus" of their own learning and serve as mentors to others. One player commented in a post-game review that when she collaborated with a peer to replay a puzzle requiring translation between Arabic, Roman, and binary number systems that was familiar to her but new to him, "I could more easily explain to him how things worked, and he could very easily offer suggestions to solve things I hadn't yet." This coaching not only deepened her own understanding of number systems through her explanation but also allowed her to benefit from exposure to her peer's unique perspective on the problem.

The Tessera ARG also includes several tasks that can be replayed for fun, such as the final design challenge we called Sketchventor (Pellicone, Kaczmarek Frew, Bonsignore, Hansen, Hoffman, & Kraus, 2018). In this challenge, players select a verb such as "shrink," "futurize," or "vilify." They also are randomly assigned a landmark invention, such as the airplane, vaccinations, or the computer mouse. Players must then apply the verb to the invention to create their entirely new innovation, which they sketch out and describe. After finishing their own innovation, players can view and like other players' inventions, as well as create more inventions if they wish. This Sketchventor game is also extensible as it can be played with the physical card deck as well as online.

By using adaptability, extensibility, and replayability as core design principles for *The Tessera*, we were able to create an alternate reality game that educators could reuse over time with multiple students, as well as facilitating self-motivated and collaborative learning.

Acknowledgements

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References

Bonsignore, E., Hansen, D., Kraus, K., & Ruppel, M. (2012). Alternate reality games as platforms for practicing 21st-century literacies. *International Journal of Learning and Media*, *4*(1), 25–54. https://doi.org/10.1162/IJLM_a_00086

Bonsignore, E., Hansen, D., Kraus, K., Visconti, A., & Fraistat, A. (2016). Roles people play: key roles designed to promote participation and learning in alternate reality games. In *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY 2016)*, 78–90. Austin, Texas: ACM.

Duncan, S. C. (2011). Minecraft, beyond construction and survival. *Well Played: A Journal on Video Games, Value, and Meaning, 1*(1), 1–22.

Hansen, D., Bonsignore, E., Ruppel, M., Visconti, A., & Kraus, K. (2013). Designing reusable alternate reality games. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1529–1538.

Kaczmarek Frew, K. (2017, August). *Casting our lights before: Immersion as access in* The Tessera *ARG*. Presented at Digital Humanities 2017, McGill University, Montreal, Canada.

Martin, A., Thompson, B., & Chatfield, T. (2006). *Alternate Reality Games White Paper — IGDA ARG SIG*. Retrieved from http://www.christydena.com/wp-content/uploads/2007/11/igda-alternaterealitygames-whitepaper-2006.pdf

Montola, M., Stenros, J., & Waern, A. (2009). *Pervasive games: Theory and design* (1 edition). Amsterdam ; Boston: CRC Press.

Nicholson, S. (2016). *The state of escape: Escape room design and facilities.* Presented at Meaningful Play, 2016, Lansing, MI. Retrieved from http://scottnicholson.com/pubs/stateofescape.pdf

Pellicone, A., Bonsignore, E., Kaczmarek, K., Kraus, K., Ahn, J., & Hansen, D. (2017). Alternate reality games for learning: a frame by frame analysis. In *Alternate reality games and the cusp of digital gameplay* (pp. 78–105). New York: Bloomsbury.

Pellicone, A., Kaczmarek Frew, K., Bonsignore, E., Hansen, D., Hoffman, S., & Kraus, K. (2018). Sketchventor: Evolving Ideations by Design. *Well Played: A Journal on Video Games, Value, and Meaning*: Special Issue on Analog Games *7*(1), 101-127.

Steinkuehler, C.A. (2004). Learning in massively multiplayer online games. In *Proceedings of the 6th International Conference on Learning Sciences* (pp. 521–528). Santa Monica, California: International Society of the Learning Sciences.

Vygotsky, L. S., & Cole, M. (1981). *Mind in society: the development of higher psychological processes*. Cambridge: Harvard University Press.

Watson, J. (2017). Games beyond the ARG. In *Alternate reality games and the cusp of digital gameplay* (pp. 187–209). New York: Bloomsbury.

Wood, D., Bruner, J.S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *17*(2), 89–100.

Wouters, P., van Nimwegen, C., van Oostendorp, H., & van der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, *105*, 249–265. https://doi.org/10.1037/a0031311

GAME DESIGN THERAPOETICS: AUTHORING THE COMPUTER GAME AUTOPATHOGRAPHY

Authoring the Computer Game Autopathography

SANDRA DANILOVIC

Abstract

In this paper, I discuss my arts-informed qualitative study and doctoral thesis on the self-healing resources of autopathographical game authorship. I mobilized the autopathography—the autobiographical illness and disability narrative—from literary theory, and organized an ethics-approved game jam in order to study the authorship processes of 13 professional game designers/developers. Their experiences with bipolar disorder, anxiety, ADHD, color blindness, PTSD, shyness, grief, and insomnia would inform their design. My findings show that autopathographical game design during a game jam (AGD-AGJ) may be healing through its four therapeutic dimensions: autopoiesis (re-making the self through introspection), fabulopoiesis (re-imagining the self through the game narrative), logopoiesis (re-perceiving the self through implementation), and sociopoiesis (shared storytelling during a game jam). I offer insights into how gamemakers are pushing the boundaries of artistic experimentation in games while forging a novel creative method of self-care—autopathographical game authorship as an expressive form of design therapy.

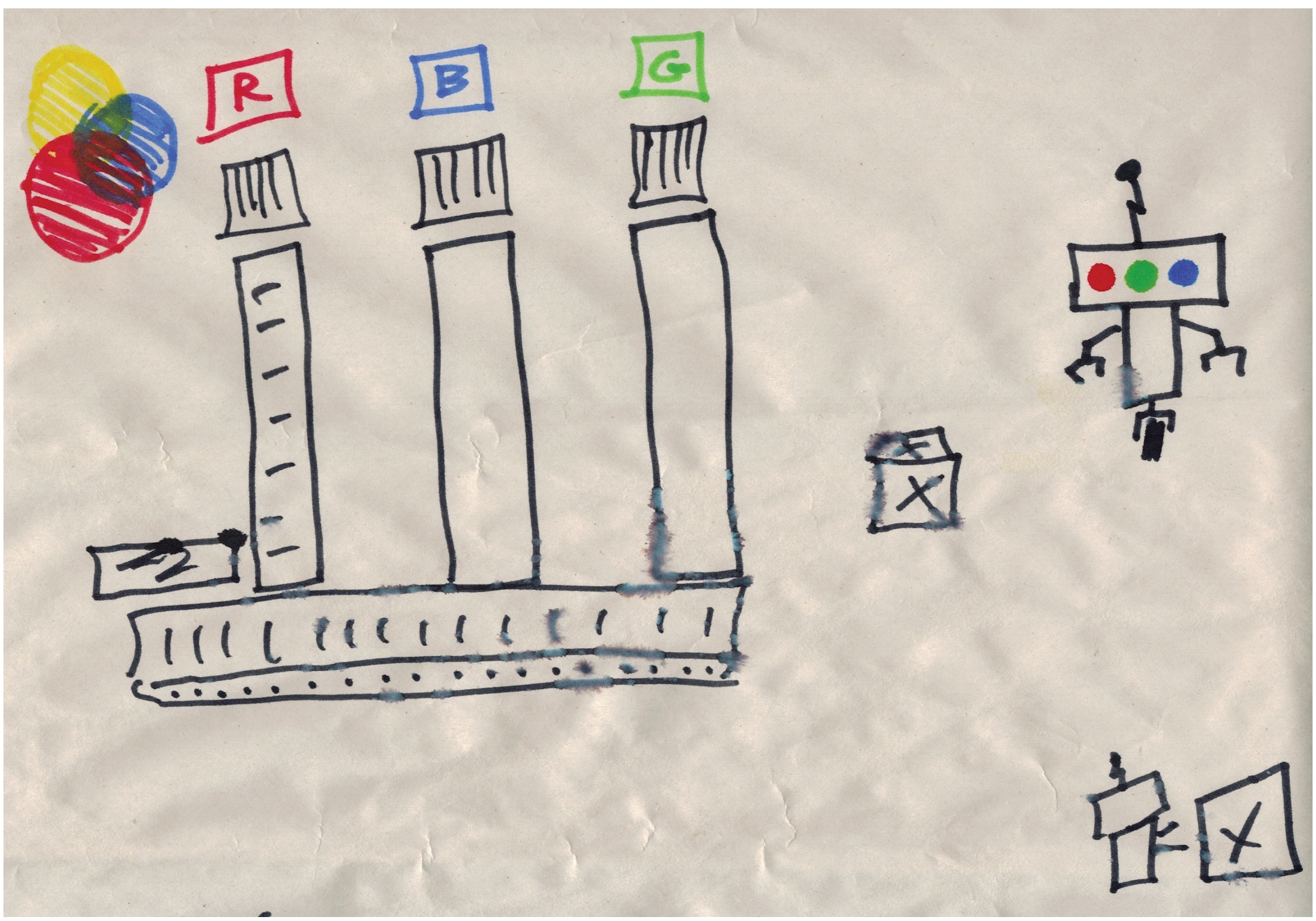
Introduction

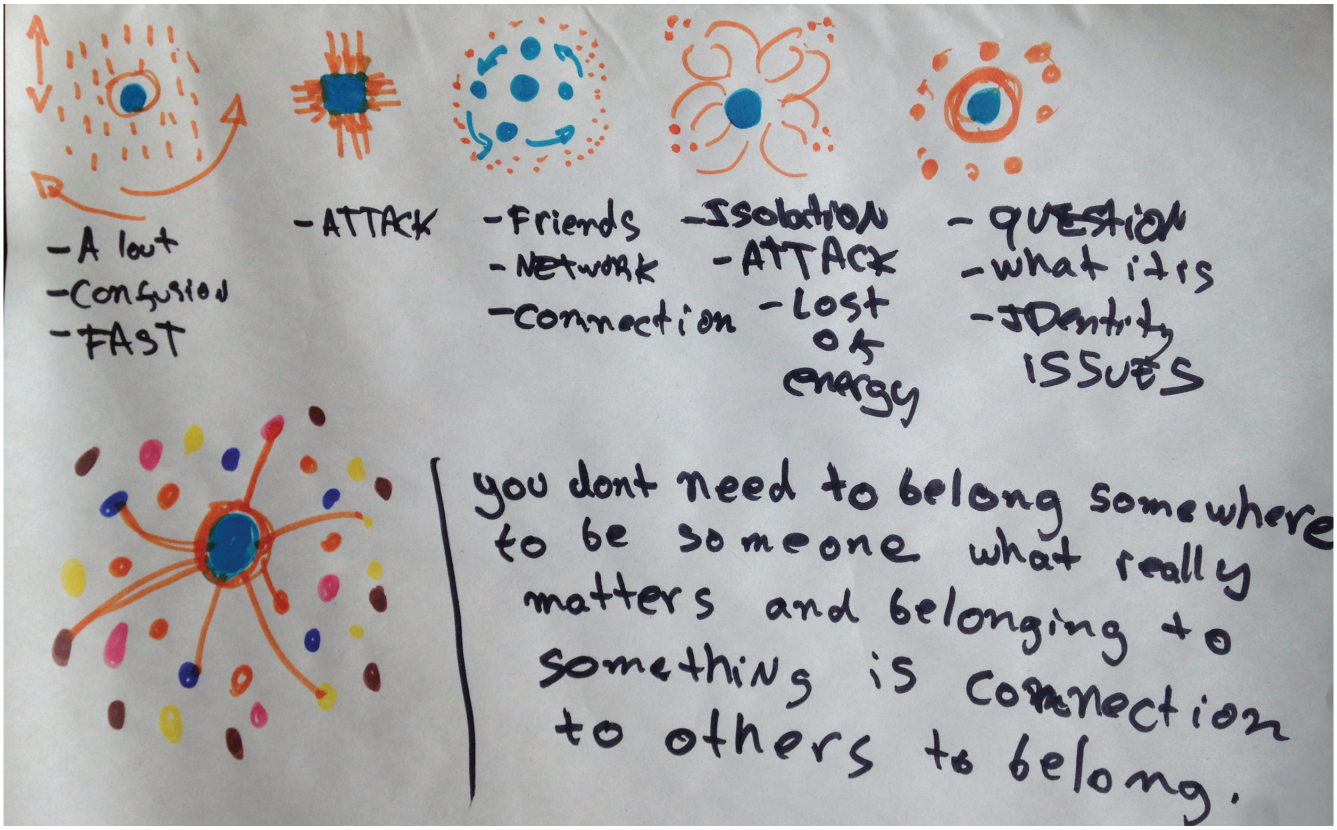
In this paper, I discuss my arts-informed qualitative study and doctoral thesis on the self-healing resources of autopathographical game authorship. I mobilized the "autopathography"— the autobiographical illness or disability narrative (Couser, 1997) from literary theory in order to study the experiences of 13 recruited game designers rendering their autopathographical narratives into computer games during a game jam, which I called the Autopathographical Game Jam. I argue that autopathographical game design (AGD) during an autopathographical game jam (AGJ) offers distinct therapeutic resources for game designers living with mental illness, emotional trauma, and disability.

This study was informed by the emergence of autobiographical games exploring personal narratives of health and illness, such as Anna Anthropy's *Dys4ia* (2012), an autobiographical account of undergoing hormone replacement therapy as a transgender woman; Zoë Quinn's *Depression Quest* (2013), a text-based interactive narrative about living with depression; and Ryan and Amy Green and Josh Larson's *That Dragon, Cancer* (2016), exploring the Greens' grief over their young child's death from cancer. The relatively new phenomenon of personal games about mental health has challenged the fundamental perception of games as playful entertainment. For example, the cultural perception of games as fun, escapist, and frivolous activities appears to be incongruous with the serious existential subjects of illness, trauma, and disability. As a matter of fact, the developers of *Depression Quest* warn that "this game is not meant to be a fun or lighthearted experience" (Depression Quest: Games for Change, 2019). In this sense, the autopathographical game genre challenges assumptions about the ontology of games while also providing cathartic experiences for the game designer.

Research Methodology and Methods

In Fall 2014, I organized a two-day game jam that I called the Autopathographical Game Jam (AGJ) in order to conduct an ethics-approved qualitative study of the authorship processes of 13 recruited professional game designers and developers—10 male and 3 female participants between the ages of 20 to 33—developing individual autopathographical games about their experiences with bipolar disorder, anxiety, attention deficit hyperactivity disorder (ADHD), color blindness, post-traumatic stress disorder (PTSD), emotional trauma, severe shyness, grief, and insomnia. Working from the methodological schools of grounded theory, case studies, discourse analysis, and research creation, the last of which facilitated the creative development of playable games, I documented the game jam through video recordings and conducted in-depth, semi-structured individual interviews with participants during the game jam (phase 1 of research) and several weeks to months after the game jam (phase 2 of research). Additionally, I collected participants' processual artifacts such as concept sketches and doodles in order to access subjective dimensions that were not verbalized in interview testimony (see images 1 and 2).





Images 1 & 2. Sketches of autopathographical games Broken Lens and Connections

Data Organization

I organized the data through a 5-step process in order to develop an original analytical framework (see image 3).

- I developed a coding protocol, manually coding the transcribed interview testimony and processual artifacts, and organizing patterns inferred from the data into approximately 10 general codes.
- I converted these 10 general codes into 7 major findings.
- I distilled the 7 major findings into three overarching themes defining my study: autopathographical game authorship as a form of self-care, self-understanding, and therapy.
- I conducted discourse analysis of interviews and artifacts, propelling my structuralist reading of game designer experiences. In doing so, I positioned original participant testimony and artifacts as a springboard for a transdisciplinary theorization informed by game and digital media studies, narratology, linguistics, semiotics, cognitive science, and philosophy.
- I developed the analytical framework of the Tetrad of Therapoiesis in order to underscore what appeared to be a structural logic to the autopathographical game design during an autopathographical game jam (AGD-AGJ) process.

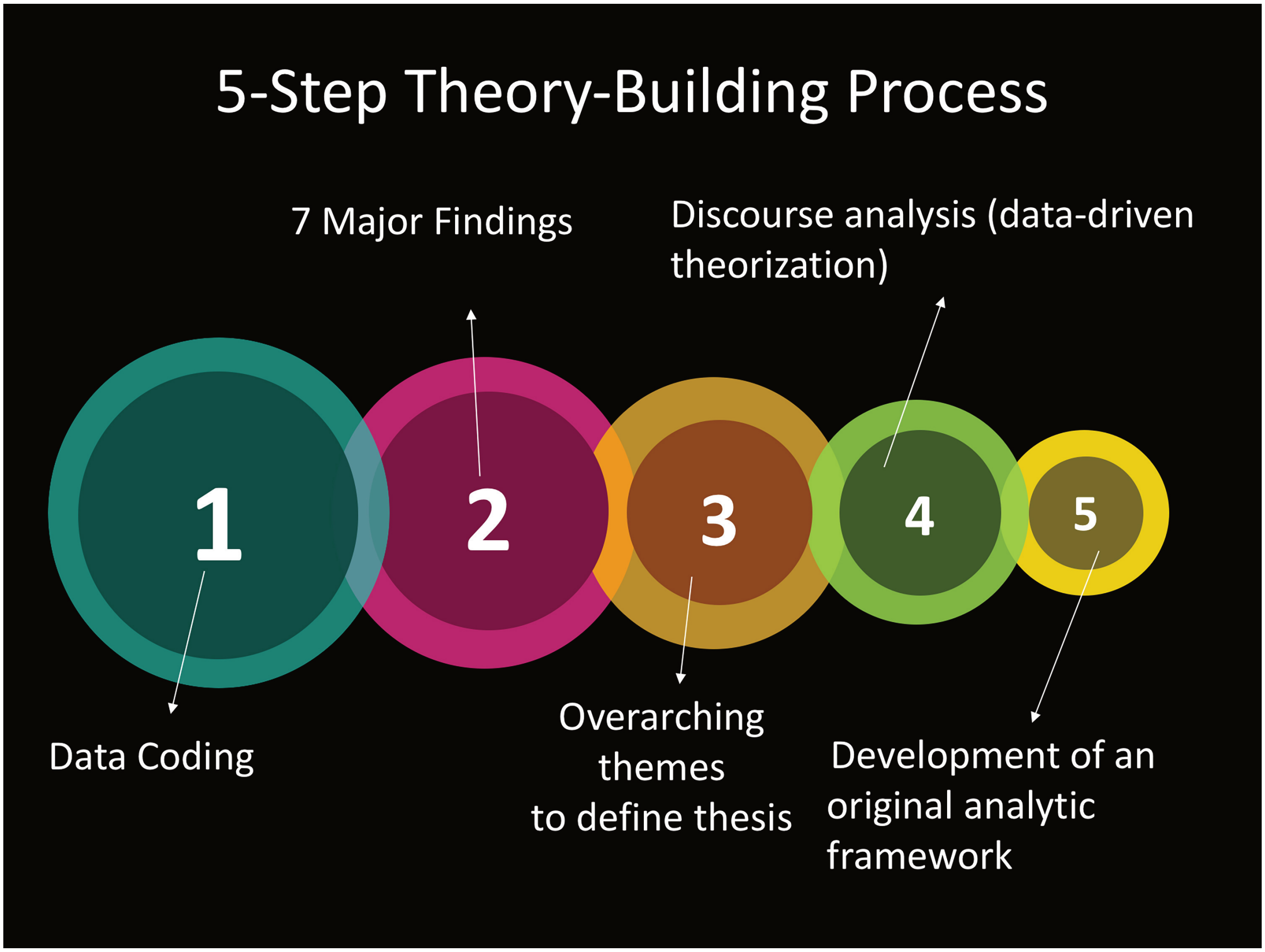


Image 3. Infographic of Data Organization and 5-Step Theory Building Process

Summary of Study Findings

1. Participants mobilized autopathographical game design during the autopathographical game jam (AGD-AGJ) towards "DIY therapy", "group therapy", "self-hypnosis", "mindfulness", and "coping with emotions" as per the direct quotes of participants.
2. Participants found the experience of integrating the autopathography and computer game as unorthodox, "out of the box", and "strange" as per participant testimony.
3. Many autopathographical games took on an abstract and symbolic form.
4. Participants backgrounded (concealing details) and foregrounded (amplifying details) the autopathographical narrative depending on context: autopathographical game design (AGD) vs. the autopathographical game jam (AGJ). That is, participants openly shared and verbally disclosed, in group conversations and interviews during the AGJ, a range of deeply personal details relevant to their autopathographical narratives. They did not, however, disclose personal details in their autopathographical games out of a desire to protect themselves from the potential of stigmatizing reactions from other participants—a form of self-care.
5. Most participants did not explore a present distressing state. Through autopathographical game design, they appeared to be revisiting past emotional states from a safe distance,

although "reliving an experience" (according to participant Alex) was always a possibility.

6. Some participants harnessed autopathographical game design as a tool of self-understanding in order to gain a deeper awareness of their first-person experiences with illness, trauma, and disability.
7. The autopathographical games were not disseminated outside of the autopathographical game jam space.

My primary research finding demonstrates that participants appeared to have experienced AGD-AGJ to be a therapeutic process of self-care—a result that I did not anticipate due to my presumption that the technically intensive processes of game design and development inhibit any therapeutic effects. Participants, however, described the AGD-AGJ process, which includes certain defining properties of autopathographical game design, as healing and self-insightful.

For example, Fred, who made a puzzle game called *Brain Buster*, wanted to understand how he had used computer game design at a previous game jam to "cure himself". He had used "game development as a form of coping with emotions" and harnessed rule-design as a form of "DIY therapy" and "self-therapy". The design of his puzzle game became an inquiry into his own healing process. In other words, Fred appeared to be mobilizing computer game design for the second time in a row to explore his own processes of self-healing and self-understanding through game design. Lukas, a shy and introverted game developer, authored a game called *Co-Op Defense* in order to practice "self-hypnosis"; he had hoped to teach himself interpersonal skills through the game and the autopathographical game jam platform, while also practicing self-acceptance of his intense shyness.

Autopathographical game design also became a problem-solving tool for participants attempting to better understand their own mental health experiences and/or communicate them to others through gameplay. An example of this deployment of autopathographical game design is Martin's game *Broken Lens*, a game about a color-blind robot as the principal game player character, tasked with separating color-coded boxes on an assembly line. This game allegorized his first-person experience with color-blindness through the rules and mechanics of the game:

> The mechanics of the game, the rules can demonstrate the troubles and the pressure of someone (who is color-blind), how normal tasks become harder for you.

The Creative Foundations of the Tetrad of Therapoiesis

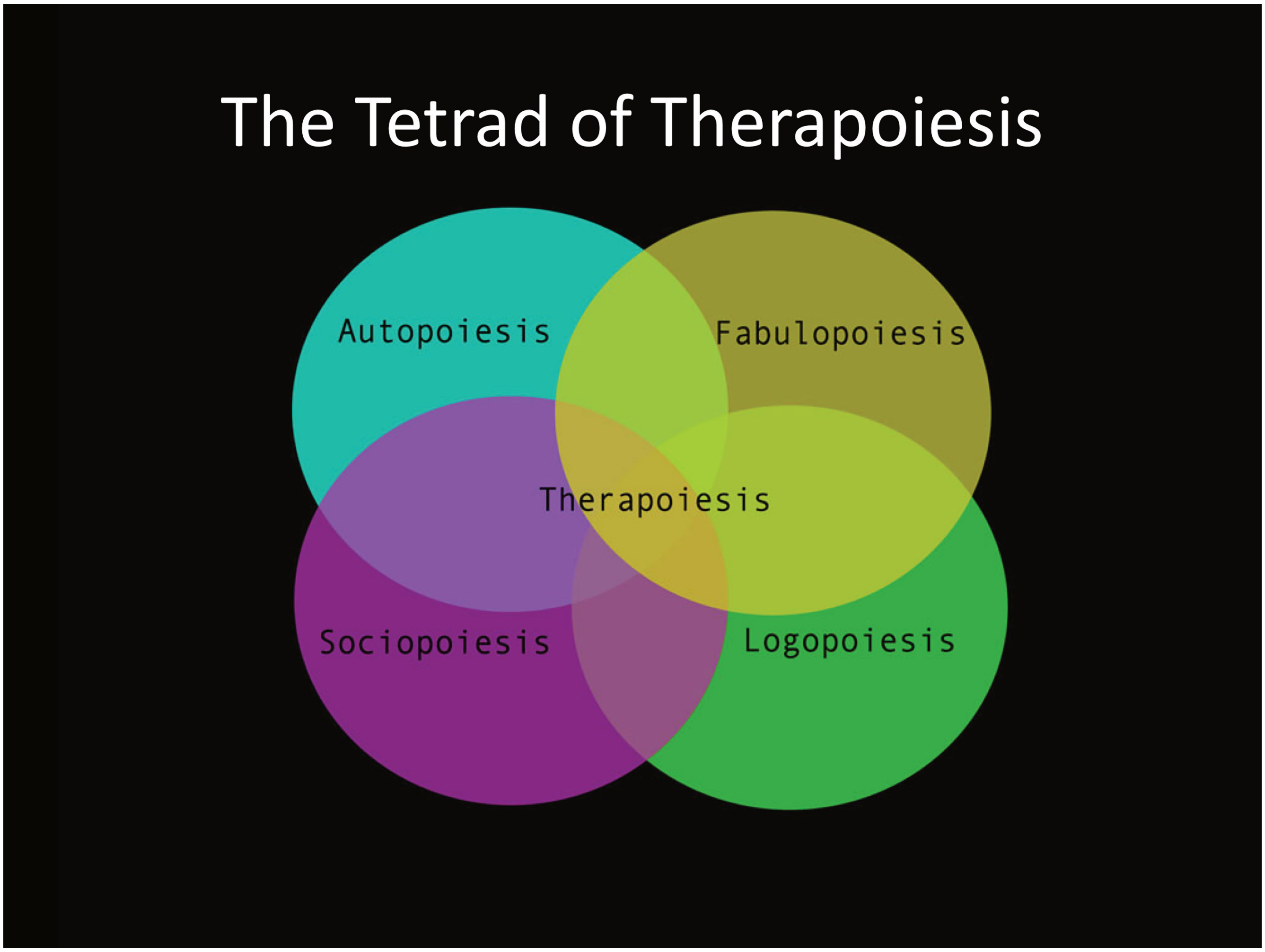
I would like to briefly address the creative foundations of the Tetrad of Therapoiesis before I delve into its details, namely the creative impulse that propelled participants to engage in autopathographical game design (AGD). Participants expanded the vocabulary of computer game design through a set of creative grammars that belong to two *semiospheres* (Lotman, 2005) or semiotic structures of meaning-making: the autopathography and the computer game. Participants found the integration of these two semiospheres through autopathographical game design unusual, resulting in the transgressive aesthetics of autopathographical game design. Here I draw on a number of theorists including Chomsky's (1968) theory of "the creative aspect of language use (CALU)", which enabled a reading of how participants created "weird games" (Alex) by "messing and experimenting" (Fred), and "doing different things" (Marco); but also, how participants positively harnessed the transgressive aesthetics (Shklovsky, 1925; Vygotsky, 1971; Juul, 2013; Linderoth & Mortensen, 2015; Sicart, 2015) of autopathographical game design in order to unconventionally build empathy in the player. In fact, four of the games authored during this study thwart player enjoyment by either manipulating the player or engendering psychologically uncomfortable gameplay. Sam's game *Anxiety Corporation* incorporated an "anxiety meter" to lure the player into a panic attack. Nathan's game *ADHD Hero* and Martin's game *Broken Lens* "de-motivate" the player in order to produce feelings of rage and frustration conveying their respective childhood experiences with ADHD and color-blindness. John's game *Untitled* about living with untreatable bipolar disorder advocated for assisted suicide by crafting unwinnable gameplay. John explains:

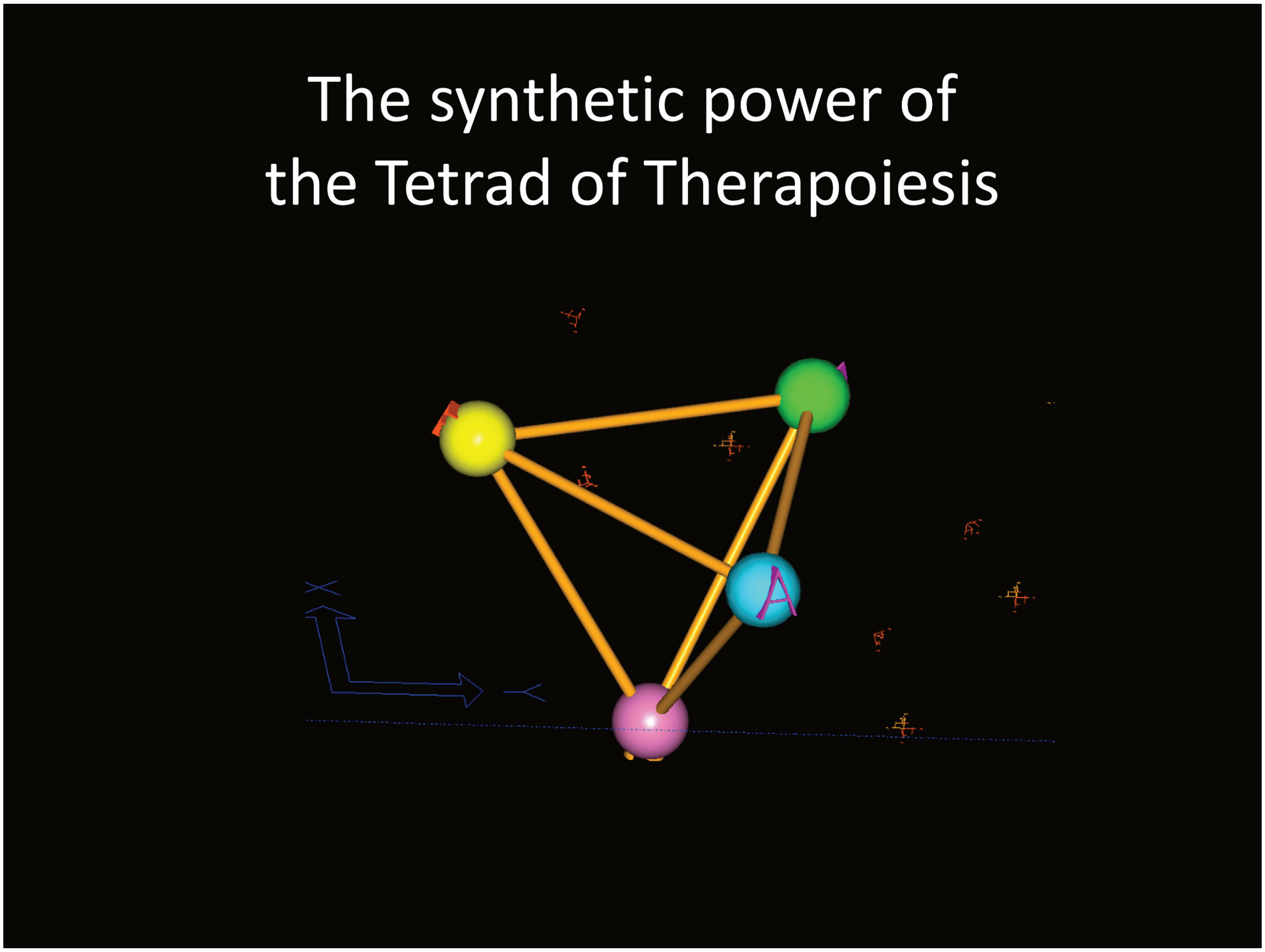
> There is no pause button, there is no way to exit the game. The only way to exit is to kill yourself and die.

These examples of transgressive game design invoke Linderoth & Mortensen's (2015) "dark play" and "cruel play", Juul's (2013) paradox of failure that presents grueling and difficult gameplay with higher player rewards, and Sicart's (2015) "abusive game design", a game design tactic which undermines pleasurable gameplay experiences by finding ways to manipulate and deceive the player. Autopathographical game design is thus transgressive by defying the primary semiotic structure of the computer game, which is the near-universal assumption that games are fun and escapist, and that the serious and existential topic of illness, pain, and trauma cannot be played.

Analytical Framework: The Tetrad of Therapoiesis

Autopathographical game design during an autopathographical game jam (AGD-AGJ) process connects to Aristotle's (1961) framework of knowledge formation: *praxis* (to do), *poiesis* (to make), and *theoria* (to understand). In other words, during the AGD-AGJ process, participants practiced their autopathographical game design skills (praxis), created games (poiesis), and gained knowledge about themselves (theoria). Participants experienced the AGD-AGJ process as therapeutic through the synthesis of four dimensions, which I call: *sociopoiesis, autopoiesis, fabulopoiesis,* and *logopoiesis* constituting my analytical framework of *The Tetrad of Therapoiesis* (see image 4). The tetrad takes shape, however, through a second phenomenon—participants' ability to immerse themselves in and distance themselves from their autopathographical narratives during the AGD-AGJ process. That is, these four dimensions enabled participants to cognitively shift among three epistemological perspectives during the AGD-AGJ process, which they experienced as restorative: the first-person (subjective), second-person (relational), and third-person (observer) perspectives (see image 6). This shift may have allowed participants to view themselves differently, akin to being able to shift perception between the front-end and back-end side of a Necker Cube. This ability to shift perspective appeared to be therapeutic for participants and engendered self-understanding and self-insight. It might also be helpful to imagine the Tetrad of Therapoiesis as a tetrahedron, which I 3D printed in order to illustrate the synthetic power of the four dimensions, which *together* amplify the therapeutic effects on the game autopathographer (see image 5).


The Tetrad of Therapoiesis
Autopoiesis
Fabulopoiesis
Therapoiesis
Sociopoiesis
Logopoiesis



Images 4 & 5. Venn diagram and 3D-printed tetrahedron of the Tetrad of Therapoiesis

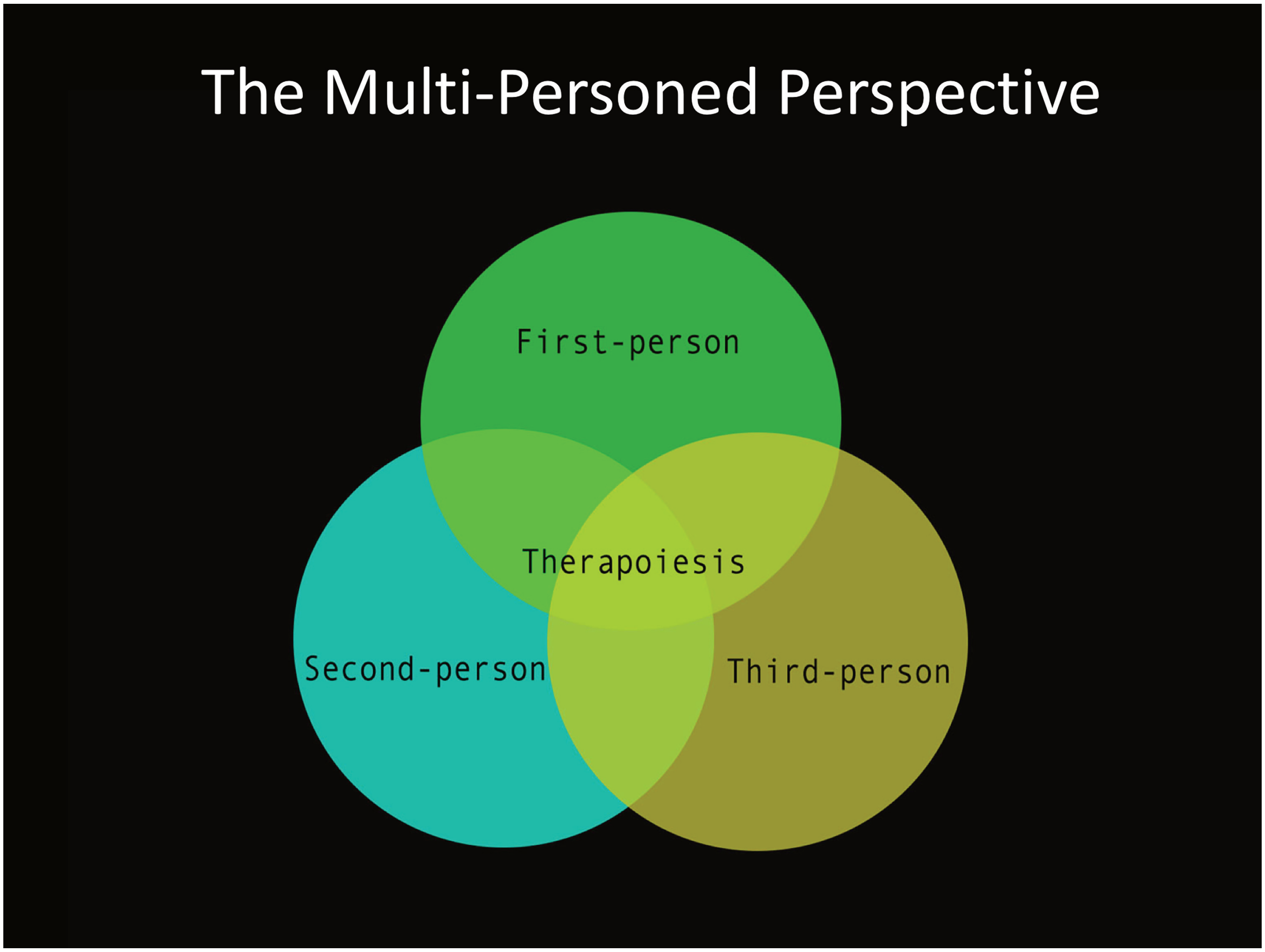


Image 6. The Multi-Personed Perspective of AGD-AGJ

The Four Dimensions of The Tetrad of Therapoiesis

Consider next a detailed description of the four dimensions of the Tetrad of Therapoiesis.

Sociopoiesis: Second-Person Perspective

Sociopoiesis is a collective-making process engaging the second-person, relational perspective; through sociopoiesis, participants safely shared their autopathographical narratives and playtested their games in the social space of the autopathographical game jam (AGJ), which appeared to propel their creativity. Participants experienced the process of verbally expressing their autopathographical narratives during this game jam as healing. Martin affirmed that building a deeper connection with others through sharing personal narratives was a significant dimension of the game jam: [block quote] I think the thing about making a game about personal stuff is sharing. [block quote] In this sense, one anonymous doodler remarked that the AGJ can be viewed as a form of "group therapy" akin to a support group, but with the added benefits of "artistry" and "anonymity" that autopathographical game design afforded (see image 7).

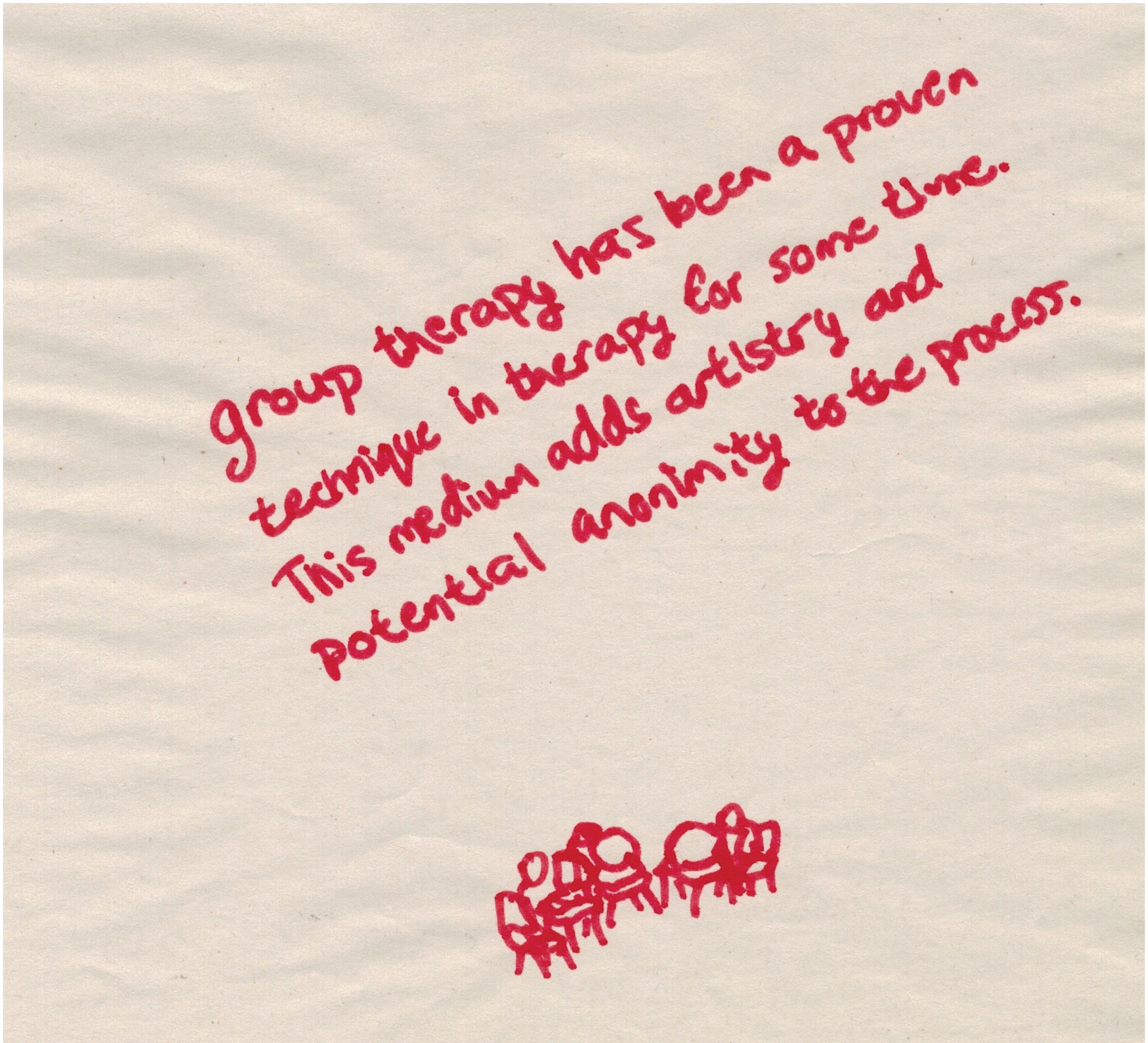


Image 7. Doodle evoking the therapeutic dimensions of the Autopathographical Game Jam

I theorize the sociopoetic dimensions of the autopathographical game jam (AGJ) as a healing community rooted in mutual care and dialogue by drawing on existential philosopher Martin Buber's (1923) dialogic theory of *I and Thou*. I and Thou give voice to the mutual encounters among persons infused with a divine presence accounting for a variety of positive and negative human interactions in community living, such as ease and hardship. As Marco testified, he experienced the AGJ as an improvisational space guided by a "spark of magic". He tied this evocative quality of the game jam to the opportunity to bond with others through autopathographical storytelling coupled with creative experimentation, which many typical game jams, driven by the pressure to create commercially-viable games, do not support. Participants also testified that they confronted feelings of vulnerability and discomfort during the AGJ given the personal nature of autopathographical narratives, a tension whose presence was paradoxically generative for their creative processes.

Autopoiesis: First-Person Perspective

Autopoiesis is an introspective, self-reflective, and self-referential process of self-making that directly engaged the first-person perspective; through autopoiesis, participants gave voice to the ontological dimensions of autopathographical game design (AGD) as a "technology of self" (Foucault, 1988)— a regenerative form of identity construction and self-craftsmanship. Through autopoiesis, participants confronted their own fears and limitations living with illness, trauma, and disability. Brody, who made the murder-mystery game *You're Invited*, invoked the process of self-reflection in autopathographical game design, which, by ontological necessity:

> …involves a level of analysis…where you have to look at yourself.

The self-referential dimensions of autopoiesis required that participants engage with their illness and disability experiences as a referent of their autopathographical games, which enables the designer to re-fashion themselves through a process of alternating between themselves (their subjective experiences) and the emerging image of themselves (the autopathographical game). Marco, who made a game called *Connections* about his experiences of being bullied, evoked the metaleptic qualities of autopoiesis in autopathographical game design whereby the author and narrator of the game co-constitute each other in an ongoing process of internal dialogue:

> It's like I am interviewing myself inside my mind…it was like getting a mirror and then putting a mirror in front of another mirror so you have infinite reflections.

This form of self-reflection, albeit an emotionally difficult process, appeared to be generative for participants by building deeper self-awareness. As Alex testified:

> It's not very easy to make stuff about personal experiences that are intimate because if I have to think about how then I have to address the thing. If I have to address the thing then I have to relive the thing (laugh). And that can be really hard.

Fabulopoiesis: First- and Third-Person Perspective

Fabulopoiesis is an analogical and metaphorical making, a self-reinvention through the game's *fabula*—the content of the narrative. Narrative medicine scholar Anne Hunsaker Hawkins (1999) reinforces the significance of fabulopoiesis to all forms of autopathographical storytelling by calling the pathography a "modern adventure story" (as cited in Couser, 1997, p. 5). Participants fabulized themselves by reimagining their illness narratives through game characters such as a spirit guide to induce sleep, a detective to understand psychological trauma, and an ADHD diagnostic test camouflaging as a musical instrument that can be played to evade positive diagnosis. For example, Brody described his game about a detective tasked to prevent a crime from occurring at a dinner party as an analogy of his hyper-attentive thought processes:

> I am doing a murder mystery game about how intense conversations can be with PTSD.

Fabulopoiesis also enabled participants to reason analogically in order to shift between their first- and third-person perspectives—mapping structural similarities (Gentner, 1989) between one domain, their first-person illness, trauma, and disability experiences and another, the computer game. John's game is an example of this structural mapping process, which analogized the emotional highs and lows of his bipolar disorder to the game's rule structure:

> If you go too far down (depression), your character kills himself, if you go too far up (mania), you can't control yourself and you die anyways.

Many of the participants fabulized their first-person experiences through narrative design and/or the gameplay architecture (systems design), harnessing novel illness and disability metaphors in order to elicit self-insight. In fact, this point relates to the deployment of analogy and metaphor as indispensable tools of creativity in both art and science. In the latter, scholars (i.e., Bruner, 1986; Boyd, 1993; Polya, 1957) have affirmed the important function of analogies and metaphors as heuristic tools of scientific discovery. In the case of autopathographical game design, participants may have used illness and disability metaphors as a heuristic method of self-discovery.

Logopoiesis: Third-Person Perspective

Logopoiesis is a calculated and mathematical making constituting the implementation processes involved in designing a game as a computer software application (information systems design), which engenders a strong form of the third-person perspective. The Greek word *logos* translates to word, reason, plan, computation, and reckoning. Logos is an intrinsic constituent of language; in this sense, the process of ordering lived experiences into narrative form can become healing. Hawkins (1999) elaborates: "pathography articulates the hopes, fears, and anxieties so common to sickness, organizing them into a coherent whole and suggesting by example ways of thinking and acting" (p. 11). Logopoiesis in autopathographical game design (AGD), however, is distinct from any other form of autopathographical storytelling (i.e., prose) — a form of coding therapy that amplifies the effects of the other three poieses. Through logopoiesis, participants harnessed the Cartesian clear and distinct properties of computation, such as digital design, algorithm design, programming, debugging, and refactoring code, in order to disambiguate their personal experiences into software code. For example, Sam gave voice to the deliberate nature of logopoiesis as a logico-analytical distancing device:

> By taking a personal experience and expressing it through code, I have to look at it objectively. I have to look at it in numerical, rigid values. [block quote] Similarly, Fred described algorithm design as an effective mindfulness practice enabling measured and deliberate engagement with autopathographical game authorship: [block quote] Once you understand the process of coding and are able to create original algorithms, the process of coding can be quite meditative. While writing the code, I personally reach a state where I focus on nothing but the math I'm creating. I'd say it's comparable to maintaining a Zen garden…At least for me this process has helped me deal with difficult emotions by placing me into an analytic head space which allowed me to work out my emotions with a new perspective.

Vicky stated that the detail-intensive dimensions of digital game authorship "quiets her (overactive) brain". During the autopathographical game jam, she abandoned her intention of authoring a game about her grief of losing her father, because this experience was too painful a reminder. Instead, she chose to make "cute and funny" pixel art as a form of self-care. She stated that she found the activity of "working with the pixels in such a small form that is so exact" to ease her anxiety. We can infer that in the case of autopathographical game design, the precise and exact nature of digital authorship can be harnessed to provide measured and detached engagement with a potentially arduous emotional experience.

Participants also suggested that the logical and analytical mindset-i.e., "computational thinking" (Papert, 1980; Wing, 2006; Denning, 2017) required by their skilled use of implementation tools enabled them to inhabit the observer position, boosting their self-confidence and imparting self-clarity. Alex, who made a game about his experiences with bipolar disorder called *Brain Pains,* affirmed the confidence-building resources of computational thinking, which are especially germane for programmers contending with the common stigma that mental illness impedes logical reasoning:

> it felt great to be capable of doing these logical things in programming.

Conclusion

One study limitation concerns the small sample size of 13 participants informing analysis and theorization. I draw on discourse analysis scholars Potter and Wetherell (1987) who claim that, for qualitative researchers interested in discursive data forms, *ten interviews* are sufficient for conducting in-depth analysis of participant testimony. They affirm that the principal determinant of sample size for the purposes of discourse analysis must be the specific research question used, and that a higher number of interviews does not necessarily ensure a better analysis of discursive data: "for discourse analysts the success of a study is not in the least dependent on sample size" (p. 161). Therefore, this study offers a legitimate yet novel methodological approach to examining the creative making processes of game designers via their experiences of autopathographical game design during a game jam (AGD-AGJ). Additionally, game jams in general offer qualitative researchers the opportunity to study a rich network of multimodal information constituting the creative process of game designers that includes both discursive data forms (i.e., verbal testimony and verbal interaction among participants) and non-discursive data forms (i.e., photographs, video recordings, design sketches and drawings), as demonstrated by the type of data collected in this study.

The autobiography is a timeless method of organizing lived experience (Olney, 1972). In this case, the autobiographical narrative is given a new form through computer game design. This study contributes to at least two fields: a) game narrative aesthetics, by introducing the Tetrad of Therapoiesis, and by theorizing how game autopathographers build self-knowledge through ludic forms of storytelling; and b) the medical humanities and disability studies, by illuminating the hidden and untapped resources that computer game design offers autopathographical storytellers. This study also intervenes into the field of serious games in underscoring the self-transformative and socially transformative potential of autobiographical forms of game authorship and game jamming practices. Most importantly, as an artist-researcher conducting a therapeutic reading of autopathographical game authorship processes, I offer my analytical framework—The Tetrad of Therapoiesis—as a description of how game designers are creatively experimenting with the medium of computer games while forging a novel method of self-care—autopathographical game authorship as an expressive form of design therapy.

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References

Anthropy, A. (Game designer/developer). (2012). *Dys4ia*. [Computer game]. Retrieved from https://freegames.org/dys4ia/#play-game

Aristotle (1961). *Aristotle's poetics.* (S. H. Butcher, Trans.). (Introduction by F. Fergusson). New York, NY: Hill and Wang. (Original work published c. 335 B.C.)

Boyd, R. (1993). Metaphor and theory change: What is "metaphor" a metaphor for? In A. Ortony (Ed.), *Metaphor and thought* (pp. 481-532). Cambridge: Cambridge University Press.

Bruner, J. (1986). *Actual minds, possible worlds.* Cambridge, MA: Harvard University Press.

Buber, M. (1996). *I and thou.* (W. Kaufmann, Trans.). New York, NY: Simon & Schuster. (Original work published 1923)

Chomsky, N. (2006). *Language and mind.* (3rd ed.). Cambridge: Cambridge University Press.

Couser, G. T. (1997). *Recovering bodies: Illness, disability, and life-writing*. Madison, WI: University of Wisconsin Press.

Denning, P. J. (2017). Remaining trouble spots with computational thinking. *Magazine Communications of the ACM, 60*(6), 33-39. Retrieved from https://cacm.acm.org/magazines/2017/6/217742-remaining-trouble-spots-withcomputational-thinking/fulltext

Depression Quest: Games for Change. (2019). Retrieved from: http://www.gamesforchange.org/game/depression-quest/

Foucault, M. (1988). *Technologies of the self: A seminar with Michel Foucault*. L. H. Martin, H.

Gutman & Patrick H. Hutton (Eds.). Amherst: The University of Massachusetts Press.

Gentner, D. (1989). The mechanisms of analogical learning. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning* (pp. 199-241). Cambridge: Cambridge University Press.

Green, A. (Writer) & Green, R. (Game Designer) & Larson, J. (Programmer). (2016). *That dragon, cancer.* [Computer game]. United States: Numinous Games.

Hawkins, A. H. (1999). *Reconstructing illness: Studies in pathography*. (2nd ed.). West Lafayette, IN: Purdue University Press.

Juul, J. (2013). *The art of failure: An essay on the pain of playing video games.* Cambridge, MA: The MIT Press.

Linderoth, J. & Mortensen, T. E. (2015). Dark play: The aesthetics of controversial playfulness. In T. E.

Mortensen, J. Linderoth, & A. M. Brown (Eds.), *The dark side of game play: Controversial issues in playful environments* (pp. 3-12). New York, NY: Routledge.

Lotman, J. (2005). On the semiosphere. (W. Clark, Trans.). *Sign Systems Studies*, *33*(1), 205-229. (Original work published 1984)

Olney, J. (1972). *Metaphors of self: The meaning of autobiography.* Princeton, NJ: Princeton University Press.

Papert, S. (2005). *Mindstorms: Children, computers, and powerful ideas.* New York, NY: Basicbooks.

Polya, G. (1957). *How to solve it: A new aspect of mathematical method*. (2nd ed.). Princeton, NJ: Princeton University Press.

Potter, J., & Wetherell, M. (1987). *Discourse and social psychology: Beyond attitudes and behaviour.* London: Sage Publications.

Quinn, Z. (Game designer). (2013). *Depression quest*. [Computer game]. United States: The Quinnspiracy. Retrieved from http://www.depressionquest.com/dqfinal.html

Shklovsky, V. (1990). *Theory of prose.* (B. Sher, Trans.). Elmwood Park, IL: Dalkey Archive Press. (Original work published 1925)

Sicart, M. (2015). Darkly playing others. In T. E. Mortensen, J. Linderoth, & A. M. Brown (Eds.), *The dark side of game play: Controversial issues in playful environments* (pp. 100-117). New York, NY: Routledge.

Vygotsky, S. L. (1971). *The psychology of art.* Cambridge, MA: The MIT Press.

Wing, J. (2006). Computational thinking. *Magazine Communications of the ACM*, *49*(3). Retrieved from https://www.cs.cmu.edu/~15110-s13/Wing06-ct.pdf

PLAYING WITH THE PAST TO UNDERSTAND THE PRESENT: THE POTENTIAL OF USING NUSFJORD (2017) TO TEACH ABOUT THE COMPLEXITY OF FISHERIES AS SOCIO-ECOLOGICAL SYSTEMS

The potential of using Nusfjord (2017) to Teach About the Complexity of Fisheries as Socio-Ecological Systems

JØRN WEINES AND MELANIA BORIT

Extended Abstract

Games are vehicles that transport their players between different realties (Peters & Westelaken 2014). By doing this, they have the potential to provide many different benefits for their players, such as relaxation, excitement, social interaction, and learning. Higher education is increasingly trying to capitalize on this potential and many teachers now make use of different forms of game-based learning and serious games (Plass et al. 2015). Some educators design their own games (Weines et al. 2017), while others either use existing serious games (Qudrat-Ullah et al. 1997) or try to repurpose commercial off-the-shelf video games (Whitton 2010) or board games (Bridge 2014). Following suite, at our own department we count on the assumption of enhanced learning through games and we are currently exploring the potential of repurposing various entertainment board games (e.g. *Nusfjord*, *Dominant Species*, *Evolution*) in the context of interdisciplinary bachelor's and master's programs in fisheries and aquaculture science. These programs combine biology, economics, and social sciences with a taste of history and technology.

Building on previous research suggesting that the use of games in teaching students deeper knowledge about complex concepts such as sustainability is promising (Blanchard & Buchs 2015), in this study, we analyze the potential of the game *Nusfjord* by Uwe Rosenberg (Rosenberg 2017) to be used as an additional learning tool for teaching about fisheries as socio-ecological systems. When teaching about such systems, the complexity of achieving economic, environmental, and social sustainability is an important part of the current discourse (Charles 2001). It is considered that when trying to make sense of this complexity, critical thinking, problem solving, and key interdisciplinary themes that connect these, such as global awareness and different literacies play a crucial role. As such, these skills are recognized as extremely relevant for the 21st Century learner (Binkley et al 2012). Recent reviews indicate that games are useful in teaching these skills, especially when making use of design-activities as part of the teaching (Qian and Clark 2016). Thus, we intend to pilot the use of *Nusfjord* with fisheries management students in late 2018/early 2019. This pilot activity will inform our design of possible game customizations and pre/post game activities that are needed in order for the game to contribute to increased achievement of intended learning outcomes.

Nusfjord is a competitive strategy type of Eurogame with an economic development theme, where

the players are cast as the owners of a major fishing company in Nusfjord in the Lofoten archipelago in Norway. The goal of the players is to develop and expand the harbor and the surrounding area. Exploiting natural resources and using basic market mechanisms, in addition to considering the advice from the local community (i.e. "the elders"), are the main tools of each player. On BoardGameGeek.com, where users have ranked more than 87,000 board games and extensions, this game is in top 400 strategy games, with more than 1,600 votes (date of visit: 16.10.2018). To our knowledge, *Nusfjord* is one of the very few board games with commercial fisheries as the main topic, something that makes it an excellent candidate for our endeavors of using entertainment games in fisheries education.

Nusfjord invokes the traditional fisheries in the Lofoten Archipelago, which is an important part of Norwegian coastal and fisheries history. This is the annual fishery on spawning cod that takes place in the late winter-early spring (February-April). Dating back as far as recorded history goes, this fishery attracted fishers from the entire country and was an important part of both subsistence and commercial fisheries. This has resulted in the Lofoten fishery becoming symbolic of coastal culture in Norway. While the scope of the fishery has decreased over the past decades, this activity is still an important part of the regional economy and food culture. Furthermore, Lofoten's importance, both as a spawning ground and basis for small-scale fishers, makes it topical in ongoing discussions about tourism development (Henley 2016) and potential petroleum exploration in the area (Pedersen 2013, Kolle et al. 2017).

In this study, we build on the growing body of previous research on historical games (e.g. (Chapman et al. 2017; Borit et al. 2018)), on using games to teach history (e.g. (McCall 2011, 2016; Hoy 2018)), as well as how games construct understanding on our own past (Begy 2017). As such, we analyze the denotative and connotative meanings of game rules, game mechanics, artwork, and game components of *Nusfjord* in an attempt to assess their potential for transporting our students between the past reality of the Lofoten fisheries and the current reality of discussions about overexploited fisheries and sustainable marine and coastal management. We investigate how the game presents the history, social structures (including ethnic dimensions and gender), modernity, and ecology of the Lofoten fisheries and relate it to the current understanding of fisheries as socio-ecological systems. We answer questions such as: How does the game engage with historical realities? Is the reality to which players of *Nusfjord* are transported a reality that is representative of the one documented in historical works, or the present? Are the biological, social, and economic models present in the game suitable for use in the training of future fisheries/aquaculture industry professionals and managers about the complexity of sustainable fisheries? What are the game elements that are suitable for learning in our fisheries and aquaculture context, and what post-game activities are needed for adapting the game for use in game-based learning?

This interdisciplinary study lies at the intersection of learning in higher education, (historical) game studies, and natural resource management research and contributes to the ongoing discussion on meaningful play in the 21st Century higher education.

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References:

Begy, J. (2017). Board Games and the Construction of Cultural Memory. Games and Culture, 12(7–8), 718–738. https://doi.org/10.1177/1555412015600066

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining Twenty-First Century Skills. In Assessment and Teaching of 21st Century Skills. https://doi.org/10.1007/978-94-007-2324-5_2

Borit C, Borit M, Olsen P. 2018. Representations of Colonialism in Three Popular, Modern Board Games: Puerto Rico, Struggle of Empires, and Archipelago. Open Library of Humanities **4**. Available from https://olh.openlibhums.org/articles/10.16995/olh.211/ (accessed June 15, 2018).

Bridge D. 2014. You Sunk My Constitution: Using a Popular Off-the-Shelf Board Game to Simulate Political Concepts. Journal of Political Science Education **10**:186–203. Taylor & Francis Group . Available from http://www.tandfonline.com/doi/abs/10.1080/15512169.2014.894363 (accessed June 23, 2018).

Blanchard, O. & Buchs, A. (2015). Clarifying Sustainable Development Concepts Through Role-Play. Simulation & Gaming, **46**(6), 697–712. http://doi.org/10.1177/1046878114564508 (accessed June 23, 2018).

Chapman A, Foka A, Westin J. 2017. Introduction: what is historical game studies? Rethinking History **21**:358–371. Routledge. Available from https://www.tandfonline.com/doi/full/10.1080/13642529.2016.1256638 (accessed June 23, 2018).

Charles A. 2001. Sustainable fishery systems. Blackwell Science Ltd. Available from https://onlinelibrary.wiley.com/doi/book/10.1002/9780470698785 (accessed March 5, 2017).

Hoy B. 2018. Teaching History With Custom-Built Board Games. Simulation & Gaming **49**:115–133. SAGE PublicationsSage CA: Los Angeles, CA. Available from http://journals.sagepub.com/doi/10.1177/1046878118763624 (accessed June 23, 2018).

Kolle, N., Nielssen, A. R., Christensen, P. Døssland, A. (Eds.) 2017. *Fish, Coast and Communities – A History of Norway*. Fagbokforlaget. Bergen.

McCall J. 2016. Teaching History With Digital Historical Games. Simulation & Gaming **47**:517–542. SAGE PublicationsSage CA: Los Angeles, CA. Available from http://journals.sagepub.com/doi/10.1177/1046878116646693 (accessed June 23, 2018).

McCall JB. 2011. Gaming the past : using video games to teach secondary history. Routledge.

Pedersen, B. T. 2013. *Lofotfisket*. Pax Forlag. Oslo.

Peters V, Westelaken M van de. 2014. Simulation games – A concise introduction to the design process. Samenspraak Advies Nijmegen, Nijmegen. Available from http://www.samenspraakadvies.nl/publicaties/Simulation games -an introduction to the design process.pdf.

Plass JL, Homer BD, Kinzer CK. 2015. Foundations of Game-Based Learning. Educational Psychologist **50**:258–283. Available from http://www.tandfonline.com/doi/full/10.1080/00461520.2015.1122533 (accessed June 22, 2018).

Qudrat-Ullah H, Saleh M, Bahaa E. 1997. Fish Bank ILE: An interactive learning laboratory to improve understanding of "The Tragedy of Commons"; a common behaviour of complex dynamic systems. Proceedings of 15th International System Dynamics Conference. Istanbul.

Qian, M., & Clark, K. R. (2016). Game-based Learning and 21st century skills: A review of recent research. Computers in Human Behavior, 63, 50–58. https://doi.org/10.1016/j.chb.2016.05.023

Rosenberg U. 2017. Nusfjord. Lookout Games.

Henley, J. 2016, August 3: *Norway's Lofoten islands 'risk being overrun by tourists*. Retrieved from https://www.theguardian.com/world/2016/aug/03/norways-lofoten-islands-risk-being-overrun-by-tourists/

Weines J, Borit M, Holm P, Hrynkiewicz R. 2017, September 27. Theoretical challenges in designing a social simulation game of balancing sustainability objectives in fisheries management. Available from https://zenodo.org/record/1261071#.Wy1bDIp9jDc (accessed June 22, 2018).

Whitton N. 2010. Learning with digital games: a practical guide to engaging students in higher education. Routledge. Available from https://books.google.no/books/about/Learning_with_Digital_Games.html?id=oN7BzH6fKVkC&redir_esc=y (accessed June 22, 2018).

RE-PLAYING AND QUALITY CONTRIBUTION: THE ROLE OF THE SCORE MECHANISM DESIGN AS MOTIVATOR

The role of the score mechanism design as motivator

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Abstract

The current study investigates how the game points allocation function affects quality of responses and replaying behavior in a game-for-crowds implementation. In a series of experiments, we compare between two scoring designs across two types of users: students and public. Two reward-based mechanisms differing in the mathematical function were applied: linear (y=3x) vs. exponential (y=6ex). Findings highlight the nuances between repeated game rounds, types of users and quality contribution. We find support for the importance of the mathematical function of scores assignment as a motivator. Insights into the design of effective game-for-crowds for different target groups are discussed.

Introduction

Games-for-crowds and gamification

The rise of the digital game medium in entertainment has motivated its adoption for pursuits beyond entertainment (Gallagher, 2018; SIWEK, 2017). These games are known as serious games, and they are used in various aspects of everyday life such as training and knowledge sharing in many areas: defense, education, scientific exploration, health care, management, marketing, communication and politics (Lieberman, 2009; Ratan & Ritterfeld, 2009). Digital technology and the integration of the Internet into mainstream society made it possible for new serious-game environments to evolve. Of relevance to the present study are those computer environments associated with crowds, namely games-for-crowds.

Crowds are made up of independent individuals, each with their own objectives and behavior patterns. Games-for-crowds are a combination between the concept of "The Wisdom of Crowds[i]" and serious games. Consequently, games-for-crowds integrate computational tasks into networked games; people played the game to have fun and as a side effect of playing they helped to solve open problems, improve artificial intelligence, involve in projects on citizen science and more (Goh, Ang, Chua, & Lee, 2011; Khatib et al., 2011; Krause & Smeddinck, 2011; Quinn & Bederson, 2011). Similarly, to serious games, gamification is the application of game elements for purposes other than their expected use for entertainment (Deterding, Dixon, Khaled, & Nacke, 2011). Some researchers suggest that serious games are a subset of gamification (Kapp, 2012), others use the term to describe the addition of games into an existing non-game system, or converting a system into a game (Seaborn & Fels, 2015). Thus, the boundary between game and an artifact with game elements is blurry, subjective and social (Richter, Raban, & Rafaeli, 2015). Some well-known examples in this regard are: *Foldit* (Cooper, Khatib et al., 2010), *Phylo*[ii], and the series *Games With A Purpose* [iii](GWAP) (von Ahn, 2006). *Fold-it*, for example, exemplifies this blurriness as some reference it as a successful example of gamification in science, while others view it as a serious game for crowds in which players use a graphical interface to predict protein structures, a problem that computers cannot solve yet. The current research extends this direction utilizing an online game to enhance contribution of knowledge. For example, the game called *Guess*, introduced in this study, is an online knowledge pooling game for crowds. By using *Guess*, organizers can gauge their audience's sentiment or knowledge regarding the topic in question.

Games-for-crowds explore how games and games technology can increase participation to accomplish tasks at scale by engaging crowds (von Ahn, 2009). Arguably, the success of these system depends upon users' participation, quality of input, re-play and co-creation continuously (Majchrzak & Malhotra, 2013; Richter, Raban, & Rafaeli, 2018; Seaborn & Fels, 2015). So far, scant research has been conducted to link points allocation as motivators for quality and persistence of contribution. Our aim is to explore quality of contribution and re-playing behavior incentivized by two point-allocation functions implemented in two types of group-users (crowds): students and public. While the first group is fairly homogeneous, the second one consists of diverse users, as will be explained in the method section. We question the overall crowd type while discussing the effect of different point scoring systems on re-playing and quality of contribution. Understanding differences among target groups can provide new insights into the design of effective games-for-crowds and gamified systems.

The rest of the paper is structured as follows: after a brief introduction to the role of scores and points in games, we discuss studies in the domain of games-for-crowds and gamification that elaborate on the mechanisms to foster quality contribution. Following a description of *Guess*, a knowledge-pooling game for crowds, which serves as our research tool, we describe the experiment as well as the results of the study. Before concluding with a summary of findings, as well as highlight future research, we deliberate on key insights gained from this work.

Reward systems in games are generally tied to collecting points as a representation of progress. Next, we explain how rewards and incentives influence motivation in the special case of distributing points and scores.

Related Work

The role of scores and points

Scores are designed to deliver information to the player as part of an on-going motivational process. They are often used as a core reward for users' effort (Morschheuser, Hamari, & Koivisto, 2016); can facilitate competition; their motivational appeal is built upon their cumulative nature (Blohm & Leimeister, 2013). The scoring process offers numbers as a mirror of progression which, in turn, motivates the user to engage in self-evaluation (Sjöklint, Constantiou, & Trier, 2013). Yet, rewards can also have a negative impact on motivation: adversely affecting participation quality (Deci, Koestner, & Ryan, 1999) and lowering performance in complex and creative tasks (Toubia, 2006). Consequently, a positive and enjoyable experience can motivate and engage users in fulfilling tasks (Domínguez et al., 2013; Füller, 2010; Piller & Walcher, 2006; Zimmerling, Höllig, Sandner, & Welpe, 2018).

Computers can implement complex arithmetic and logical rules, and therefore can offer a large variety of scoring mechanisms. Combined with the ability to monitor game decisions and performance, the computerized environment is well-suited for developing behavior-based scoring mechanisms. Yet, the design of these systems is relatively seldom researched, a gap we wish to narrow (Richter et al., 2018).

Points and scoring mechanisms as design elements to foster quality of contribution

The most common purpose behind using a game for crowd or gamified approaches is to encourage behavior change, i.e. increase participation, improve performance, or quality of contribution (Seaborn & Fels, 2015). For example, Cooper et al. (2010) highlight the potential for encouraging quality contribution through online games to solve real-world problems; they used puzzles, ranking and accumulation of points to motivate users to find the best possible protein structures. Anderson et al.(2013) demonstrated that virtual rewards could motivate quantitative activities while using the question-answering site Stack Overflow; Von Ahn (2006) used human computation games to improve the accuracy of image search; participants evaluated gamification elements such as points and badges as motivating when used in an idea contest (Witt, Scheiner, & Robra-Bissantz, 2011). This approach rests on the assumption that game mechanics address user's psychological needs for relatedness, autonomy, and competence, and therefore positively influence motivation (Przybylski, Rigby, & Ryan, 2010).

Despite the growing use of games-for-crowds and gamification as a tool in various domains and contexts, there is still limited research on this topic, and developing a clear understanding of the positive or negative effects of the design of game elements is required. Furthermore, developing a stronger understanding for allocation of gamification elements, such as points, can contribute to the research regarding an optimal design of these platforms, to reach its objectives.

Previous research on points allocation refers to broad diversity of game elements: points, leaderboards, status, badges, and reports mixed results (Hamari, Koivisto, & Sarsa, 2014; Seaborn & Fels, 2015). It is difficult to isolate and measure the specific effect of scoring design (Richter et al., 2018). Liu et al. (2011) developed a mobile crowdsourcing application for image to-text translation. The application used several gamification features, including points and scores. They reported improvement in response speed and quality, yet how these results compared to a non-gamified version was unclear, and authors questioned the overall impact of gamification incentive on participation motivation.

Witt et al. (2011) examined the implementation of leaderboards and dual point systems: game points for completion of actions and social points for engaging in social behaviors (rating and commenting) in an online idea competition. Their results were mixed. Although gaining points motivated the introduction of further ideas, game elements were not consistently effective or well received, and questionnaire results evaluated their effect less strongly (they fell into a neither agree nor disagree category) (Witt et al., 2011). The authors attributed these results to the unsophisticated implementation of game elements that prevented its success.

Farzan et al. (2008) investigated the effect of points, levels, status and avatar on content contribution to a social networking site of an enterprise. A fixed number of points were awarded to each type of content contribution (photos, list of items, profile page). Researchers reported that the increase in contributions diminished shortly after the launch of the system. They attributed these results to the expected and no-dynamic nature of the system.

A scoring function that includes dividend points and dynamic update of player's contribution was introduced by Guy et al.(2011). Weekly update emails, indicating current ranking, and point missing for moving one ranking up, were used to support players' engagement. Yet, authors observed the same rapid decay of content contribution behavior. They suggested investigating refinements of the scoring function to obtain long- term engagement and quality contribution (Guy et al., 2011).

The above mentioned studies represent some of the attempts to understand the connection between points, scoring mechanism design and user behavior. They also pointed out several weaknesses: relying on a small sample size, implementation of several game elements simultaneously, not considering the varying response of participants to the incentives, count on one episode of play, missing a detailed description of the scoring mechanism, as well as suffer from lack of control group. It remains challenging to: 1) isolate and test different kinds of mechanical systems such as reward points, 2) discuss the design of game points allocation, 3) refine the link between point allocation and type of crowd, 4) investigate the scoring design to promote re-playing.

First steps of research in this direction can be seen in the work of Richter et al. (2018) who addressed the design of point scoring mechanisms to promote contribution of knowledge. Results indicated that implementing a point allocation mechanism promotes performance depending on the implementation, and that different types of crowds behaved differently in reaction to varying scoring conditions. The study involved three reward conditions: reward-free condition (control); and two conditions that differ in the algorithm applied across different crowds. In the current study, we expand this direction by looking at quality of information contributed and re-playing behavior as a function of game score design.

Points can be enhancers of quality, however, at the same time, they can catalyze generating spam just for the sake of earning points. Thus, we explore the balance between instrumental knowledge contributions and spam. To evaluate the effect of the scoring system we conducted a controlled study. In this context, we present three main research questions that summarize the goals of this study.

> RQ1: How do different score mechanism designs affect quality contribution in games-for-crowds?
>
> RQ2: What is the relation between different score mechanism designs and re-playing?
>
> RQ3: Do quality and re-play depend on the type of crowd participating?

Method

We compare two scoring designs (mathematical functions) across two types of crowds via a word association game for crowds called "*GUESS*" (originally developed by IBM). Following a description of the game we explain the experimental design and introduce the participants.

GUESS is an association game where knowledge accumulates by prompting questions simultaneously to all users who, in turn, receive points for responses. It is played in a 'Single Player' mode, where no direct interaction occurs between users. Yet the accumulated data is displayed visually, in real time, on users' screens. Game procedure:

- Users access a personalized home screen where they select a game to play from the available games.
- Each game consists of several short questions (example question: Name famous scientists).
- Each question appears for 60 seconds until the next question comes up.
- Users are encouraged to input as many responses as they can for each question. Responding is done by typing a response and pressing enter (Example responses: Einstein, Newton, Curie).
- Once users enter a response, they receive a feedback message: (1) 'You got X points'- indicating how many points were gained for the current response; or, (2) 'you already mentioned this answer' to inform users when they type a response that they have already mentioned.
- Players see responses graphically, on-screen, in the peripheral circles (see *Figure 1.*).
- Users can choose SKIP to move on to the next question (before the time expires or if they prefer not to respond a certain question).
- Previously given answers (by other users) are presented on screen yet they are hidden behind black dots. Once the user repeats such a response, the black dot opens, and the response appears.
- The game ends with a "game over" notification and a display of some game statistics and a leaderboard.

Figure 1. presents the main game interface: a question with an input box appears on top; responses are shown in the peripheral circles. The black dots denote responses given by other users. Additional on-screen information includes time remaining, user's statistics (dynamic update of current total points), basic game statistics (number of players, number of responses given by all players).

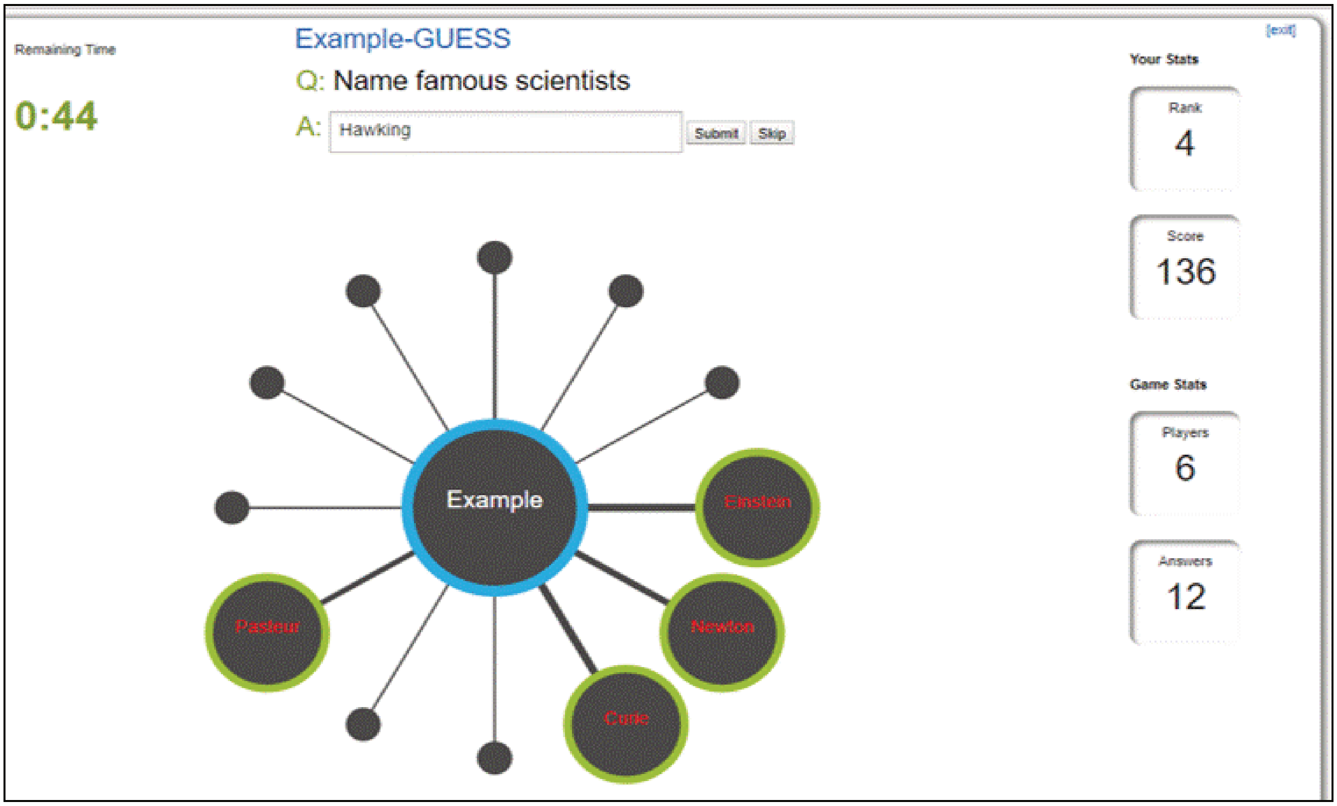

Figure 1. Main game interface

Designing the score mechanism

We implemented a new scoring wizard to allow fast adjustments of the algorithm applied. The goal was to compare two mathematical functions for the allocation of points. We compared usage of a monotonic and expected linear scoring mechanism with an irregular and incalculable (for the user) exponential scoring mechanism. The functions applied were: (1) linear function: $y=3x$ (2) exponential function: $y=6ex$. The linear function follows a simple arithmetic rule, while the exponential function introduces irregularity to the system. Rather than following formula strictly, we used an approximation with integer coefficients. Thus, the linear function y=3x, in which a player earns 3 points for each action, may be compared with the exponential function y=6ex (the series expansion at x=0 is y=6ex= 6+6x+3×2+x3+o(x4)). *Figure 2.* depicts both functions.

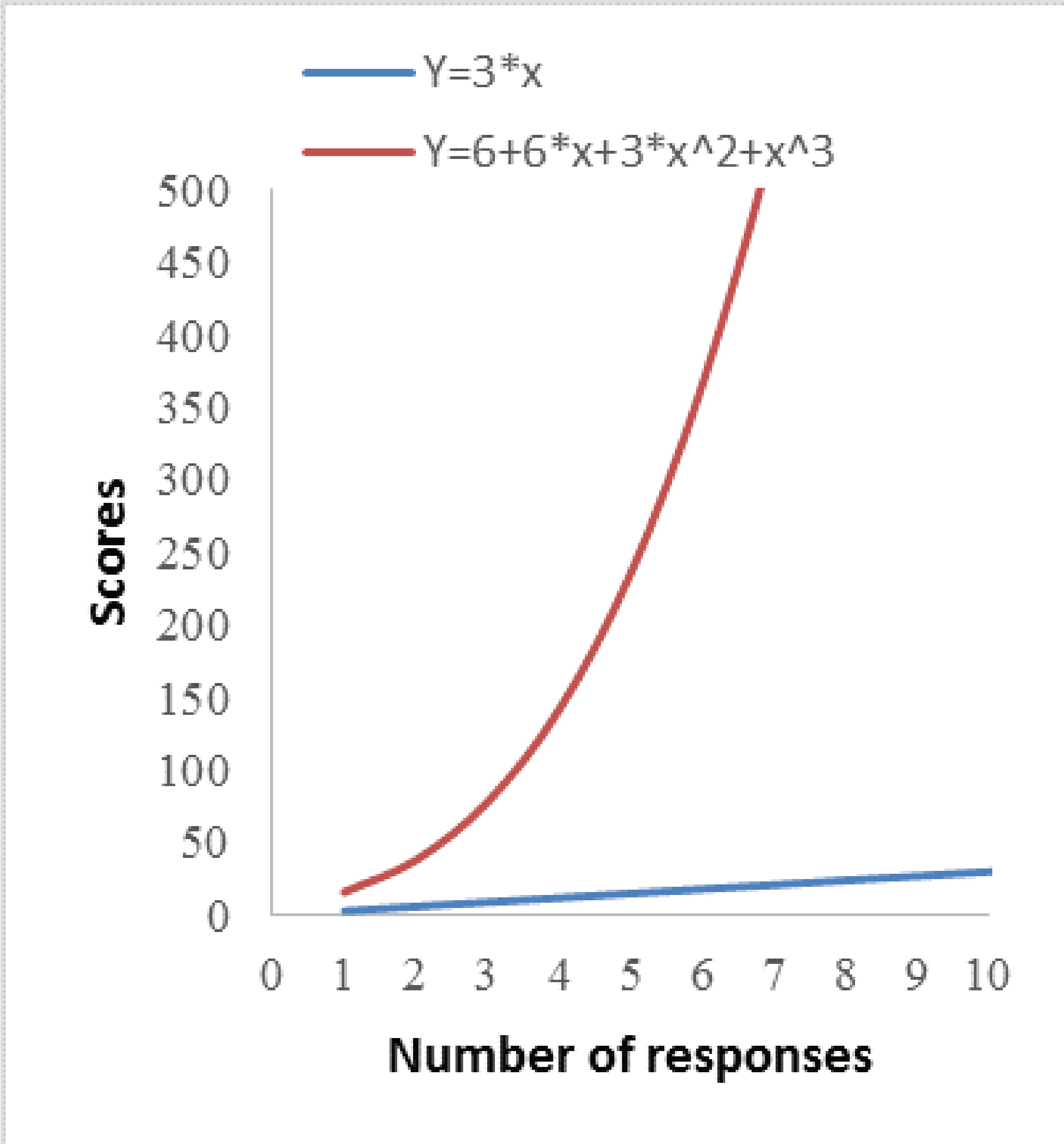

Figure 2. Point accumulation: linear vs. exponential function

Defining quality – Quality is calculated as the proportion of useful responses out of all responses. To clarify, 'useful responses' means plausible answers to a given question. For example, a plausible answer to a question about European capital cities would be Paris. Even typos or slight spelling errors were counted as useful, e.g. Pariz or Parris. However, writing 'abc' in response to the same question would count as a non-useful response.

Procedure– GUESS was deployed in two events of The European Researchers' Night which is a "popular science and fun learning event" open to the general public, and in three university courses at the Faculty of Management. Participation was voluntary. Participants were randomly assigned to one of the experimental conditions; two reward-based systems differing in the scoring function applied (linear vs. exponential). Questions were randomly displayed on users' screen.

The data collected includes 10 games, 5 games in each scoring condition. Group size (number of participants in a game) ranged from 10 to 57. A total of 7268 responses were gathered: linear score function 3318 responses, exponential score function 3950 responses. For the evaluation, we examined the server logs, which documented the details of each response provided by users in a game along with a time-stamp. Derogatory responses as well as meaningless letters and numbers were marked as spam.

Participants– A total of 352 participants were involved in the game; played at least once in one of the conditions. We identified two types of crowd: the general public and students distributed as defined in *Table 1.* We did not gather demographic data.

Types of crowd	**Definition**	**N**	**%**	Linear score mechanism N	Exponential score mechanism N
Public	Teenagers and older visitors attending The European Researchers' Night events, answering questions that require common knowledge	171	48.6	63	108
Students	Management students answering questions on management topics	181	51.4	97	84

Table 1. Participants types, size and distribution across condition

41 participants re-played the game without being asked to do that. The number of game rounds varied between 1 to 5 times. *Table 2.* shows the distribution of game rounds, across types of crowd and scoring design. The current study examined incentives for re-playing among the different types of crowd; therefore, in addition to analysis data of all users, we isolate participants' data across game-rounds, in order to look into participants who played the game the same number of times. Note that re-play was done voluntarily, not by design.

No. of game-rounds	N	%	Frequencies- types of crowd		Frequencies -scoring mechanism design	
			Public	Students	Linear score	Exponential score
1	311	88.35	155	156	142	169
2	33	9.37	15	18	16	17
3	5	1.42	1	4	1	4
4	2	0.57		2	1	1
5	1	0.28		1		1

Table 2. Participants frequencies according to type of crowd and scoring design

Results

We compare performance between point allocation conditions, linear or exponential, regarding the two types of users (crowds: public, students) across play rounds. First, we look at the 'big picture' as reflected in the collected data, then we focused on the first game round as compared to the others, later we investigate participants who played the game twice.

Quality**:** Since most responses were useful (58.02%) and variance was low, quality was defined as a dichotomy variable. A hierarchical logistic model was conducted to predict the probability for quality responses, i.e. all responses are useful. The analysis yielded that there was a main effect of score design ($F(1, 53) = 6.14$, $p < .05$). The probability that all responses are useful tends to be higher (in 0.54) in the linear condition than when the scoring function is exponential, across both types of crowd. There was no statistically significant difference between type of crowds, and there was no interaction effect of scoring condition*type of crowd.

Further analysis of responses that were not all useful revealed a main effect of type of crowd ($F(1, 17) = 8.39$, $p < .05$) indicating that there is an overall significant difference in means between the two crowds. The mean quality for students was significantly higher than the mean for public (M = 0.82, SD =0.24; M = 0.75, SD = 0.27; respectively). Analysis for game round revealed a main effect indicating that there is an overall significant difference in means between the first round and the other rounds ($F(1, 17) = 15.99$, $p < .001$). As the number of rounds increases, the quality decreases (M = 0.82, SD =0.22; M = 0.63, SD = 0.35; M = 0.58, SD =0.37; for the first, second and third rounds respectively).

Re-playing: A chi-square test of independence was performed to examine the relation between scoring design and replaying across the two type of crowds. The relation between these variables was significant in the student group, (?2(4)=12.12 , $p < .05$). For students, exponential point allocation design was more likely to promote re-playing than was linear scoring design.

To advance an understanding of replaying behavior and its relation to the scoring mechanism design, we investigate in isolation participants who played the game for the same number of times. However, since the sample size is very small with only one or two observations in some of the cells (*Table 2.*), we explore data of 41 participants from their second round. Due to the size of the data sets, we present descriptive statistics: 1) to provide basic information about the variables, and 2) to highlight potential relationships between variables. We add a basic performance metric, named contribution (# of responses per question) to get a more comprehensive description (Richter et al., 2018). *Table 3.* presents descriptive statistics along the two type of crowds and across the two-scoring design.

Scoring mechanism design	Variables	Public N=16 M (SD)	Students N=25 M (SD)
Linear scoring design (N=18)	Game rounds	2 (.00)	2.21 (.58)
	Contribution	3.25 (1.91)	5.26 (2.80)
	Quality	.98 (.05)	.85 (.28)
Exponential scoring design (N=23)	Game rounds	2.08 (.29)	2.73 (1.00)
	Contribution	6.49 (6.17)	5.46 (2.00)
	Quality	.69 (.42)	.90 (.15)

Table 3. Descriptive statistic according to type of crowd and scoring design

Discussion, Limitation and Future Research

Scores are collected in points that can be illustrated also in numbers of "likes", comments, shares, friends, and followers, or in the traditional way as plain numbers. Thus, designing a game scoring mechanism to support achieving objectives is a relevant practical issue, as well as an academic interest, not only in game environments (Guy et al., 2011; Hamari, 2013; Kankanhalli, Taher, Cavusoglu, & Kim, 2012). Current literature tends to explore game-systems, rather than elements in isolation (Hamari et al., 2014; Richter et al., 2018). This work narrows this gap, namely the need to isolate and test specific gamification elements.

Through a series of online experiments, we explore how different scoring mechanism designs have a differentiated effect on voluntary re-playing and quality items contribution. We compare usage of a monotonic and predictable linear function, with an exponential function which is more likely to be surprising and introduces irregularity to the system. We sampled from two different groups of users, the general public and students, exposing each to the different scoring conditions.

Findings offer first insights into the effect of scoring mechanism design, within a knowledge pooling game for crowds, on quality and re-playing. We used quantitative, unobtrusive data retrieved from game logs. Prior to discussing the implications of this work, it is necessary to recognize some inherent limitations of this study. With 41 participants who re-played the game, the sample is small, and the overall external validity may be questioned. In addition, re-playing was not the focus during the implementation of the system, yet it is an unexpected behavior worthy of attention relating to previous findings where we discovered a significant effect on engagement time, suggesting the exploring of quality of responses (Richter et al., 2018). Therefore, the study is exploratory, and findings are in tendency statements. Better understanding of re-playing behavior, awareness to differences between highly-motivated users and average users, may provide new insights into the design of effective games-for-crowds and gamified systems for different target groups and is much needed.

Overall, in answer to our research questions we can generalize the following assertions: 1. Implementing a linear point allocation mechanism promotes quality of responses independent of the type of crowds participating. 2. Re-playing tends to decrease quality. 3. Students show better performance than the general public regarding quality. 4. Scoring design affects re-playing behavior. 5. It is more difficult to mobilize students than the general public, yet, students generate high quality responses regardless of the point allocation mechanism. 6. The hardest challenge is to pool quality responses from the public. In the following we unpack the observations that led to these generalizations.

Analysis for quality yielded that quality was significantly higher for the linear condition than for exponential scoring. Investigating responses that were not all useful indicates a big difference among the two crowds, as students tend to contribute more quality responses. This means that it is more difficult to pool quality knowledge from the public compared to the students. Students appear to be indifferent toward the scoring conditions. In addition, they generated a low percentage of spam compare to the general public. Quality is also compromised due to re-playing. One explanation for that can be that the accuracy of responses may have decreased because players already know the questions and do not pay attention to typing, or by them deciding to spam.

Since there was a statistically significant association between scoring condition and game-round; that is, exponential scoring design boosts re-playing, it seems a good idea to look at all participants who re-played the game for the same number of times, in our case, twice.

It appears that exponential scoring design is more effective for students. They tend to re-play 1.2 times more in the exponential condition over the linear scoring, and 1.3 times higher than the general public in the exponential condition. Yet, a crowd of students is more difficult to mobilize than the general public in regard to content contribution, although students produce the higher quality in the exponential condition. Incentives in the form of points do not lead to quality impairment among highly motivated participants.

Working with heterogenous crowds (public) is challenging; incentives in the form of exponential points lead to an increasing in quantity yet also in generating spam. Contribution in the exponential condition was twice higher than in the linear scoring, but quality was higher for linear than for exponential scoring. This means that it is more difficult to pool quality knowledge from the public compared to the students, thus the linear condition seems to be the best option for public. Designers should take into consideration the low-quality rate and possibly rely on additional software to filter out spam. Further studies will take a deeper look and test on a larger scale game mechanics to confirm or disprove this effect.

To conclude, we test two different scoring mechanisms to determine which is better in driving quality of responses; furthermore, we suggest that exponential scoring encourages replaying behavior, and highlights the nuance between highly motivated users (students) and average users (public). To encourage knowledge contribution behavior via a game for crowds, care should be taken in selecting the scoring condition, and attention should focus on the type of crowd and kind of knowledge collected (common or specific knowledge). Caution must be exercised when using rewards (such as points) to encourage users' contribution in the long run, since the effect of rewarding on user behavior is complex.

References

Anderson, A., Huttenlocher, D., Kleinberg, J., & Leskovec, J. (2013). Steering user behavior with badges. Paper presented at the *Proceedings of the 22nd International Conference on World Wide Web,* Rio de Janeiro, Brazil. 95-106.

Blohm, I., & Leimeister, J. M. (2013). Design of IT-based enhancing services for motivational support and behavioral change. *Business & Information Systems Engineering, 5*(4), 275-278.

Cooper, S., Khatib, F., Treuille, A., Barbero, J., Lee, J., Beenen, M., . . . Popović, Z. (2010). Predicting protein structures with a multiplayer online game. *Nature, 466*(7307), 756-760.

Cooper, S., Treuille, A., Barbero, J., Leaver-Fay, A., Tuite, K., Khatib, F., . . . Baker, D. (2010). The challenge of designing scientific discovery games. Paper presented at the *Proceedings of the Fifth International Conference on the Foundations of Digital Games,* 40-47.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*(6), 627-668.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. Paper presented at the *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments,* Tampere, Finland. 9-15.

Domínguez, A., Saenz-de-Navarrete, J., de-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education, 63*(0), 380-392. doi:http://dx.doi.org/10.1016/j.compedu.2012.12.020

Farzan, R., DiMicco, J. M., Millen, D. R., Dugan, C., Geyer, W., & Brownholtz, E. A. (2008). Results from deploying a participation incentive mechanism within the enterprise. Paper presented at the *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* Florence, Italy. 563-572. doi:10.1145/1357054.1357145

Füller, J. (2010). Refining virtual co-creation from a consumer perspective. *California Management Review, 52*(2), 98-122.

Gallagher, M. D. (2018). US video game industry revenue reaches $36 billion in 2017. Retrieved from http://www.theesa.com/article/us-video-game-industry-revenue-reaches-36-billion-2017/

Goh, D. H., Ang, R. P., Chua, A. Y. K., & Lee, C. S. (2011). Fight or unite: Investigating game genres for image tagging. *Journal of the American Society for Information Science and Technology, 62*(7), 1311-1324.

Guy, I., Perer, A., Daniel, T., Greenshpan, O., & Turbahn, I. (2011). Guess who?: Enriching the social graph through a crowdsourcing game. Paper presented at the *Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems,* 1373-1382.

Hamari, J. (2013). Transforming homo economicus into homo ludens: A field experiment on gamification in a utilitarian peer-to-peer trading service. *Electronic Commerce Research and Applications, 12*(4), 236-245. doi:http://dx.doi.org/10.1016/j.elerap.2013.01.004

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work?—A literature review of empirical studies on gamification. Paper presented at the *Proceedings of the 47th Hawaii International Conference on System Sciences (HICSS).* Hawaii, USA. 3025-3034.

Kankanhalli, A., Taher, M., Cavusoglu, H., & Kim, S. H. (2012). Gamification: A new paradigm for online user engagement. Paper presented at the *The 33rd International Conference on Information Systems, ICIS 2012,* Orlando. 1-10.

Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education* John Wiley & Sons.

Khatib, F., Cooper, S., Tyka, M. D., Xu, K., Makedon, I., Popovic, Z., . . . Players, F. (2011). Algorithm discovery by protein folding game players. *Proceedings of the National Academy of Sciences of the United States of America, 108*(47), 18949-18953. doi:10.1073/pnas.1115898108

Krause, M., & Smeddinck, J. (2011). Human computation games: A survey. Paper presented at the *Proceedings of 19th European Signal Processing Conference (EUSIPCO 2011),* Barcelona, Spain. 754-758.

Lieberman, D. A. (2009). Designing serious games for learning and health in informal and formal settings. In U. Ritterfeld, M. Cody & P. Vorderer (Eds.), *Serious games: Mechanisms and effects* (pp. 117-130) Routledge New York, NY.

Majchrzak, A., & Malhotra, A. (2013). *Towards an information systems perspective and research agenda on crowdsourcing for innovation* doi:https://doi.org/10.1016/j.jsis.2013.07.004

Morschheuser, B., Hamari, J., & Koivisto, J. (2016). Gamification in crowdsourcing: A review. Paper presented at the *49th Hawaii International Conference on System Sciences (HICSS), 2016,* 4375-4384.

Piller, F. T., & Walcher, D. (2006). Toolkits for idea competitions: A novel method to integrate users in new product development. *R&d Management, 36*(3), 307-318.

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology, 14*(2), 154-166.

Quinn, A. J., & Bederson, B. B. (2011). Human computation: A survey and taxonomy of a growing field. Paper presented at the *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* Vancouver, BC, Canada. 1403-1412.

Ratan, R., & Ritterfeld, U. (2009). Classifying serious games. In U. Ritterfeld, M. J. Cody & P. Vorderer (Eds.), *Serious games: Mechanisms and effects* (pp. 10-24) New York/London: Routledge.

Richter, G., Raban, D. R., & Rafaeli, S. (2015). Studying gamification: The effect of rewards and incentives on motivation. *Gamification in education and business* (pp. 21-46) Springer International Publishing.

Richter, G., Raban, D. R., & Rafaeli, S. (2018). Tailoring a points scoring mechanism for crowd-based knowledge pooling. Paper presented at the *Proceedings of the 51st Hawaii International Conference on System Sciences,* Big Island, Hawaii. 1128-1137.

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *International Journal of Human-Computer Studies, 74*, 14-31.

SIWEK, S. E. (2017). *Video games in the 21st century: The 2017 report.* USA: Entertainment Software Association (ESA).

Sjöklint, M., Constantiou, I., & Trier, M. (2013). Numerical representations and user behaviour in social networking sites: Towards A multi-theoretical research framework. Paper presented at the *Proceedings of the 21st European Conference on Information Systems, ECIS 2013, Completed Research.* (144)

Toubia, O. (2006). Idea generation, creativity, and incentives. *Marketing Science, 25*(5), 411-425.

von Ahn, L. (2006). Games with a purpose. *Computer, 39*(6), 92-94.

von Ahn, L. (2009). Human computation. Paper presented at the *Proceedings of the 46th Annual Design Automation Conference,* San Francisco, California. 418-419.

Witt, M., Scheiner, C., & Robra-Bissantz, S. (2011). Gamification of online idea competitions: Insights from an explorative case. Paper presented at the *INFORMATIK 2011 – Informatik Schafft Communities 41. Jahrestagung Der Gesellschaft Für Informatik,* Technische Universität Berlin, Germany. 192.

112. Liu, T. Alexandrova, T. Nakajima, & V. Lehdonvirta. (2011). Mobile image search via local crowd: A user study. Paper presented at the *2011 IEEE 17th International Conference on Embedded and Real-Time Computing Systems and Applications, , 2* 109-112. doi:10.1109/RTCSA.2011.10

Zimmerling, E., Höllig, C. E., Sandner, P. G., & Welpe, I. M. (2018). Exploring the influence of common game elements on ideation output and motivation. *Journal of Business Research,* doi:https://doi.org/10.1016/j.jbusres.2018.02.030

[i] Some common examples of Wisdom of Crowds are information sites like Wikipedia and Yahoo! Answers.
[ii] http://phylo.cs.mcgill.ca/teaching/index.php
[iii] http://www.gwap.com/

DESIGNING EDUCATIONAL ALTERNATE REALITY GAMES: INTRODUCING THE MAQUETTE DESIGN FRAMEWORK

Introducing the Maquette Design Framework

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Abstract

We present the Maquette Framework for designing educational Alternate Reality Games (ARGs). The framework synthesizes prior ARG literature and integrates the authors' experience designing and running three different ARGs with over 4,000 players. The Maquette Framework can be used generatively (to help create educational ARGs) or analytically (to review existing ARGs). The framework is represented by a table with four foundational pillars (audience, learning outcomes, setting, and This is Not a Game). A tabletop represents the narrative theme, upon which rests a three-dimensional model (i.e., maquette) game world that represents the pervasive transmedia interface of the game. Upon the game world are players, gamerunners, and fictional characters; activity diamonds consisting of learning activities, learning goals & assessment, educational scaffolding, and game mechanics; and story fragments. Player trajectories are various pathways that players take through the maquette. Elements and their relationship to one another are explained and illustrated with examples.

Introduction

Alternate Reality Games (ARGs) are a "genre of transmedia practice where players collaboratively hunt for clues, make sense of disparate information, and solve puzzles to advance an ever-changing narrative that is woven into the fabric of the real world" (Bonsignore, Hansen, Kraus, & Ruppel, 2012a, p. 25). While originally developed for marketing purposes (Kim, Lee, Thomas, & Dombrowski, 2009), the potential value of ARGs as an educational platform has been recognized and explored for over a decade. Educational ARGs have been developed to support language learning (Connolly, Stansfield, & Hainey, 2011), computational thinking (Fraistat, 2017), scientific inquiry (Pellicone et al., 2017), information literacy (Bonsignore, et al., 2012a; Johnson, Buhler, Hillman, 2010), counterfactual historical thinking (Bonsignore, et al., 2012c), globalization (Waddington, 2013), and many more topics (Whitton & Moseley, 2012). They have also inspired additional educational simulations and platforms, such as Playable Case Studies (Balzotti, Hansen, Ebeling, & Fine, 2017) that borrow ARG principles such as "This is Not a Game" (TINAG) ethos (McGonigal, 2003). Educational ARGs and related genres face significant challenges such as replayability (Hansen, Bonsignore, Ruppel, Visconti, & Kraus, 2013), continued engagement, sustainability, (Watson, 2017), and integration into classrooms (Bonsignore, et al., 2012b; Colvert, 2009). However, the narrative-driven, cooperative, and authentic nature of ARGs and related genres have shown significant promise as a learning environment that stands in stark contrast to the over-simplistic, decontextualized learning environment so prevalent in education today (Ito, et al., 2013; Whitton & Moseley, 2012).

Despite the increasing number of educational ARGs, designing them is a difficult task. While a significant and growing body of literature provides theoretical and practical guidance on designing educational games (Boller & Kapp, 2017; Gee, 2003; Linehan, Kirman, Lawson, & Chan, 2011; Salen, 2008), most guidance targets designers of digital games, which differ significantly from ARGs with their unique characteristics such as TINAG, transmedia interfaces, interactive storytelling run by puppet masters, etc. Existing case studies of educational ARGs, such as those cited above, have identified challenges, successes, and lessons learned from specific designs and design choices, though most studies do not address the design process itself. There are exceptions. A handful of studies examine the design process of ARGs directly. Bonsignore, et al. describe design strategies for integrating ARG characters (e.g., "protagonist by proxy") and distributed story elements into authentic learning contexts (2013). Pellicone, et al. focus on the need to consider ARGs through the lenses of gameplay, narrative, and learning (2017). Bonsignore, et al. describe which participatory design and playtesting techniques conducted with teenagers were most and least useful in the development of DUST (2016). Whitton and Moseley's edited book *Using games to enhance learning and teaching: a beginner's guide* (2012) provides strategies for ARG game designers to create low-cost games, embed learning goals and assessments, and create highly contextualized and authentic narratives. Hansen, et al. identify three different types of ARG reuse (extensibility, portability, and replayability) and provide design strategies for implementing them (2013). Waern, Montola, and Strenros illustrate design techniques that blend the real world with a fictional world through role playing and technology use (2009).

While this prior work has helped identify and articulate the key challenges and opportunities of designing ARGs, it has not been integrated into a comprehensive framework for the design of educational ARGs. The purpose of this paper is to present a framework that can be used to design and analyze educational ARGs. The Maquette framework identifies the key elements of ARGs and articulates how those elements relate to one another and to learning. We then illustrate how the framework can be used to design and analyze educational ARGs through a meta-analysis of lessons learned from evaluating 3 distinct educational ARGs that the authors developed and ran with over 4,000 players.

Maquette Framework Overview

Design frameworks are "prescriptive" in nature and "describe the characteristics that a designed artifact must have to achieve a particular set of goals in a particular context" (Edelson, 2009, pp. 114). They should ideally have a clear purpose and audience in mind. The Maquette Educational ARG Design Framework (Maquette Framework) presented here is meant to help designers **create** and **analyze** educational ARGs. The French word for "scale model," *maquette* is routinely used in architecture and the fine arts to designate a prototype of a building or sculpture (Wikipedia, Tate Gallery). In recent years, the term has been expanded to encompass preliminary models produced in a range of media and contexts, including filmmaking and video game production (Wikipedia). We draw on this more generalized sense of maquette to denote our own educational ARG design framework, which uses the visual metaphor of a tabletop game with a model game world to identify, label, and explain the foundational and supporting elements of ARGs. It is an example of a representation of intermediate-level design knowledge (Höök, K., & Löwgren, 2012) that sits somewhere between theory and practice. It can be used generatively during the design phase to suggest the process through which design may occur and the elements and perspectives that must be considered. It does not specify which design approach to use (e.g., co-design, user-centered design, contextual inquiry), but can help ensure that key elements are considered and various elements are in harmony with one another. The framework can also be used as an analysis tool to help systematically assess and compare ARGs.

A visual representation of the Maquette framework is captured in Figure 1, which uses an analogy of a table with a model game world and game pieces resting upon it. At the base of the structure are the 4 key foundational elements represented by table legs, which support the rest of the game including the target **audience**, **learning outcomes**, **setting** (e.g., museum, library, online-only), and **TINAG**. The table itself is the **narrative theme**, which brings together the 4 elements and supports the remaining elements. The **transmedia interface** is represented by the model game world in order to convey the importance of the physical world in ARGs, although many buildings and areas in the city also represent social media, mobile, and web-based technologies. This structure was chosen because it helped illuminate the relationship between the various elements. For example, it highlights the importance of the 4 key foundation elements (i.e., the legs of the table) upon which all other elements rely and the need for them to be in harmony for a stable foundation. It also shows the bridging elements (i.e., table and model city) that are based on the 4 foundation elements, but also connect them together and serve as a further support for additional design elements.

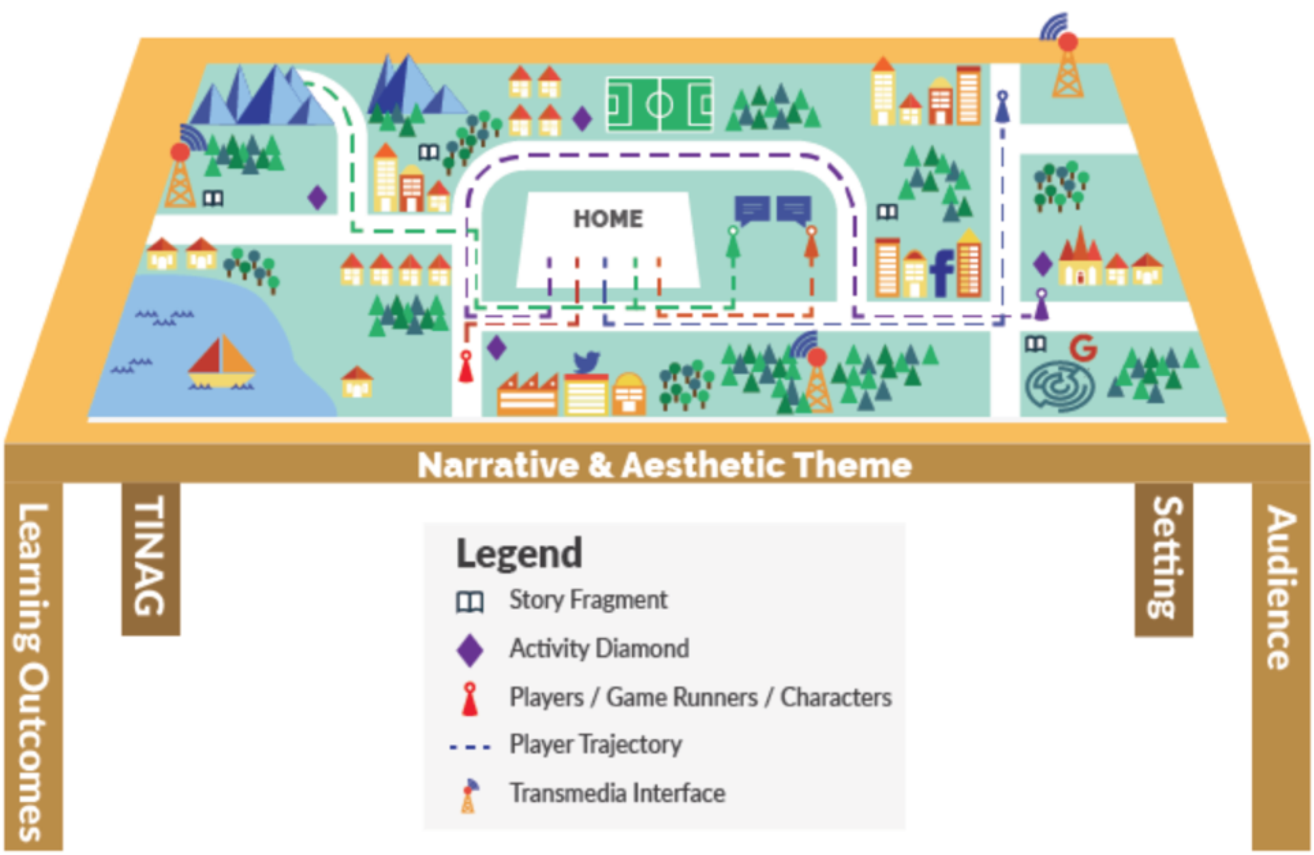

Figure 1. Maquette Design Framework Diagram

On top of the game world model rest various elements scattered throughout. **Story fragments** occur in different locations across the **transmedia interface**, which represent different social media platforms, real world locations, etc. There are also **activity diamonds** dispersed throughout that include four key cornerstones: learning activities, educational scaffolding, game mechanics, and learning goals/assessments that are integrated into a coherent whole. **Players, gamerunners, and characters** all play in the same landscape together, interacting with one another, as well as the environment, activities, and story fragments. **Player trajectories**, based on Benford, Giannachi, Koleva, & Rodden (2009) represent the unique pathways through which the player experiences the game. In fact, the network of roads and paths may be thought of as the **trajectory architecture**, which is the combination of all potential player trajectories. Though not represented in Figure 1, the **puppet masters** (also called game masters or game designers) create the various elements and helps orchestrate the gamerunners and fictional characters in a dynamic process. For example, the game masters may architect new paths and add new activities or story bits dynamically as players gravitate toward different parts of the board.

The remainder of the paper will illustrate each of these key elements of the Maquette Framework and their relationship to one another using examples from 3 ARGs designed by the authors. Insights will be shared that illustrate what to consider when looking at each element and how the framework can help in the creation process. For example, designing from the bottom upward was helpful in our own design work, since the elements at the bottom are often the most constraining, while those at the top are most flexible. The importance of certain elements in providing "creative constraints" that inspire detailed design ideas, such as the **setting** and **narrative theme** will be illustrated. Next, the paper will illustrate how the framework can be used to assess and compare educational ARGs. For example, it suggests the need to check for close alignment of learning activities with the other activity diamond points (educational scaffolding, game mechanics, and the learning goals/assessments). Additionally, it suggests techniques for assessing different player trajectories and how the experience differs for different players. It also suggests the need to consider which elements are in harmony with one another, such as the learning outcomes and the target audience.

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References

Balzotti, J., Hansen, D., Ebeling, D., & Fine, L. (2017, January). Microcore: A playable case study for improving adolescents' argumentative writing in a workplace context. In *Proceedings of the 50th Hawaii International Conference on System Sciences*.

Benford, S., Giannachi, G., Koleva, B., & Rodden, T. (2009, April). From interaction to trajectories: Designing coherent journeys through user experiences. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 709-718). ACM.

Boller, S., & Kapp, K. (2017). Play to learn: Everything you need to know about designing effective learning games. Association for Talent Development.

Bonsignore, E., Hansen, D., Kraus, K., & Ruppel, M. (2012a). Alternate Reality Games as Platforms for Practicing 21st-Century Literacies. *International Journal of Learning and Media*, *4*(1).

Bonsignore, E. Hansen, D, Kraus, K., Ahn J., Visconti, A., Fraistat, A., & Druin, A. (2012b). Alternate Reality Games: Platforms for Collaborative Learning. In *The Future of Learning: Proceedings of the 10th International Conference of the Learning Sciences (ICLS 2012) – Volume 1, Full papers*, 251–258.

Bonsignore, E. Hansen, D, Kraus, K., Visconti, A., Ahn J., & Druin, A. (2013). Playing for real: Designing alternate reality games for teenagers in learning contexts. In *Proceedings of the 12th International Conference on Interaction Design and Children*, 237–246.

Bonsignore, E., Hansen, D., Pellicone, A., Ahn, J., Kraus, K., Shumway, S., Kaczmarek, K., Parkin, J., Cardon, J., Sheets, J., Holl-Jensen, C., & Koepfler, J. (2016, June). Traversing transmedia together: Co-designing an educational alternate reality game for teens, with teens. In *Proceedings of The 15th International Conference on Interaction Design and Children* (pp. 11-24). ACM.

Bonsignore, E., Kraus, K., Visconti, A., Hansen, D., Fraistat, A., & Druin, A. (2012c, May). Game design for promoting counterfactual thinking. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 2079-2082). ACM.

Colvert, A. (2009). Peer puppeteers: Alternate reality gaming in primary school settings. *Breaking New Ground: Innovation in Games, Play, Practice and Theory: DiGRA, Brunel University, London. Retrieved from www. digra. org/dl/db/09287.19018. pdf. [Accessed 14/05/12]* (2009).

Connolly, T. M., Stansfield, M., & Hainey, T. (2011). An alternate reality game for language learning: ARGuing for multilingual motivation. *Computers & Education*, *57*(1), 1389-1415.

Edelson, D. C. (2002). Design research: What we learn when we engage in design. *The Journal of the Learning sciences*, *11*(1), 105-121.

Fraistat, Ann [Tessera Source]. (2017, May 5). The Tessera – A Spotlight [Video file]. Retrieved from https://www.youtube.com/watch?v=HCDIv60N58c

Gee, J. (2003). What video games have to teach us about learning and literacy (1st ed. ed.). Palgrave Macmillan, New York.

Hansen, D., Bonsignore, E., Ruppel, M., Visconti, A., & Kraus, K. (2013, April). Designing reusable alternate reality games. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1529-1538). ACM.

Höök, K., & Löwgren, J. (2012). Strong concepts: Intermediate-level knowledge in interaction design research. ACM *Transactions on Computer-Human Interaction (TOCHI)*, 19(3), 23.

Ito, M., Gutiérrez, K., Livingstone, S., Penuel, B., Rhodes, J., Salen, K., … & Watkins, S. C. (2013). Connected learning: An agenda for research and design. BookBaby.

Johnson, M., Buhler, A. G., & Hillman, C. (2010). The library is undead: Information seeking during the zombie apocalypse. Journal of Library Innovation, 1(2), 29-43.

Kim, J., Lee, E., Thomas, T., & Dombrowski, C. (2009). Storytelling in new media: The case of alternate reality games, 2001–2009. *First Monday, 14*(6).

Linehan, C., Kirman, B., Lawson, S., & Chan, G. (2011, May). Practical, appropriate, empirically-validated guidelines for designing educational games. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1979-1988). ACM.

McGonigal, J. (2003). 'This Is Not a Game': Immersive Aesthetics and Collective Play. In *MelbourneDAC: 5th International Digital Arts and Culture Conference. Melbourne*.

Pellicone, A., Bonsignore, E., Kaczmarek, K., Kraus, K., Ahn, J., & Hansen, D. (2017). Alternate reality games for learning: A frame by frame analysis. *Alternate Reality Games and the Cusp of Digital Gameplay*, *5*, 78.

Salen, K. (2008). *The ecology of games: connecting youth, games, and learning*. MIT Press, Cambridge Mass.

Tate Gallery. Maquette–Art Term. Retrieved June 22, 2018 from http://www.tate.org.uk/art/art-terms/m/maquette.

Waddington, D. (2013). A parallel world for the World Bank: A case study of Urgent: Evoke, an educational alternate reality game. *Revue internationale des technologies en pédagogie universitaire/ International Journal of Technologies in Higher Education, 10*(3), 42-56.

Waern, A., Montola, M., & Stenros, J. (2009, April). The three-sixty illusion: Designing for immersion in pervasive games. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1549-1558). ACM.

Watson, J. (2017). Games Beyond the ARG. In A. Garcia & G. Niemeyer (Ed.), *Alternate Reality Games and the Cusp of Digital Gameplay* (pp. 187-209). Bloomsbury Academic.

Whitton, N., & Moseley, A. (Eds.). (2012). Using games to enhance learning and teaching: A beginner's guide. Routledge.

Wikipedia contributors. (2018, January 8). Maquette. In Wikipedia, The Free Encyclopedia. Retrieved 22:04, June 22, 2018, from https://en.wikipedia.org/w/index.php?title=Maquette&oldid=819210495

ROSENSTRASSE: HOLOCAUST EDUCATION THROUGH ROLE PLAY

Holocaust Education Through Role Play

JESSICA HAMMER, MOYRA TURKINGTON, AND NATHAN LEBLANC

Abstract

Rosenstrasse is a digitally augmented tabletop role-playing game for four players and a facilitator. Players take the role of Jews and Aryans in mixed marriages living in Berlin between 1933 and 1943; the game culminates in the eponymous protests by Aryan women to free their Jewish husbands. In this paper, we describe key game design challenges encountered in developing a Holocaust-based role-playing game, and how we addressed them. How could players with little historical context participate successfully in the game? What were the risks of players getting the history wrong? Would players accept limits on their agency, and what conclusions would they draw from it? Could we make the connections between characters feel real, meaningful, and motivating in only a few hours? We conclude by sharing preliminary evidence for the game's impact, and by considering some of the challenges of deployment.

Introduction

A key opportunity in game design is to have players take on alternate identities (Klopfer, Osterweil, & Salen, 2009). These identities can broaden our perspectives, for example by revealing the lost and forgotten histories of women, by centering marginalized historical experiences, and by providing a multiplicity of perspectives rather than a single dominant narrative. Walter Benjamin called this process "brushing history against the grain" (Benjamin, 2005), and it is equally critical today. Brushing history against the grain is a political act meant to allow us to re-imagine our past, understand our present, and create our future. Through historical role-play, players can be invited to participate in this process.

Rosenstrasse is a digitally augmented tabletop role-playing game for four players and a facilitator. Players take the role of Jews and Aryans in mixed marriages, living in Berlin between 1933 and 1943. During the first part of the game, players experience the erosion of civil rights and the persecution of Jews through the lens of their marriages. By centering these marriages, which protected the Jewish spouse to a greater or lesser degree, the game challenges the dominant narratives of persecutor and victim. In February 1943, however, that protection ended, and the Jewish men in these marriages were rounded up for execution. Their wives and other family members led a spontaneous non-violent protest outside the Rosenstrasse holding facility. Eventually, most of the men were released, which serves as the climax of the game.

Designing a game addressing the Holocaust is a challenging problem. Some Holocaust educators argue that using games or simulations around this topic "trivializes" the subject, for example by collapsing the experiences of victims and survivors into the experience of play (Davidowicz, 1992; Totten, 2000). On the other hand, Schweber found that emotionally identifying with individual Jewish lives, particularly those that did not line up with simple stories of victimhood, helped players develop empathy and gave context to factual information about the period (Schweber, 2004). While *Rosenstrasse* is not intended to be used in a classroom setting, we draw on Schweber's approach to ask players to think differently not only about the Holocaust, but about themselves (Facing History and Ourselves, 2017).

In this paper, we describe key game design challenges encountered in the development of *Rosenstrasse*. How could players with little historical context participate successfully in the game? What were the risks of players getting the history wrong? Would players accept limits on their agency in the game, and would they be able to connect it to the historical context? Could we make the connections between characters feel real, meaningful, and motivating in only a few hours? And finally, how would the game transform players? We conclude by sharing preliminary evidence for the game's impact, and considering some of the challenges of deployment.

Literature Review

Historical role-playing games can be effective ways of engaging with history; however, the Holocaust introduces substantial challenges to the design and deployment of such games.

Historical Role-Playing Games

Tabletop and live-action role-playing games ask players to take on the roles of characters in a shared fictional world. When that world is a historical one, these games can provide opportunities for players to engage with history. For example, games in the *Reacting to the Past* series situate players in a Ming dynasty succession crisis, the trial of Anne Hutchinson, and the Indian independence negotiations (*Reacting to the Past*, 2018). Players take on the role of stakeholders in these historical events and explore them through the lens of their characters.

In formal educational settings, role-playing games can be used as part of the curriculum (e.g. Carnes, 2014; Travis, 2010) or can even replace the curriculum entirely (Hyltoft, 2008). In informal play settings, role-playing games offer the opportunity for players to adopt the roles and practices of historians (Hammer & Heller, 2012) and to experience aspects of history that might otherwise remain abstract (*Kapo*, 2017). While many role-playing games incorporate fantastic or fictional elements, these elements can actually encourage players to research and reflect on history (Hammer & Heller, 2012). Post-game debriefs can also aid reflection and transfer, whether conducted by an instructor or by other participants (Crookall, 2014; Atwater, 2016).

To be most effective, educational games should be well-designed (Clark, Tanner-Smith, & Killingsworth, 2016) and should align game content with the game's activities (Aleven, Myers, Easterday, & Ogan, 2010). Whether a particular historical role-playing game is explicitly educational or merely incidentally so, these games can take advantage of what role-playing games do best. Hammer et. al. (2018) identify key opportunities of the genre that include portraying a character, manipulating a fictional world, generating an altered sense of reality, and sharing an imaginative space. In a historical role-playing context, these elements can be used either to communicate dominant narratives of history, or to brush history against the grain.

Holocaust Education

While role-playing can be an effective way of engaging players with history, Holocaust history introduces unique challenges. Substantial debates exist within the field of Holocaust education, including what is meant by Holocaust education in the first place (Davis & Rubenstein-Avila, 2013; Francapane & Haß, 2014). Should the emphasis be on the entire Nazi period, including the early persecutions of Jews, or primarily on the mass killing? To what extent should it focus on the Holocaust as a Jewish experience of genocide, to what extent should it incorporate the Roma genocide, and how should it address the persecution of other groups? How much should the material be universalized, for example by drawing moral lessons, and how much should it be particularized to that historical period and/or to the history of antisemitism? These debates become even more complex when placed in a global context. For example, relatively few Jews remain in most Central and Eastern European countries, but persecution against the Roma is ongoing; in some of these countries, focusing on the Jewish victims of the Nazis may be a safe way to avoid political action (Bărbulescu, Degeratu, & Guşu, 2013).

One major question in the field concerns the appropriateness of simulations and games as a pedagogical approach. Critics cite two areas of concern. First, does the nature of simulation trivialize the Holocaust? By making the experience tame, or by risking making it fun for players, a game might diminish the historical events themselves (Laqueur, 1994; Totten, 2000). Second, would players learn the wrong things from their experience? For example, they might believe that they truly understood what the victims of the Holocaust had suffered (Totten, 2000).

While these are serious concerns, empirical research on Holocaust education suggests that these are problems games and simulations must *address*, not ones that are inherent to games and simulations as an approach. For example, Schweber (2004) observed a successful classroom simulation that fused moral and historical experiences into a larger whole (Facing History and Ourselves, 2017). While many students described the simulation as fun, Schweber points out that they likely did not have better language to express the deep, respectful engagement she observed in the classroom. Additionally, in the simulation Schweber observed, students began by taking on the roles of Jews living everyday lives under the Nazis, in sharp contrast to most images of Jews in Holocaust education (which typically emphasize propaganda images and images from death camps). This role-taking led them to see Jews as ordinary people rather than through the eyes of the perpetrators of the Holocaust, brushing history against the grain.

Schweber attributes the success of the simulation she observed to the gifted instructor, and calls it "barely replicable." Additionally, she identifies limitations with the design of the simulation, such as the failure to connect Jewish stories to the role of bystanders and non-Jewish collaborators. These are design challenges that future work – such as *Rosenstrasse* – can address.

Historical Context

Rosenstrasse is set in Berlin between 1933 and 1943. When the game begins, Hitler has just been appointed as chancellor; the country is economically unstable, politically polarized, and ideologically divided. Under his rule, the civil rights of Jews were first restricted, then revoked. For example, the Nuremberg Laws of 1935 forbade marriages between "Aryans" and Jews, while by 1936, Jews had been banned from all professional jobs. By September of 1939, over 60% of German Jews had fled the country, but over 200,000 remained. Then the deportations and executions began (Kaplan, 1996).

Despite the Nuremberg laws forbidding new intermarriages, approximately 30,000 previously-intermarried couples remained in Germany in 1939. Intermarriages where the Jewish partner was female were in many ways treated as German families, while intermarriages involving Jewish male partners were far more affected by legal restrictions (Stoltzfus, 1996; Koonz, 2013). Similarly, some intermarriages were considered "privileged," such as families who had chosen to baptize their children prior to 1935. Privileged marriages afforded a degree of protection to the Jewish partner, such as not having to wear the star (Stoltzfus, 1996; Koonz, 2013). Until 1943, intermarried German Jews did not have to fear deportation, even as the remainder of the Jews of Germany were being systematically executed.

On February 27, 1943, the Gestapo began a final roundup to capture and deport the last Jews of Berlin. The targets included approximately 1,500 Jewish men in privileged marriages. While Jews were held at several locations around the city, most of these men were taken to Rosenstrasse 2-4. By that night, hundreds of women had gathered in front of the building. Between February 27 and March 6, they protested day and night, demanding their husbands' release (Stoltzfus, 1996). Behind the scenes, German authorities debated whether or not to shoot the protesting women; the SS sent trucks with machine guns to threaten them, but the women stayed put. On March 6, 1943, Goebbels ordered that the Jewish men held at the Rosenstrasse facility be released back to their families.

Jewish men who had the bad luck to be sent to another facility due to overcrowding did not fare as well. These men were sent to Auschwitz, along with the other Jews caught by the final roundup, and some of them were murdered there. Others were returned from Auschwitz to a prison camp outside Berlin as a result of the protests (Stoltzfus, 1996).

On May 19, 1943, Germany was declared *judenrein*, or free of Jews. By 1945, approximately 8,000 Jews remained in Berlin, either in hiding or married to non-Jews (Gross, 2015). The men released from the Rosenstrasse facility were among the survivors.

The Rosenstrasse protest was the only protest ever raised against the "Final Solution" under the Third Reich (Michalczyk, 2004).

Game Description

Rosenstrasse is a tabletop role-playing game for four players and one facilitator, designed to be played in a single four- to five-hour session. During play, players describe the thoughts, feelings, and actions of their characters. The facilitator presents game challenges, tracks secret information, helps players follow the rules, and manages the time allocated to each scene.

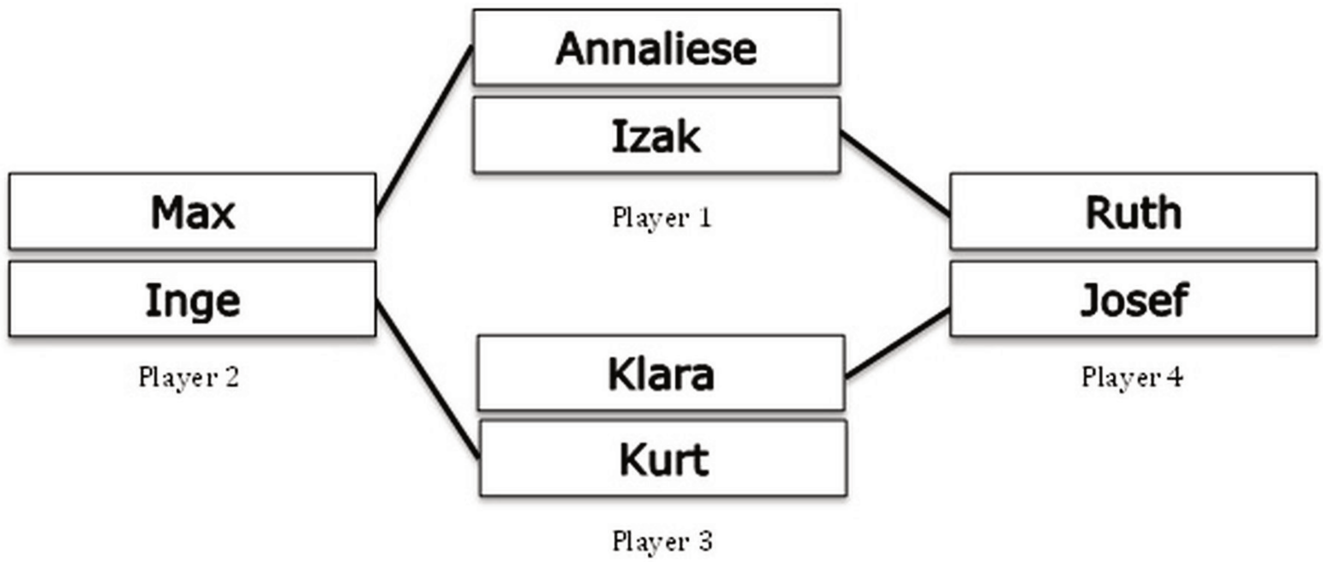

Figure 1: Relationships between players and characters at the game table.

Each player is assigned two characters: one male, one female. They alternate between portraying their two different characters in different scenes of the game. These characters span a range of social positions that affect their vulnerability to the Nazi regime. For example, Ruth is a Jewish woman married to an Aryan man, so her family is considered an Aryan family and is largely unaffected by the race laws. On the other hand, Max is a Jewish man, so his family is considered Jewish even though he is married to an Aryan woman, and their lack of children reduces the protections of their marriage further.

Characters are paired with one another, either as spouses or siblings. Characters are assigned so that each person's spouse or sibling is played by another player (Figure 1). Each player directly interacts with two other players during most of the game: one as the partner for their male character, and one as the partner for their female character. In some scenes late in the game, characters can interact with characters other than their partner. More typically, however, one or two players are interacting with one another and with the facilitator, while the rest of the players watch.

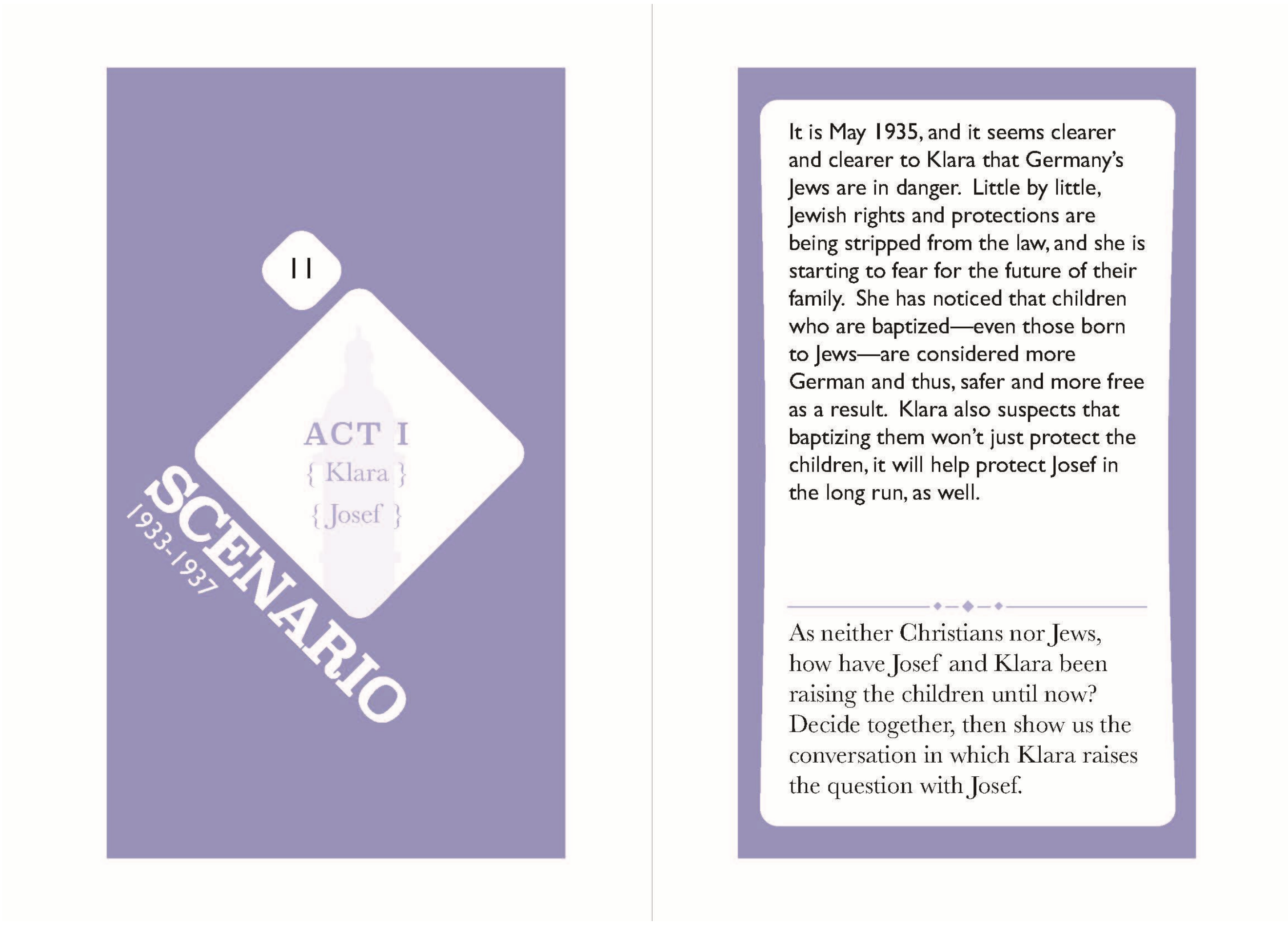

Figure 2: A sample scenario card.

The game is made up of 90 individual scenes, separated into a Prologue (1921-1933), Act I (1933-1937), Act II (1938-1942), Act III (February-March 1943), and the Epilogue (1943). Each scene is presented on a card, and reprinted in a guidebook for facilitators. In addition to the text on each scene card, the facilitator's guidebook includes additional instructions for the facilitator and suggestions for how they can support players in that scene. Not all scenes are used in a given game of *Rosenstrasse*, as players' choices can cause some cards to be discarded.

There are three different types of scene card: scenario, update, and complicity cards.

Scenario cards (Figure 2) ask the facilitator to read text from the card, typically followed by a question or prompt directed at the characters named by the card. For example, one scenario card asks Klara and Joseph to role-play a conversation about whether to baptize their children, and then to decide whether they will do so. The facilitator may also have other actions to take as a result of the scenario card. For example, one scenario card asks the facilitator to distribute yellow star tokens to the players.

Update cards are distributed to the players between acts and provide new information about their characters. Update cards are read privately by each player, then summarized back to the group.

Complicity cards come in pairs. Each pair of cards is handed to a player, who silently reads them and must decide which one to inflict on the character named by the card. They then take the facilitator role, reading the card aloud and asking the affected character how they behave. Unlike scenario and update cards, which are focused on the central characters, these cards describe acts of complicity by ordinary Germans with the Nazi regime.

The facilitator also has a risk matrix for the male characters, a tracking sheet that allows them to identify what actions have made them more or less vulnerable to the Nazi regime. For example, baptizing one's children before 1935 decreases risk, while coming to the attention of the authorities in any way increases it. The facilitator is instructed not to show the risk matrix to the players, or to answer questions about what they are tracking.

Additional game materials include character sheets for each of the eight characters (each player receives two sheets); yellow star tokens, to be worn by relevant characters after 1935; a set of postcards used during the epilogue; and optional sound files that can be used to enhance the experience of specific scenes. A facilitator app, which can replace the printed guidebook, is currently under development. The app automates some facilitator functions, such as card selection, and logs player decisions for later reflection and discussion.

Playtesting and Data Collection

Full sessions of *Rosenstrasse* have been run at game festivals such as Fastaval, at game conventions such as Metatopia, at synagogues and Jewish centers, and in private sessions for historians and educators. A formal research study is currently ongoing, with preliminary data presented here. Across all contexts, more than 25 sessions of the game were run involving over a hundred players and facilitators.

Recruitment for playtest sessions was performed through the organizations involved with the playtest, including advertising in local museums and libraries. Data collected from playtest sessions included facilitator observations of play, player feedback forms, and summaries from the post-game debrief. This data was used to identify design issues with the game and perform design iterations. The exact data available varied across contexts and by facilitator. Additionally, nearly 10% of playtest participants independently contacted the designers to provide additional feedback on the game.

Recruitment for the research study was conducted on and around the campus of a private university in a moderate-sized American city. All game sessions were recorded, as were post-game debrief sessions and interviews. Demographic data was collected from all players, including their prior knowledge of the Holocaust. When four players could not be recruited for a given session, a research confederate played with the group. A preliminary dataset of interviews were transcribed and open coding was used to identify key themes.

Across all sessions, players varied in their knowledge of the Holocaust and in their relationship to the Holocaust. Players have included the children and grandchildren of Holocaust survivors, the grandchildren of Holocaust perpetrators and collaborators, professional historians, and players who had never learned about the Holocaust before. Players also varied by age (18-80), by gender, by country of origin, and by racial and ethnic identity.

Finally, Holocaust educators performed a heuristic evaluation of the game text and other game materials.

Design Challenges and Game Analysis

Rosenstrasse faced a number of design challenges related to its subject matter and its transformational goals. We describe these challenges, how we addressed them as designers, and what we observed from playtests and preliminary research studies.

Beyond Victimhood

One challenge of Holocaust media is that it often flattens Jewish stories into a single story of victimhood (Schweber, 2004). Not only does this dishonor the complexity of Jewish lives, it also allows non-Jews to implicitly cast themselves as the heroic saviors of the helpless Jewish people. *Rosenstrasse* seeks to brush history "against the grain," recovering the lesser-known stories of women during wartime. However, focusing only on the women of the Rosenstrasse story would play into the dominant narrative of the non-Jewish rescuer, when in fact the vast majority of Germans were either complicit with or actively participating in the Nazi regime.

By requiring every player to have two characters, one a Jewish man and one a protesting woman, we were able to focus on the heroism of the women while still centering Jewish voices. We were also able to complicate the stories of two of the female characters to incorporate Jewishness. Klara is racially classified as Aryan, but must keep her Jewish grandmother a secret or be reclassified as *mischlinge*. Ruth is a Jewish woman married to an Aryan man (Hans, portrayed by the facilitator). She is personally safe, but can do much less to protect her brother Izak than the other women can do to protect their husbands. More broadly, we chose social situations for our characters that would show the diversity of Jewish lives. There is no single story of what it meant to be a Jew in wartime Berlin. The characters vary in social class, in political outlook, in their relationship to Judaism, and in the relationships they have with their spouses. This diversity complicates typical Holocaust narratives.

We observed players comparing and contrasting the experiences of different characters in the game. These contrasts illuminated the "crazy" and "shocking" rules of the Reich, which players felt were both irrational and inescapable. These comparisons drove players to action as their characters. For example, one player explained that "I feel like why I did half of what I did as Ruth was that I felt guilt … like when the [Jewish] stars came out, that [Izak] got one and I didn't. It felt wrong and unfair. Our lives weren't that different … we were siblings and our biology is the same, we have the same parents. But by virtue of who we married and the fact that [Izak] was a man and therefore married a woman who couldn't carry her protections onto him, that parallel felt really wrong and guilt-inducing." Players also reported comparing the two characters they personally portrayed, e.g. "I felt [a stronger connection] with Josef than with Ruth. Like, by the end I very much felt like Josef. When he lived, I lived." Finally, players reported learning about new categories of Jewishness, such as *mischlinge*. Both the *mischlinge* characters (Kurt and Klara) are treated as Aryan early in the game and only revealed as Jewish later on. This mid-game revelation caused players to internalize and process the characters' Jewish identities. For example, one Klara player chose to keep her Jewish grandmother secret for part of the game because "I hadn't come to terms with it yet." Note the player's use of the first person to describe the process.

Supporting Participation at Varying Levels of Historical Knowledge

As a role-playing game, *Rosenstrasse* faces additional challenges related to history. Players do not simply consume game content, but also contribute to it through the choices their characters make. However, we wanted to make the game accessible to players who might not know very much about the Holocaust or about Berlin under the Reich. How could players make meaningful choices and contribute to the game without a strong grounding in history?

To address this, we asked players to ground their participation in emotional rather than historical expertise. Each player is situated in two different long-term relationships, one for each of their characters. They can use what they know about sibling relationships and/or marriages to inform their choices, and they are explicitly instructed to do so as part of the game instructions. Scene prompts are written to support a relational approach to the material, and embed the history in character-centric decisions. For example, one scenario card asks Max and Annaliese to describe how they comfort one another while huddling in a coal cellar during a bombing (Figure 3). The historical information, which is that Jewish families were not permitted to use bomb shelters reserved for Aryan Germans, is embedded in the text read by the facilitator and made actionable by the content of the prompt.

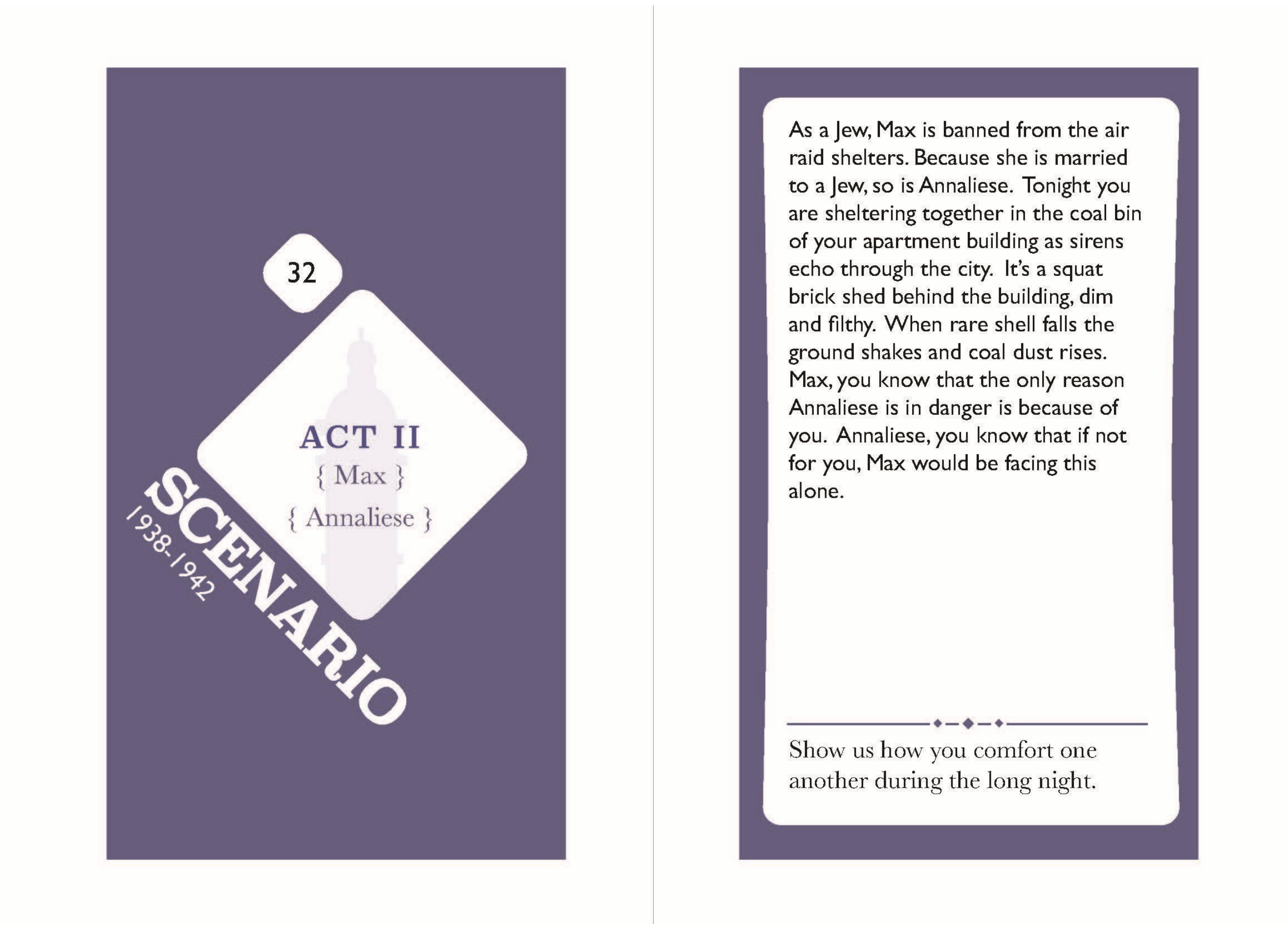

Figure 3: Annaliese and Max in the coal cellar.

Nonetheless, allowing player contributions risks players getting something wrong about the history of the period or about the Jewish experience. One way we addressed this was giving the facilitator the role of gently steering the players around the history. They are explicitly instructed to ignore minor inaccuracies, such as a wrong date or pronunciation, but can suggest acceptable alternatives if players are truly far from the historical reality. Of course, facilitators also may not be knowledgeable about the history. To support this role, the facilitator's guide provides suggestions around scenes where playtesting revealed that players were most likely to make errors. For example, in one late-game scene, Annaliese is waiting for Max to return from work, when in fact he has been caught up in the roundup. In playtests we observed that Annaliese's player would commonly suggest that she call someone, when in fact she would have had no access to a telephone. A note to that effect was added to the facilitator's guide.

Many of the racial laws in Germany under the Reich were difficult, contradictory and hard to understand – and yet they would make a life-or-death difference to the characters and their children. Despite the fact that the game could not teach the minutia of how the laws worked, we needed to find ways to have facilitators effectively convey the information, and to help players understand how the law was targeting their characters and loved ones. For example, the laws around who had to wear a yellow star were particularly complicated. We created an extended scene in which the facilitator assigned stars and read pre-generated justifications for the decisions, so that they could be accurate in reflecting a complex system. As each Jewish character is addressed, they are given an emotionally evocative prompt to respond to. For example, Jews had to pay for their own stars. Max, the poorest of the characters, is asked which of his few possessions he will sell in order to afford the star that marks his persecution.

Even given these techniques, and even with relatively knowledgeable participants, there is still the possibility of groups making mistakes with the history. We considered inserting additional historical information, such as pre-game readings for the facilitator, but we discovered that players were motivated to verify the historicity of game elements after play. When team members conducted post-game interviews, typical questions included whether the protests really happened and whether other elements of the game were true. Because misunderstandings were likely to result in players conducting research after the game, and did not appear to risk falling into existing stereotypes or misconceptions, we chose to give participants the opportunity to make mistakes with the history during play in service of post-game engagement.

In practice, both players with high and low levels of historical knowledge were able to participate in the game. For example, a player who identified themselves as having "the least knowledge of the Holocaust" commented that you "probably can't even imagine the details" of the atrocities in any meaningful way, but that "you can truly identify with [the game experience] at a human level" and "make decisions like the character would make." In other words, rather than attempt to imagine the atrocities in detail, the character provided a lens to create "personal connection" and "context" for the history, as per Schweber (2004). Meanwhile, historically knowledgeable players, and particularly those with personal connections, described their historical knowledge as providing context and meaning over and above the gameplay. For example, one descendant of survivors said, "When [something that happened to my family] would come along, I would have this initial reaction of 'Oh boy, here we go, here's that thing.' But the further along we got in the story and the more emotionally attached I was to the characters, the less it was this feeling of removed dread and it felt really personal…. I think the combination of the [historical] knowing and the relating back to the feeling of hearing the stories of people you do know, it sort of ties it home in a really real and emotional way."

Managing Agency

One concern of Holocaust educators is the problem of agency. The question "Why didn't people just *do* something?" reflects a naïve approach to social systems and can sometimes be used to blame the victims of the Holocaust (Totten, 2000). This problem is amplified by the game context, which primes players to be able to make meaningful decisions. In a potentially open-ended tabletop game, players may try to stop the Holocaust or defeat the Nazis, instead of engaging with the limited agency possessed by ordinary people living in Berlin under a fascist regime. This is particularly important because the Aryan wives, extended families, neighbors, colleagues, and oppressors in the story provide a system of individual people making individual choices that enabled the Reich to happen. These people were sometimes complicit in the oppression of Jews, they were sometimes resisting the oppression of Jews, and sometimes they were doing both at the same time. To convey that reality, players have to understand what is and is not possible for their characters to accomplish.

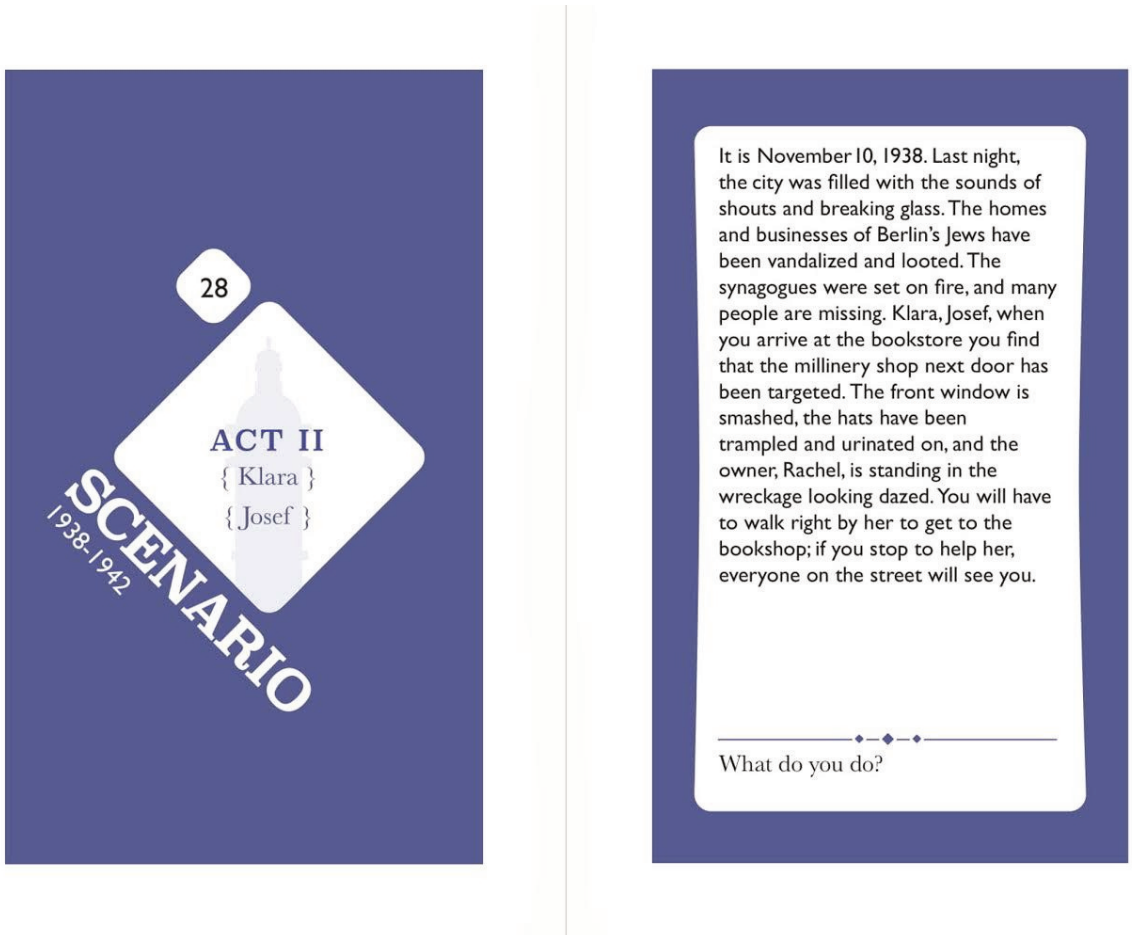

Figure 4: The morning after Kristallnacht.

One way we addressed this issue was through prompt design. Prompts cast the characters in intimate, domestic scenes, or as vulnerable when in public. For example, we knew we wanted to have a scene involving *Kristallnacht*. Instead of allowing the characters to play during *Kristallnacht* itself, we set the scene the morning after (Figure 4). Klara and Josef arrive at their bookshop, which was not damaged because Klara passes for Aryan. The choice they must make is whether to risk social censure in order to comfort their Jewish neighbor, whose hat shop has been destroyed. In playtests, we observed that the prompt issues a moral challenge and provides scope for emotional agency without inviting action-movie heroics. The characters develop their resistance not in immediate, dramatic action, but rather in the thick of everyday life.

Only at the end of the game, when the female characters collectively (and historically) protest, can players collectively resist the regime. Players reported rising tension throughout the game, often associated with looking at the card deck to see how many scenes were left. As cards were removed from the deck, players knew that an inevitable and possibly dark ending was coming for their characters. As that tension increases, the prompts allow more direct confrontation for the female characters attending the protest. A woman screams at a prison guard. Another returns to the protest after being ordered to disperse. Players are typically quick to take up these offers of dramatic action, which contrast with the scope of the choices they are offered in the rest of the game.

After the game, players often asked whether their decisions changed the game's ending. For the female characters, the answer is no. All female characters always survive the game, though their life circumstances are affected by player decisions. However, player decisions do affect the ending for the male characters. There are four possible game endings, which are assigned to characters based on their vulnerability score. More vulnerable characters have worse endings, including deportation to Auschwitz. The facilitator tracks the vulnerability of male characters secretly, and players do not always know which actions will put their male characters at risk. Although players are often dubious whether their actions made a difference to how the game turned out, they nonetheless report feeling that their choices during the game were meaningful and important.

Players also reported that the game successfully captured "the frustration and helplessness that these people were feeling. There's no way to be like, 'Oh, there's a friend who will get us to America' in the early part of the game." Another participant reported that it made them "more empathetic to those characters in history, especially when we say 'Why didn't they just leave?' Like, this game shuts down that question entirely, which I think is really effective and opens you up to thinking more constructively about history and why human beings seem to repeat the same mistakes over and over again." While players found the game's constraints experientially frustrating, they drew insights from them to obviate the question of why people did not act. At the same time, some players reported that a late-game scene, where an old friend of Klara's refuses to help her, left them asking why the women waited to protest until it was *their* husbands on the line. This tension is at the heart of what we hope to convey with *Rosenstrasse*.

Building Relationships

Agency alone is not enough to carry the climax of the game, in which the women participate in the Rosenstrasse protest. To give the climax emotional weight, the first two acts of *Rosenstrasse* compress ten years of a Jewish-Aryan marriage into three hours. As part of this design goal, we took advantage of live tabletop play to create intimacy-enhancing physical cues. For example, players are assigned a consistent partner to play their spouse throughout the entire game. Periodically, each pair receives a single physical card that describes their next role-playing scene. The text on the card is deliberately small, so that the partners must lean toward one another and bend their heads together over the card in order to play. In playtests we observed that this physical closeness helped players feel connected, even when they never touched one another.

Part of making the marriages and the sibling relationship feel real meant including moments of connection, joy, and relief along with moments of oppression and fear. These moments also allowed us to highlight Jewishness outside the context of persecution. For example, early in the game, Izak and Ruth's families host a joint Passover Seder (Figure 5). The prompt on the card places Izak and Ruth in the position of benefactors, offering gifts to their children in exchange for the ritual-ending afikomen. It demonstrates the closeness of the characters and their families, and it shows that although both siblings are married to Aryan Germans, Jewishness is important in both their lives. We observed that these moments of intimacy heighten the heartbreak of the sad times; players felt that they had something of value to lose.

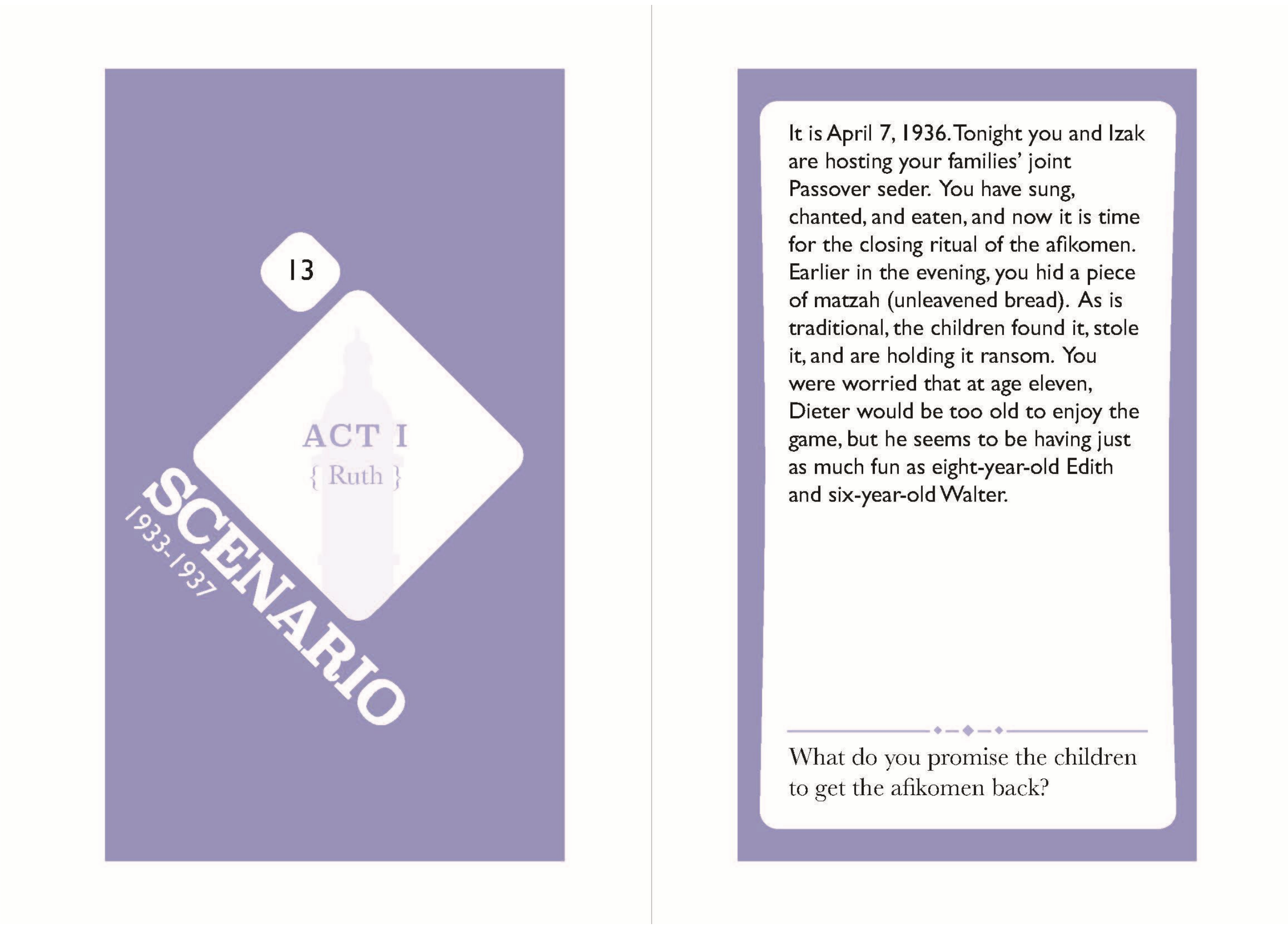

Figure 5: The Seder scene.

We also generated tension between the characters relating to the intersections of race and gender. Under the guidance of the Reich, the priorities of a woman were expected to be husband, family, children, and home (Stoltzfus 1996, Koonz, 2013). Women did not have access to a lot of influence outside of that framework. But in their mixed marriages, these women often found themselves with a sudden power over their husbands, and conflicting priorities from the government. They were under constant pressure to divorce and abandon their husbands, and they knew that if they did that their husbands would not survive it. Inge, for example, is explicitly asked to divorce her husband Kurt by her Aryan family members; her players describe this decision as appropriately momentous, no matter what they choose.

Players described their in-game relationships as intensely motivating. In describing a late-game scene where Izak is arrested, Ruth's player explained, "How do you get the officer out of your house? What do you do? You have to care for your kids but you also have to care for yourself and your brother." The relationships felt profound and real to the player, providing a driving emotional baseline for the scene. Another player described the game-ending protest: "So like everybody there loves their husbands, but in different ways. They love their children and are thinking about them all the time. They're thinking 'Can I afford to lose my life? Will this be successful? Is there any point to trying to get this person out? Should I give up?'…. Here's everyone protesting, 'I'm here because I love this person, I want them back. Let's just go forwards.'" Not only did the player feel a deep connection to their in-game spouse, they also directly connected it to why the protest felt so important to them during play.

Takeaways

Finally, there is the question of the impact of the game on players. As designers, we considered the Rosenstrasse story as part of a history of protest. Many people think of the Nazi regime as a great, unshakable, ultimate evil that could not be challenged. While that is not an undeserved reputation, it is also not the whole truth. In accepting that narrative, we excuse ourselves from action, in the past and in the present and in the future. *Rosenstrasse* fundamentally challenges this narrative and reveals it as the lie it is. This group of women—average, everyday women, who themselves were in very vulnerable situations, who had no support or personal power stood up against the Reich in a peaceful and unorganized protest and the Reich capitulated. This challenges players to consider the idea that maybe there was more people at the time could have done, and that there might be opportunities for them to resist injustice today. This opportunity for transformative play is the key this game, because we are not asking people to play a game about the Holocaust for fun. We ask people to submit themselves to a game about the Holocaust to learn something, to see the world differently, to act differently in it, and to find new courage in themselves.

Players reported that they learned new things about the Holocaust from playing *Rosenstrasse*. For example, one player reported that despite doing "Jew school" for many years, they had never heard of the Rosenstrasse protests: "Everyone always talks about the *suffering*… *Kristallnacht* gets covered ad nauseum, they talk about Auschwitz and Birkenau and Bergen-Belsen, and they talk about people who helped hide Jews and get them out. But they don't talk about the ways that people tried to resist…. The protest for me was the shock." While implying that protests were common would be inappropriate – they were not – the game provided a useful contrast to the dominant narrative.

Players also connected the game to their personal responsibility to resist oppression. For example, one player commented that "it's quite easy to just sit back and let things happen… unless you were the one being directly affected by it, and it shows that sometimes you just need to put yourself out there and put yourself in other people's boots, step into the characters boots or step into another person's boots, and try to figure out what they might be going through to help. Cuz its, I mean it's really easy to walk away from all this and say 'I'm not going to bother myself' like… Klara could have said I don't have to wear the Star of David. And Inge could have just stayed back home, but they didn't. And I guess, personally out of the game as well, I can choose not to do a lot of things as well and just sit back and enjoy my life, but what's the point?" Here we see the player identifying with the female characters, all of whom are safe from being directly targeted by the regime. Rather than focus on the moments of complicity, the player describes moments where these women chose to stand in solidarity with the

Jewish men in their lives; they then connect these moments with their personal choices to help others and show solidarity.

Finally, the game seems to have a significant and lasting effect on at least some players. In addition to the feedback provided immediately after play, nearly 10% of players have independently contacted us months or even years later to talk about their experiences in the game. Three separate players have sent us photographs from the Rosenstrasse memorial in Berlin, and one reported adding Berlin to their itinerary specifically so that they could visit the memorial. Multiple players cited the game as "the most honest conversation [they] have ever had about the Holocaust," particularly those for whom family legacies had previously made such conversations fraught. At least one of those players reported subsequently beginning a difficult family conversation as a result. Some players have simply reached out to let us know how much they enjoyed playing the game, despite its difficult emotional content, and to ask when they can play again.

Conclusion & Future Work

This paper describes key design decisions for the historical tabletop role-playing game *Rosenstrasse*. In particular, it examines techniques used to reduce the need for players to know history; to manage the risk of historical inaccuracy; to address the necessary limitations on player agency for a game set under the Reich; and to make the connections between the characters feel real, meaningful, and motivating. While a formal study of the impact of Rosenstrasse is beyond the scope of the present work, our evidence to date suggests that the game is an important and meaningful experience for players. In the long term, we hope to evaluate the impact of *Rosenstrasse* around three transformational goals. What do players learn about history? How does *Rosenstrasse* change their thinking about resistance to oppression? Does playing the game with "weak ties" – people that know each other, but not well – help them build networks related to activism? We look forward to better understanding the impact of our design choices on the game's transformational outcomes.

We also look forward to addressing some of the challenges of deploying *Rosenstrasse*. Because the game requires approximately four hours and exactly five participants, one of whom is willing to take the role of a facilitator, coordinating sessions can be complex. To partly address this, we have created a short demo of the game that can be used to raise player interest, and we are developing a facilitator app that can lower the burden of facilitation. However, there are also larger questions of where, when, and by whom this game is played. Beyond festivals and conventions, what is the right setting for the game? For example, we have turned down several opportunities to integrate *Rosenstrasse* into formal history curricula, because we believe that making gameplay mandatory may induce reactance in players (Heeter, Lee, Magerko, & Medler, 2010). How might the game need to be adapted for global play? We look forward to exploring these questions of deployment and accessibility, and to engaging new audiences with our game.

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References

Aleven, V., Myers, E., Easterday, M., & Ogan, A. (2010, April). Toward a framework for the analysis and design of educational games. In *Digital Game and Intelligent Toy Enhanced Learning (DIGITEL), 2010 Third IEEE International Conference on* (pp. 69-76). IEEE.

Atwater, B. (2016). We need to talk: A literature review of debrief. *International Journal of Role-Playing*, 6, 7-11.

Bărbulescu, A., Degeratu, L., & Guşu, C. (2013). The Holocaust as reflected in communist and post-communist Romanian textbooks. *Intercultural Education, 24*(1-2), 41-60.

Benjamin, W. (2005). On the Concept of History (D. Redmond, Trans.). Retrieved from https://www.marxists.org/reference/archive/benjamin/1940/history.htm

Carnes, M. (2014). *Minds on fire: How role-immersion games transform college.* Cambridge: Harvard University Press.

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. *Review of educational research, 86*(1), 79-122.

Crookall, D. (2014). Engaging (in) Gameplay and (in) Debriefing. *Simulation & Gaming, 45*(4-5), 416-427.

Davis, B. L., & Rubinstein-Avila, E. (2013). Holocaust education: Global forces shaping curricula integration and implementation. *Intercultural Education, 24*(1-2), 149-166.

Dawidowicz, L. S. (1992). How they teach the Holocaust. In N. Kozoday (Ed.), *What is the Use of Jewish History?* (pp 65-83). New York: Schocken Books.

Facing History and Ourselves. (2017). Retrieved from https://www.facinghistory.org/

Fracapane, K., & Haß, M. (2014). *Holocaust education in a global context*. Unesco.

Gross, L. (2015). *Last Jews in Berlin*. Open Road Media.

Hammer, J., & Heller, K. (2012). Playing history: How Ars Magica players develop historical literacy. *Proceedings of Meaningful Play*.

Hammer, J., To, A. Schrier, K., Bowman, S., & Kaufman, G. (2018). Learning and Role-Playing Games. In Deterding, S., & Zagal, J. (Eds.), Role-Playing Game Studies: Transmedia Foundations (283-299). Routledge.

Heeter, C., Lee, Y., Magerko, B., & Medler, B. (2010). Impacts of forced serious game play on vulnerable subgroups. Meaningful play, East Lansing, MI. Retrieved from http://meaningfulplay.msu.edu/proceedings2010/mp2010_paper_61.pdf

Hyltoft, M. (2008). The role-players' school: Østerskov efterskole. *Playground Worlds Creating and Evaluating Experiences of Role-Playing Games, 14*, 12.

Kaplan, M. (1996). *Between dignity and despair*. New York: Leo Baeck Institute.

Kapo. (2017). Retrieved from http://www.kapo.nu/experience.html

Klopfer, E., Osterweil, S., & Salen, K. (2009). Moving learning games forward. Cambridge, MA: The Education Arcade.

Koonz, C. (2013). *Mothers in the fatherland: Women, the family and Nazi politics*. Routledge.

Laqueur, T. (1994). The holocaust museum. *The Threepenny Review*, (56), 30-32.

Michalczyk, J. J. (Ed.). (2004). *Confront!: Resistance in Nazi Germany*. Peter Lang.

Reacting to the Past. (2018). Retrieved from https://reacting.barnard.edu/about

Schweber, S. (2004). *Making sense of the Holocaust*. New York: Teachers College Press.

Stoltzfus, N. (1996). *Resistance of the heart: Intermarriage and the Rosenstrasse protest in Nazi Germany*. New York: Norton.

Totten, S. (2000). Diminishing the Complexity and Horror of the Holocaust: Using Simulations in an Attempt to Convey Historical Experiences. *Social Education, 64*(3), 165-171.

Travis, R. (2010). A note on the word "practomime". Retrieved from http://www.playthepast.org/?p=198

TEACHING LITERATURE THROUGH THEATRICAL PLAY: EMBODIED DIFFERENCE IN MIXED REALITY GAMES

Embodied Difference in Mixed Reality Games

GINA BLOOM

Extended Abstract

There has been an explosion of interest over the last decade in the use of digital games in educational contexts (Gee, 2007; Salen, 2008; Schrier, 2014), but games and playful performance practices have long been a standard part of the teaching of literature (Chisolme, 2016; Fennessey, 2006; Grant et al., 2008). In particular, scholars and practitioners have published numerous studies of the effectiveness of what I would term "theater games pedagogy" for the teaching of Shakespeare (Banks, 2014; Cohen, 2007; Edminston & McKibben, 2011; Rocklin, 2005; Winston, 2015). The extensive and longstanding investment in ludic strategies for teaching Shakespeare is not surprising given that Shakespeare's dramas are, after all, *plays* and thus deeply connected historically and theoretically to ludic culture (Bloom, 2018). But teachers are especially drawn theater games pedagogy because Shakespeare intimidates and/or bores many students—and sometimes their teachers, too (Blocksridge, 2003; Cohen, 2007; Haddon, 2009). With Shakespeare being the only named author in the English Language Arts curriculum for both the Common Core in the U.S. and the National Curriculum in the UK, the stakes of student disengagement are high. But what is gained and what is lost in theater game pedagogy?

Proponents of teaching with theater games maintain that students, particularly those who are visual, auditory, and kinesthetic learners, understand Shakespeare better when their bodies are involved in the learning process (Banks, 2014; Edminston & McKibben, 2011; Winston, 2015). But as it is traditionally used, theater games pedagogy treats the body as a tool and medium of expression, not as an object to be critically investigated. As a result, theater game pedagogy often presumes a neutrality and universality of the playing body, thereby leading teachers and students to overlook complex issues of gender and racial identity in Shakespeare and in the classroom where his plays are taught (Thompson and Turchi, 2016). This paper argues that digitally remediating theater games can address the shortcomings of this pedagogy without abandoning its core goals and premises.

My case in point is *Play the Knave*, a mixed reality game that I co-designed at the University of California, Davis's ModLab and have integrated into K-12 and university-level teaching, studying its impact. In this Windows-based digital game, one to four players enact speeches or dialogues from dramatic texts. Players design a theater production (choosing from among a range of costumed avatars, theater stage models, and background sounds) and then perform the script they have selected

karaoke-style. The game is preloaded with scripts from Shakespeare's dramas or players can use an online tool to write and upload a script of their own. As players read out their lines, they attempt to move their onscreen avatars with their own bodies: a motion sensing camera captures user-generated skeletal data and maps it onto 3D avatars. This enables the avatars to mirror players' movements in what feels like real time.

I argue that the mixed reality platform of *Play the Knave*—which meshes digital and physical embodiment—is key to its pedagogical effectiveness. By not only bringing digital bodies into the classroom but also *staging* the relationship between these digital bodies and their physical counterparts, mixed reality games like *Play the Knave* draw students organically into conversations about embodied difference.

Bibliography

Banks, F. 2014. *Creative Shakespeare: The Globe Education Guide to Practical Shakespeare*. London, UK: Bloomsbury Arden Shakespeare.

Blocksidge, M. 2003. "Shakespeare: iconic or relevant?" in *Shakespeare in Education.* M. Blocksridge (Ed.). London, UK: Continuum.

Bloom, G. 2018. *Gaming the Stage: Playable Media and the Rise of English Commercial Theater*. Ann Arbor, MI: University of Michigan Press.

Chisolme, J., Whitmore, K., Shelton, A., & McGrath, I. 2016. "Moving Interpretations: Using Drama-Based Arts Strategies to Deepen Learning about *The Diary of a Young Girl*." *English Journal* 105.5, 35-41.

Cohen, R. A. 2007. *ShakesFear and How to Cure It: A Handbook for Teaching Shakespeare.* Clayton, DE: Prestwick House.

Edmiston, B. & McKibben, A. 2011. "Shakespeare, Rehearsal Approaches, and Dramatic Inquiry: Literacy Education for Life." *English in Education* 45.1, 85-101.

Fennesey, S. 2006. "Using Theater Games to Enhance Language Arts Learning." *The Reading* Teacher 59.7, 688-691.

Gee, J. 2007. *Good Video Games and Good Learning*. New York: Peter Lang.

Grant, A., Hutchison, K., Hornsby, D., Brooke, S. 2008. "Creative Pedagogies: 'Art-Full' Reading and Writing." *English Teaching: Practice and Critique* 7.1, 57-72.

Haddon, J. 2009. *Teaching Reading Shakespeare.* New York, NY: Routledge.

Rocklin, E. L. 2005. *Performance Approaches to Teaching Shakespeare.* Urbana, IL: National Council of Teachers of English.

Salen, K. 2008. *The Ecology of Games: Connecting Youth, Games and Learning.* Cambridge, MA: MIT Press.

Schrier, K., Ed. 2014. *Learning, Education and Games*. Vol I: Curricular and Design Considerations. ETC Press.

Thompson, A. & Turchi, L. 2016. *Teaching Shakespeare with Purpose: A Student-Centered Approach.* London, UK: Bloomsbury Arden Shakespeare.

Winston, J. 2015. *Transforming the Teaching of Shakespeare with the Royal Shakespeare Company* London, UK: Bloomsbury Arden Shakespeare.

LEARNING THE ART OF HERDING CATS: THE DEVELOPMENT OF LEADERS IN MMO GROUPS

The Development of Leaders in MMO Groups

OSKAR MILIK

Extended Abstract:

Digital games, in particular games that require cooperative online play, are increasingly a social phenomenon that is shared by people in many different stages of their lives. These men and women engage with social structures of different types; clans, guilds, teams, corporations, and even empires. As they engage with these groups, they find themselves in a position of social and goal-oriented obligation to an organization (Chang & Zhang, 2008; Chen et al. 2008). They may feel social ties to others within the group and the need to help other team-members in order to pursue goal tasks. At the same time, research into leadership in online games indicates that players performing leadership tasks online also learn out-of-game skills for engaging in teamwork and bureaucratic structures (Reeves, et al., 2008). In working with their organization, then, the individual is engaging in social self-improvement that can be applied to situations in other social contexts besides gaming. Even in situations where the player feels like they do not wish to engage in leadership roles, the sense of obligation to their social relations within the organization can cause these players to "step up" and learn these skills (Bos & Shami, 2006; Butler, 2007). As the level of engagement increases, so does the impact that these different game-based interactions on the development of new generations of citizens and workers who will engage in social action and shared social experience.

Digital games research is an active and developing field, and this project lies within it. There have been many works on player demographics and personal goals and experiences (Yee, 2006; Moore, Ducheneaut, & Nickell, 2007), on organizations online (Mysirlaki & Paraskeva, 2012; Nardi & Harris, 2006), and on social problems in these games (Bergstrom, 2012; de Zwart, 2009; Carter & Gibbs, 2013). The value of this work lies in its connection to studies of leadership (Weber, et al. 2001) as described above. This project is based on a series of long semi-structured interviews with leaders of in-game organizations in the online games EVE Online and World of Warcraft. These two-hour long interviews focus on the reasons for why an individual entered a leadership position and how they interacted with others in their group. The participants were 8 individuals in different leadership positions – in WoW, they consisted of guild leaders, raid leaders, and "supporting" officers. In EVE, they were an alliance leader, a corporation leader, and the leader of an EVE Alliance Tournament team (an EVE esports system). Two of the participants were women, with 6 being men. Specific focus was made to ask about how leadership skills were gained and whether the role of leader was a teaching

moment for their lives. The interviews were performed over Skype, TeamSpeak, Discord, and in two cases, in face-to-face interaction. Interviews were recorded and transcribed afterwards.

Analysis is performed through a combination of ethnomethodology (Garfinkel, 1967), dramaturgy (Goffman, 1959), using a grounded theory (Charmaz, 2006) approach. This means that there was not a core theoretical construct or hypothesis at the start of the analysis, and the other analytical approaches, as well as identity theory (Burke & Stets, 2009), were used due to their applicability. This project finds that leaders of these online groups find themselves taking on a different mentality and sense of sociality the longer they engage with others within the group. They start to use different language, focusing on specific goal-oriented speech (Milik, 2015), and ensure to use "in-speak" with members of the group and socialize new members through this organizational language use (Weber, 1995). These habits increase cultural unity, but also causes the leader to feel more accepting of norms through structuralization. Even certain qualities of the organization that they thought were problematic before (recruitment policies, "baddies" in the group) were described as less problematic or at least something worth engaging as leadership became an active identity for these individuals.

In many cases, the actual role of leader is seen in a negative light; there is a large time commitment and very little reward seen in a voluntary form of entertainment. Many of the respondents describe in detail how much happier they would be with the game if they were able to participate without the "need" for leading. Despite this, they also worry that their organizations could be unstable or at least less successful if they did not perform these tasks. Due to the social bonds they've formed as well as the practical interest in engaging end-game content of their game, they feel that the extra work is necessary. In addition, the actual job of having to work with people and organize a large group of anonymous and online-based relationships (described by one as "herding cats") is seen as a learning opportunity to engage in leadership roles that they were able to use as a basis for career advancement or as a talking point in interviews. In many of these cases, the fact that he leadership happened in a game is not mentioned, but the actual skills are transferrable enough that they are helpful to the individual in these contexts. In the end, the feeling of obligation towards others in an online organization is creating a situation where an individual learns important life skills and improves their social and economic position. This can serve as an example of how digital games, when structured to allow for organizational systems and player engagement, can be valuable tools in helping people to learn important qualities and behaviors that help them outside of the game.

Bibliography:

Bergstrom, K. 2012. Virtual Inequality: A Woman's Place in Cyberspace. FDG '12. May 29-June 1, 2012. Raleigh, NC, USA.

Bos, N. and Shami, S. (2006). Adapting a Face-to-Face Role-Playing Simulation for Online Play. *Educational Technology Research and Development*. Vol 54, 5: 493-521.

Burke, P., and Stets, J. (2009). Identity Theory. New York, NY. Oxford University Press.

Butler, B. (2007). Community Effort in Online Groups: Who Does the Work and Why? Paper presented at the *Human-Computer Interaction Institute*. Retrieved from http://repository.cmu.edu/hcii/90

Carter, M. & Gibbs, M. 2013. eSports in EVE Online: Skullduggery, Fair Play and Acceptability in an Unbounded Competition. FDG 2013 Proceedings, Crete.

Chang, J.H. and Zhang, H. (2008). Analyzing Online Game Players: From Materialism and Motivation to Attitude. *CyberPsychology & Behavior, 11*(6) 711-714.

Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. London. SAGE Publications.

Chen, C.-H., Sun, C.-T., and Hsieh, J. (2008). Player Guild Dynamics and Evolution in Massively Multiplayer Online Games. *CyberPsychology & Behavior*. Vol 11, 3: 293-301. Doi: 10.1089/cpb.2007.0066.

De Zwart, M. 2009. Piracy vs. Control: Models of Virtual World Governance and Their Impact on Player and User Experience. Journal of Virtual Worlds Research. 2(3).

Garfinkel, H. (1967). Studies in Ethnomethodology. Polity Press. Cambridge, UK.

Goffman, E. (1959). The Presentation of Self in Everyday Life. New York, NY. Anchor Books.

Milik, O. (2015). Virtual Warlords: An Ethnomethodological View of Group Identity and Leadership in EVE Online. *Games and Culture*.

Moore, R., Ducheneaut, N., & Nickell, E. 2007. Doing Virtually Nothing: Awareness and Accountability in Massively Multiplayer Online Worlds. Computer Supported Cooperative Work, 16, 265-305.

Mysirlaki, S. & Paraskeva, F. 2012. Leadership in MMOGs: A Field of Research on Virtual Teams. Electronic Journal of e-Learning, 10(2), 223-234.

Nardi, B. & Harris, J. 2006. Strangers and Friends: Collaborative Play in World of Warcraft. CSCW'06. November 4-8, 2006. Baniff, Alberta, Canada.

Reeves, B., Malone, T., and O'Driscoll, T. (2008). Leadership's Online Labs. *Harvard Business Review, May,* 59-66.

Weber, R. et al. 2001. The Illusion of Leadership: Misattribution of Cause in Coordination Games. Organization Science, 5, 582-598.

Weick, K. (1995). *Sensemaking in Organizations*. Thousand Oaks, CA. SAGE Publications, Inc.

Yee, N. 2006. The Demographics, Motivations and Derived Experiences of Users of Massively-Multiuser Online Graphical Environments. PRESENCE: Teleoperators and Virtual Environments, 15, 309-329.

INDIGITALGAMES AND THE REPRESENTATIONS OF INDIGENOUS PEOPLES BEYOND TOMAHAWKS AND HEADDRESSES

NAITHAN LAGACE

Digital identity has become an influential aspect of Indigenous representations in the 21st century. With the rise in popularity of social media, blogging sites and other social platforms, identity can become skewed or assimilated in digital media. The Indigitalgames.com project wants to show the complexities and various factors that contribute to representations seen in video games throughout the decades. Initially, the plan was simple, examine images similar to those seen in other media forms like Hollywood Western movies, or Western comics. As I began to investigate more diverse genres of games, there were multiple types of representations involving Indigenous people that didn't follow the Noble Savage characteristics. Not all representations wore headdresses and threw tomahawks. This discovery allowed me to examine other images seen in video games and compare the tropes and stereotypes. As technology continues to develop and expand concepts of space, people use said space to inform, to connect with others over long distances and to explore ideas and values that otherwise would not be accessible in the physical area. By using technology like blogs, social media outlets, and cellular devices, local space becomes intertwined with technology, often, used as a starting point for discussions and relationships. This paper will discuss the complexities that digital media has on Indigenous identity and by using Indigitalgames.com to show video games like Until Dawn and Assassins Creed 3's complex tropes of Indigenous cultures can be used to counteract negative representations of Indigenous people through digital content aimed at educating multiple generations of peoples on video game stereotypes.

Digital media can reshape the way people perceive cultures, and communities as generations of younger people continue exploring this media through technology. Digital technology is an interest for many Indigenous communities who wish to pursue etiquette ways of including their cultures into newer forms of technology. Perceptions surrounding space and the importance of physical space come into question as more Indigenous peoples rely on digital space for connecting with their communities. As younger generations of Indigenous peoples continue to move away from their traditional homelands, the higher the reliance on digital media to stay connected with family back home becomes. Messaging, however, can consistently change within digital spaces as there becomes more input from people sharing similar backgrounds, experiences, and relationships. For many communities, this becomes a concern when representations within digital media become intertwined traditional roles and other information associations. As Joshua describes in his book; *No Sense of Place:*

The Impact of Electronic Media on Social Behavior; "The change in the information characteristics of traditional groups lead to two complementary phenomena: the decreasing importance of traditional group ties and the increasing importance of other types of association" (Meyrowitz, 131). Connectivity through digital media for Indigenous communities raises concerns as many feel digital space assimilates communities and traditions. It is up to re-establishing the importance of roles and responsibilities within communities through digital media to rebalance what potential disconnections may arise while incorporating digital space into physical spaces.

Roles and responsibilities can continue to resemble parts in natural communities if input and relationships continue to be reflected similarly within digital spaces. Reconnecting physically disconnected people to communities through digital space is essential, as technology can quickly bring individuals back into their respective communities. It is important to note, that because physical presence declines within Indigenous communities with every generation, roles of elders and youth can still preserve the importance of relationships through contributions in digital space. Knowledge can again be passed down, and relations can always be upheld using technology. As Joshua explains; "Electronic media affect social roles because they bypass the communication networks that once made particular places unique. More and more, people are living in a national (or international) information system rather than a local town or city" (Meyowrityz, 146). Reconstructing relationships within Indigenous communities by using digital media allows families to reconnect that are separated by physical space. However, concerns arise as aspects of identity become harder to simulate within digital media outlets that involve larger, multi-ethnic groups, which incorporate more substantial inputs from people that undermined or underestimate essential aspects of a particular culture.

Relationships within the digital realm have considerably more identity issues when relating to physical ones. Part of the problem, as Joshua describes is that; "The integration of social spheres does not simply give people new places to play their old roles; it changes the roles that are played. As place and information access become disconnected, place-behaviors and activities begin to fade" (Meyrowitz, 148). Within physical connections, roles of elders or community leaders become tied to community presence. These social spheres reinforce the importance of continuing roles and responsibilities, tieing people back into their culture. Digital media plays a significant role in rebuilding mentioned relationships, as more and more Indigenous youth travel away from their home communities pursuing a career or personal interests. Using social media sites, blogs or even digital phone channels like Skype or Discord, youth can now reconnect and often teach older generations to harness these technology gifts as tools for reinforcing positive relationships. What digital sites achieve is significant, as on the one hand they can strengthen roles and responsibilities of older people in the community, but can change how to address challenges from being physically distant from their community. As technology continues to develop and expand concepts of space, people use this space as an opportunity to inform and to connect with others over vast distances.

Additionally, to explore ideas and values that otherwise would not be accessible in the physical area. As Eric explains;

> "local space is defined by a users ability to locate information flows.. local information acquisition, once regulated to the sidewalk conversation, church meetings, town halls, is now potentially extended to the internet or mobile phone… In each case, they are privy to local

> information without setting foot in the physical space to which information is accessed, in a networked society…" (26).

Video games differentiate from other popular forms of media like comic books and television shows or movies, that loosely identify Indigenous characters only through visual and auditorial ques, whereas video games combine these formats to enhance representations.

Video games present information to a multitude of different generations that play them. For comparison, books have confidently separate age groups according to the complexities of the material, whereas digital media like video games allow the more adult-oriented content to be accessed more readily for younger generations. Eric describes this as; "A child's age was once a prime determinant of what he or she knew. Very different types of children were exposed to similar information because they were in the same age group. Now, children of every age are presented with "all-age" social information through electronic media" (Meyerowitz, 151). An "all-ages" information system dissolves the restrictive order placed on written information, as the specific or adult-focused content is more available or accessible on the platform. Information in digital media consistently shifts and changes depending on who or what factors contribute within them. Multiple aspects of Indigenous imagery portray the complexities facing identity, culture and traditional values when describing what makes an Indigenous person Indigenous. Using examples like Until Dawn, Assassins Creed 3 as well as others, provides examples of non-Indigenous video game companies reconstructing Indigenous cultures in their games. Indigitalgames examines some of the portrayals that famous video game developers use to devalue Indigenous people. Some examples that are used by non-Indigenous video game developers are mystical, or Wendigo depictions that are used to reconstruct essential traditions surrounding spiritual lessons. As well as hyper-violent warrior imagery, that deconstructs vital roles warrior teachings have on Indigenous men. Both examples show that adverse impacts are displaying beyond what the game visually presents to the player.

Mystical and Wendigos in Until Dawn

A dominant contributing trope continuing to restrict representations of Indigenous cultures, communities, and traditions is through mystical and Wendigo tropes. These tropes share similar relationships with the "savage" or "noble savage" tropes as their representations other and limit mystical or traditional ties of Indigenous communities to their past. In video game media, mystical or Wendigos are used as historical lore within the game as a justification for the demonic nature that the game takes place within. Mystical representations include tropes like spiritual creatures such as the Wendigo in Until Dawn are the antagonists that the player must conquer to fight their way out of a remote cottage in the northern Alberta winter. Shape-shifters are a part of many First Nations cultures and have become popular plot devices in recent popular literature- especially the subgenre of horror/science fiction. In *Shape-shifting: Images of Native Americans in Recent Popular Fiction,* Macdonald, Macdonald and Sheridan (2000) describe shape-shifting as;

> "a human being changing into another living creature- for example. The shamanistic idea of the Lakota Sioux warriors shape-shifting into buffalo or wolves to enhance hunting skills and to honor the animal hunted… In general, it carries the idea of metamorphosis, of transformation from one form to another, or to some degree, becoming the other, sharing point of view and lifeway" (Adare, xvii; MacDonald et al., xiv-xv).

One example that uses the Wendigo or mystical tropes as the backbone to their storylines is Until Dawn. This game reinforces a character that "others" or disassociates essential teachings involving traditions, vital lessons or cultures that many Indigenous cultures would use to reiterate fundamental cultural ties that are passed down through younger generations.

Until Dawn is a 3rd person horror adventure game set in an isolated cabin in the northern mountains of Alberta, Canada. In the game, you take control of 9 friends who return to the family cabin one year after a tragic event. Throughout the game, the player controls multiple characters between chapters, often exploring both new and familiar surroundings previously examined. The main story revolves around the teenagers, as shortly after reaching the cabin, something or someone begins to hunt them down. Every interaction, dialogue choice and button press or button miss press impacts the character's path through their portion of the story.

The "butterfly effect" as the game describes it early on, is the primary mechanism that revolves around the player's choices and weaves them into pieces of the story. Every decision the player makes shifts the story into another direction. For example, if the player decides one character should be killed or accidentally fails a chase scene, where button combination completions are required to see a character safely cross a dangerous section of the level, the player will lose a piece of the story that only that player can acquire. Ultimately, player choice having such a substantial impact on the story is an essential mechanic that keeps the player emotionally invested in ensuring every character contributes to their portion of the game.

The story involving the playable characters is not the only story told, however, as the player explores the mountain environment, they will find side story tidbits revolving around the previous residents living up on the mountain. The game describes the mountain as having a checkered history. The game details that in 1893, "the Cree" were the original inhabitants amongst the mountain. Upon colonial expansion, Tin and Radium were discovered in the region causing a massive mining boom. After a lack of maintenance, a devastating structural collapse in the mine caused 30 miners to be trapped in the intricate tunnels of the pit. After numerous days of surviving on only a small stream of water, 12 miners resorting to cannibalism. The miners were found and rescued and placed into the recently built Blackwood Asylum, where the miners would slowly turn into cannibalistic creatures. In the early 1990's, property near the Asylum was purchased by the American movie mogul Bob Washington and a vacation home was soon constructed. This vacation home is the location surrounding the player's main story.

Until Dawn uses mystical or Wendigo representations throughout the main story of the game. Firstly, the Indigenous group that the story revolves around is the Cree. The Wendigo depicted in the game are based on legends that describe a creature or monster who transforms from a human into a cannibalistic monster. The story states that anyone who ate human flesh would run the risk of being possessed by the Wendigo around the Blackwood Mountain. During a playthrough, if the player finds the "Strangers Journal," it describes that the Cree believed that the Blackwood Mountain was sacred land. It also details that prophecies were foretold of butterflies guiding ones to wither good or bad fortune. As mining began to disrupt the holy grounds, the Wendigo was released. The attachment that once solidly connected the Cree nation to the Blackwood Mountain region would dissipate by the destructive measures of mining in the area.

Over consuming resources are also described as another symptom of transforming a person into a Wendigo. Basil Johnson argues in; *The Manitous: The Spiritual World of the Ojibway,* that overconsumption of an individual rather than supporting his/her family can also contribute to the Wendigo becoming stronger.

> "There is nothing more harmful in humankind's inclination to rest, play, celebrate, feast, and pursue hobbies. The trouble is that some people don't know when to stop and appear not to care, because nature, or Kitchi-Manitou, has endowed them with slightly more than is good for them: appetites, passions, and desires that dilute their talents, common sense, and judgment. It doesn't take much. A fraction too much or too little of anger, envy, or lust is enough to create an imbalance in a person's character to impair his or her judgment and weaken his or her resolution" (Johnston 223-224).

Johnston describes the rapid western colonial expansion, similarly to the development mentioned in the game, as a crucial contributor to the survival of the Wendigo entity. As Johnson indicates that the ends of business deal with power, wealth, and profit. Anything that diminishes the return, ensuring not to violate the rights of others or; "to ensure the land remains fertile and productive for future generations…"(Johnston, 237). When exploring the miner's side story clues, the player would find out the history of the miners themselves and 1952 mine collapse. The game also makes mention in a Journal clue found as a secondary source of information about the slow transition into Wendigo's as some would resort to cannibalism. It is important to note that the game designers did not use resource extracting as another symptom that would lead the miners to turn into Wendigo's, only the idea of resorting to cannibalism set the transformation into play.

Until Dawn plays with an iconic 1980's horror movie trope setting to tell a story of isolation, desperation, and revenge. The mystery surrounding the Wendigo is solely upon the fear surrounding nonhuman actions like cannibalism rather than a multitude of factors that could change a character into a Wendigo like greed, or cannibalism as Johnston describes earlier. The depiction of wendigoes as a "mythical" or nonhuman like entity that completely dissociates the creature from a human. The game uses Wendigoes as creatures that only transform through nonhuman actions (cannibalism) and not that of massive resource extraction. Another example that takes on a different form of negative stereotyping is through the Warrior representation used in Assassins Creed 3.

Warrior and "Hyper Violence"

The player portrays the warrior representation in the game Assassin's Creed 3. In Assassin's Creed 3, the player controls the character named Desmond Miles, who uses a futuristic device called the Animus to travel back in time to fight an organization trying to run the world called Templars. During this setting, Desmond will use the Animus to live out one of his Native America relatives during the American Revolutionary War period. Connor, Ratonhnhaké who is a half-English, half-Mohawk man whose father is a part of the Templars. The player may play an active role in warriorhood in Assassin's Creed 3, but some factors continue to reinforce unhealthily aspects involving Indigenous men and violence within Assasins Creed 3. In Assassin's Creed 3, Ratonhnhaké must build up an army in which helps him continue his search throughout the Americas for his father, Haythem Kenway. Kenway, early on within the game finds, kills and burns down Ratonhnhaké community. The player experiences the harsh realities of interactions between early colonial settlers and Indigenous communities. Showing Ratonhnhaké as a small child losing his community gives the player the understanding of his struggles throughout the game, forcing the player to explore and interact with the environment and continue to grow with Ratonhnaké. The destruction of the community by his father paints Ratonhnaké as an underdog being forced to overcome such obstacles to survive. This event occurs while, Ratonhnhaké is still a young child, attempting to get the player to sympathize with Ratonhnhaké as after seeing his community destroyed, he must kill everyone involved. What Assassins Creed 3 illustrates is a very violent event of "warrior" mentality where Ratonhnhaké must then partake in violently assassinating everyone held responsible for his communities extinction.

Hyper "warrior" mentality is a destructive accomplice in many Indigenous communities surrounding the men. However, one example of warriorhood that is described by Thomas Ka'auwai Kaulukui Jr in the book; *Indigenous Men and Masculinities* as warriorhood coming from the deity Ku, which represents the god of war. In the interview, Ty.P. Kawika Tengen writes: "In actuality, Ku is a deity of male generative force and productivity, and including statecraft, governance, farming, fishing, and healing; even more broadly, Ku is seen as the masculine component of society that compliments Hina, the Feminine" (Tengan, 229). Kaulukukui explains that Ku mainly represents responsibility. The responsibility of one's self regarding ethics, morality, having good values, being in substantial physical strength. All factors contribute to responsibilities surrounding "protection, building, and carrying the heavy physical loads and all of those things which are necessary for a male role in society" (Kaulukui, 230- 231). Roles and responsibility then sprout out from self to family, then to the community and finally to nations. Throughout the interview, there are conversations about Kaulukui's time serving in the military and the experiences he sees in other Indigenous men dealing with their Kus. In the interview Kaulukukuis discusses that one of the most important things in which Indigenous warriors need to do when dealing with this built up Ku is to rather than fighting with that aspect of life, there needs to be recognition that Ku is a part of who Indigenous men are. Secondly, Kaulukukui mentions that recognition of the community needs is vital for what is acceptable conduct within a civilized society, separating that from the violent actions appropriate in war. Lastly, Kaulukukuis mentions that then the men would need to:

> "deal with the experience itself and try to translate the experience of battle into something that is positive, has made you stronger so that you can move forward to carry your community responsibilities in the peacetime effort… take those things in which can be seen as a negative experience and look at the positive aspects of it that make you stronger and better to live a better life to carry your kuleana here" (Kaulukukui, 232).

Ultimately suggesting, that the warriorhood mentality is something that is inside every Indigenous male and that for that kuleana to remain positive, violent actions that only hurt oneself or the people around them must be dealt with accordingly.

Throughout Assassins Creed 3, the family values that Kaulukukui mention in his interview with Kawika Tengen are absent in Ratonhnhaké as he ventures through his story. The character deals with his "warriorhood" by lashing out, assaulting and killing the people responsible, continuing to address the pain of loss through violence. The character never looks at his actions as destructive within the community he makes. Often, Ratonhnhaké divides his new community and the "real" world, even more, apart from as the player progresses through the game. The community that Ratonhnhaké creates is that in which all have similar desires. That desire is to kill every Templar (who are British colonizers) and to obtain an abundant amount of wealth. This community is not family or that of even nationhood; it forms the image of the colonizers.

Concluding thoughts:

With video games like Until Dawn and Assasins Creed 3 incorporating harmful tropes and stereotypes of Indigenous peoples as the games main narratives, the importance of Indigenous identity dissolves. The lack of identity leaves younger Indigenous peoples lacking traditional teachings, or the desire to seek out that knowledge as they feel mainstream media has portrayed their cultures as harmful or destructive. However, by providing analyzed information surrounding multiple types of tropes and stereotypes, numerous generations of Indigenous peoples can seek out educational opportunities that constructively display harmful tropes. Having blog type entries like Until Dawn and Assassins Creed 3 shown as examples, the project can enhance the significance of essential roles involving spirituality, the importance of warriorhood, as well as other factors that greatly hinder positive aspects of Indigenous cultures, communities, and traditions for generations of Indigenous peoples. The continuation of blog entries that present both positive and negative tropes continue to expand concepts of Indigenous identity, as well as address concerns about cultures expanding into digital media. Roles, responsibilities, and communities can draw upon video games that detail specific examples that either incorporate examples of positive cases or as shown with the examples given in this essay, dissolve essential aspects of Indigenous culture. As each game adds another example of the complex nature surrounding Indigenous representations in video games, Indigitalgames.com wants to present these issues in a suitable way that can be consumed by multiple generations of Indigenous and non-Indigenous peoples that further the conversations surrounding positive digital media relationships of cultures, traditions, and communities.

Bibliography:

Adare, S. (2005). *“Indian” Stereotypes in TV Science Fiction*. University of Texas.

Anderson, K., & Innes, R. A. (2015). *Indigenous Men and Masculinities; Legacies, Identities, Regeneration.* Winnipeg: University of Manitoba Press.

Bergland, R. (2000). *The National Uncanny: Indian Ghosts and American Subjects*. Press of New England.

Gordon, E. (2009). *Redefining the Local: The Distinction between Located Information and Local Knowledge in Location-Based Games*. Peter Lang Publishing.

Macdonald, A., Macdonald, G., & Sheridan, M. (2000). *Shape-Shifting: Images in Native Americans in Recent Popular Fiction*. Westport, CT: Greenwood Press.

Mayerfeld Bell, M. (1997). *The Ghosts of Place Theory and Society 26*. Kluwer Academic Publishers.

McKegney, S. (2014). *Masclindians; Conversations About Indigenous Manhood*. University of Manitoba Press.

Meyrowitz, J. (1985). *No Sense of Place: The Impact of Electronic Media on Social Behaviour*. Oxford University Press.

Tengan, T. K., Kaulukukui Jr, T. K., & Richards Jr., W. K. (2015). “The Face of Ku:” A Dialogue on Hawaiian Warriorhood. In K. Anderson & R. A. Innes (Eds.), *Indigenous Men and Masculinities* (pp. 229–242). University of Manitoba Press.

LEARNING TO CREATE OR CREATING TO LEARN

ADRIENNE DECKER, CHRISTOPHER EGERT, AND ANDY PHELPS

Abstract

Splattershmup: A Game of Art and Motion blends elements of a traditional arcade game with the creation of an abstract expressionist piece of art. Upon completion of the game, the actions taken by the player create the lines and colors on the canvas that can then be saved and shared. While not intending to create an educational game, the game was motivated by a desire to have players experience modern art. However, in playtesting and release, these goals were not realized. In order to help connect the player to the art concepts, we engaged an art educator to create scaffolding around the gameplay experience. The resulting materials leveraged both the cognitive and affective domains to engage the players. Results of the pilot testing of these materials confirmed that the player showed a deeper connection to the art content of the game while not minimizing the enjoyment of the gameplay experience.

Introduction

When we contemplate the phrase "educational video game", we are examining two systems and sets of concerns. One set of concerns involves the game design process in which the creative leads express their ideas through the function of gameplay. As such, design encompasses everything from story, mechanics, user interface, goals, challenges, game balance, and the myriad of experiences that provide entertainment value to the player.

The other set of concerns involves the educational value of the experience. The design must address the educational outcomes conveyed by the game in terms of the cognitive outcomes perhaps like those expressed by Bloom (Bloom, 1956) which we can measure though a process of using a game experience as an intervention and accessing the outcomes with appropriate instruments.

While the ideal is that these elements work in harmony, finding a desirable balance can be a trying and elusive process. If the educational content is too obvious then the game is seen as a thin veneer for what is essentially a typical presentation of instructional content. If the gameplay is the focus, the educational content can be overlooked and its importance downplayed or misunderstood.

To counter these tensions, it is often desirable to introduce gameplay designers and educational domain experts early on in the process. To be effective, each group must balance their expertise with enough understanding of the other group to create compelling experiences. It is very easy to fall into the mindset that educational game design is an "all or nothing" proposition with sharp boundaries between success and failure.

In *Splattershmup: A Game of Art and Motion* (Splattershmup, n.d.), the design team started with a simple premise – provide an experience that was an engaging arcade-style game while simultaneously serving as a creative endeavor that spoke to the techniques and processes of action painting (Kleiner, 2010). The initial goal for this was not an educational game – the goal from the beginning was to create an experience that informed exploration and contemplation but that was not overtly educational in its presentation. However, it was clear that there was a potential to allow for freeform exploration into action painting though sharing and reflecting on the digital works created through the gameplay experience and the possibility that such engagement would help educate players as to the underlying principles of the artistic movement. Thus, the goal was to create what was termed an "experientially educational game", one that would, by the sheer act of playing it, incorporate some knowledge transfer and provide potential for reflection.

By using this free-form approach without a specific built-in assessment mechanism, *Splattershmup* is an example of a game that speaks to educational outcome through both intentional goals as well as through opportunities to augment education without a specific set of pedagogical outcomes in mind. The hope was that developers and players would be able to engage with the game on both levels and be able to demonstrate a knowledge of this interplay between the two. In this paper, we will explore *Splattershmup* as a case study of a video game with intended educational potential and entertainment value versus the eventual use by target player audiences.

Our Game

As a video game, *Spattershmup* is best categorized as what is known as the "shmup" (shoot 'em up) (Rojas, 2012). This genre is characterized by the player controlling a vehicle (usually a spaceship) that is able to move around the screen. The player encounters wave after wave of enemies in attack, and the goal for the player is to defeat as many enemies as possible before losing all health and taking too much damage as to lose their turn. Typically, losing the turn returns the player to the beginning of the level or the game. Images 1 and 2 provide some example imagery from the game.

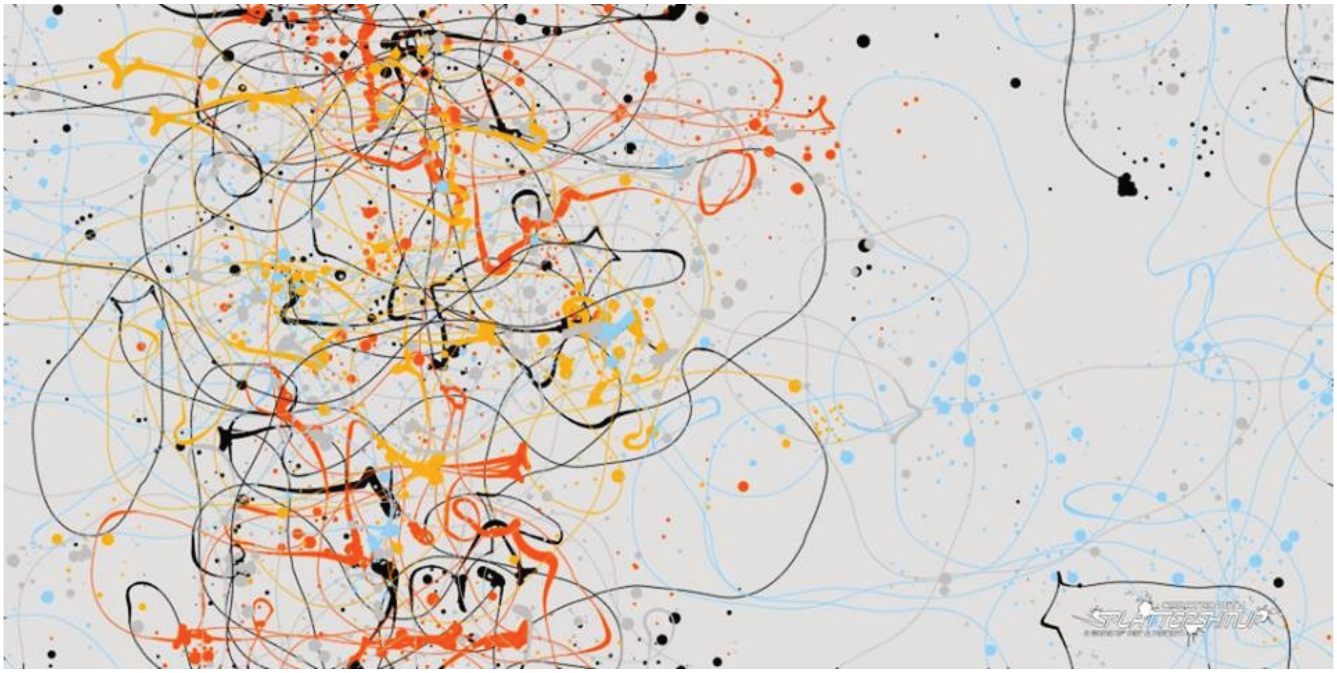

Image 1: Player generated artwork created through Splattershmup: A Game of Art & Motion

Image 2: Splattershmup gameplay screenshot

The player has the ability to select from a number of offensive and defensive capabilities that must be applied with a level of strategy that balances gameplay. Each capability has its strengths and weaknesses, and the use of these abilities draws from limited resources available to the player. The player restores resources by collecting power-ups or performing specific achievements within the game. Similarly, enemies have their own offensive and defensive capabilities that vary as the gameplay advances.

From a progression standpoint, the shmup format is characterized by constant navigational advancement. This may be illustrated as continued forward progress without end (with enemy waves breaking the gameplay into segments) or may be punctuated with "boss" encounters throughout the gameplay.

Splattershmup utilizes the shmup mechanic but contextualizes the game play as the creation of a work of art. The gameplay takes place on a never ending (scrolling) canvas upon which a creative work is constructed. Interaction within the game produces strokes (lines, trails) for each motion and splatters for encounters with enemy elements. Power-ups and progression not only allows for the player to enhance the capability of their vehicle and to recharge depleted resources, but also allows for changes to the visual elements of expression such as color and palette. Success in the game moves beyond a high score as the player also has access to the visual representation of the art he or she created through gameplay, and can choose to save or share the artifact with others via social media. *Splattershmup* is available for free to play and download from: http://splattershmup.rit.edu/ .

Response from Developers

Splattershmup was created as part of a senior level production studio course (Decker, Egert, & Phelps, 2016; Decker, Phelps, & Egert, 2017). The primary goal of the production studio course was to educate students about the process and practice of game development and production processes. Specifically, the course sought to elevate student outcomes away from a "student project" and towards a "viable commercial work" to the extent possible given constraints of the undergraduate experience. Towards this end, particular attention was paid to the production pipeline, aesthetic quality, integration of art, design, programming, and UI/UX, and perhaps most of all, to critical feedback and reception of the product as developed.

Students enrolled in the course were already familiar with the shmup genre through their previous studies in game design and development. Therefore, the instructor did not need to spend significant time teaching students what type of game needed to be made from the game play and interaction perspectives. Instead, the challenge was posed to the development team to infuse an existing artistic process into gameplay in such a manner that challenged players to not just succeed in the game but engage with the resulting creative aspects as well.

As part of the course, there were lectures on Jackson Pollock including his work, his influence, and his process, as well as how the game needed to mimic aspects of these processes to be effective. Students were provided with interviews from Pollock documentaries where he describes approaching the canvas as "an arena for action" and other similar terminology that is not unlike that used in game design for arcade-style interactions. Students were also encouraged to engage in creating their own action paintings, and the student producer on the project attempted to organize an event with the development team where they could engage in this activity at scale.

These efforts were met with limited success: while some members of the development team seemed to engage with the subject matter and recognize its importance relative to the desired game design, others were simply interested in the technical aspects of game development and could not seemingly recognize the importance of the subject to their work. There was significantly more engagement when action painting was distilled down from its artistic perspective into a more engineering based discussion – i.e. the physics of paint flow, speed, angle, viscosity, etc. Numerous attempts to define the "paint effect" in the game in these terms were made, and ironically none of them "felt right". However, it was through these terms that some of the student developers were most engaged.

In teaching the course during the semester, expected challenges were encountered in the students' transition from the requirements of a typical classroom project to a production-quality product. However, the greater challenge was integrating the gameplay elements with the domain-specific creative and cultural elements. While there was general agreement and buy-in about the concept of the game, there was very little engagement in the underlying artistic subject matter and history. Many of the developers deconstructed the problem of enabling a creative experience by compartmentalizing game design challenges into individual mechanics. Successfully solving those challenges addressed game play function but did provide an opportunity to integrate the mechanic into the overall experience.

One specific example of this was an inability to get the "paint trail" to effectively mimic the drop and trail effect common in the major works of gestural abstraction to a degree such that the output of the game was recognizable as an action painting. Students spent time solving this issue as one of a visual challenge or optimization problem. When the solution was reached, little time was spent on reflecting if the outcome would support the creative expression effectively, or whether the effect even mimicked clearly discernable traits the in the published work of Pollock and other artists that were representative of the artistic movement.

Response from Players

In designing and constructing *Splattershmup*, the intent was to create a game that players would find engaging as a shmup-style action arcade game while simultaneously allowing them to learn more about gestural abstraction as an artistic form. This exploration was intended to open the door to greater exploration of the medium without being overly prescriptive or demanding with the educational message.

When looking at the player response, it is important to examine their perspective at the different points of development and product release. As such, the player response is divided into several categories based upon the game development lifecycle – development playtesting, player download from distribution channels, and player engagement at events and gatherings.

Response from Playtesting

The first wave of player responses occurred during the development of the game as a series of playtests. These playtests were required to help educate the student developers about the process of playtesting, and inform their work during initial development. The playtests were designed to reveal if the player experience was in alignment with the expectations of the shmup gameplay experience, as well as other elements (bearing in mind that the game at this point was incomplete). Early gameplay testing focused on movement and balance – did the player representation handle as expected, did the user interface controls map in an intuitive manner, did the feedback properly inform the player of state and progress in the game? Simply speaking, the early gameplay tests focused on mechanic and initial game experience. While the developers were being exposed to a number of activities that linked the gameplay to action painting as an expressive medium, these activities were not making it into the early playtests.

Most of the early playtests during development occurred by capitalizing on pre-existing or externally planned visits to the lab by various groups and tours. While beneficial from a scheduling point of view, this meant that nearly every group, either internal or external, was coming to the lab with the preconceived notion that they were coming to see 'game development' and or 'a game that students were making' and as such this biased their notions as to what to expect from the game. Unsurprisingly, these groups then focused almost exclusively on the 'game' aspects of *Splattershmup* as opposed to any utility as an art creation or education tool, because this was the context in which they were approaching it even before arrival. Interestingly, the guides of several of the tours (teachers, parents) were interested in the educational aspects and art-based approach, but often did not play the game themselves, preferring instead to have their children or students engage in the activity.

This began to change later in the development process when the "save your painting" and "share your painting on Facebook" features were implemented. These proved to be particularly challenging from a development perspective, and were never made available while the class was in session, but were completed after the term was complete by a smaller team of developers prior to the full release of the game. As such, most of the early testing allowed for users to recognize they were making a painting, but not to reflect on it as a created artifact after play, or to share it with others. This key component in the learning process was thus absent from the gameplay experience until after a large proportion of the developers had left the project, and a number of the early playtests were already completed.

Response at Release

The second wave of player responses occurred when the game was released. The game was launched via social media, university news articles, presentation at the Game Developer's Conference in San Francisco, and through a dedicated website that described the experience as "…a game that explores the intersection of the classic shoot-em-up (or "shmup") arcade game and gesturalized abstraction or "action painting" (a term coined by critic Harold Rosenberg in 1952 and often used to describe the work of American artist Jackson Pollock). It is intended to allow the player to reflect on their in-game actions and strategy through visual record, and to approach the creation of art as an arena of action. Art can thus be created, shared and discussed that comes "from inside the moment" of game-based decision." (Splattershmup, n.d.). Along with screenshots of the game and educational materials, the game was made available for free through a number of distribution channels including direct download for a number of web browsers, standalone executables, and access on the Windows Store.

Much of the player feedback after product release was gathered through social media posts about the game as well as collected email and communications via instant messaging services. Although mostly positive, most of the comments focused on the gameplay experience and the interaction with the work as a shmup. Players valued their interactions through their affinity towards the genre of shmup and fast-paced arcade games. A much smaller segment used social media to post and share their work as opposed to the overall player base. An even smaller segment commented on the educational value of the work. Again, despite a desire to create linkage between the game experience and a deeper appreciation of the process of creating action painting, most players focused upon the game with only a surface appreciation of the deeper context or its intended, if subliminal, focus.

Events and Festivals

The third wave of player response occurred as the game was presented at various events and festivals. In such situations, there was a more controlled engagement with the public, allowing the developers to interact with the public and to discuss the game. Under these conditions, it was observed that there was more interest from the public regarding the potential of the game to spark interest in art and art processes, although there were still tendencies to avoid these educational elements when lines were long or towards the end of the presentation period. Two events stand out as markedly different in player response: the Imagine RIT festival, and the presentation of the game at the Indie Arcade at the Smithsonian American Art Museum (SAAM).

The Imagine RIT festival is a public festival held annually at RIT every spring wherein groups from across campus demonstrate projects for the general public. Typical attendance is between 25,000 and 30,000 for the one day, rain-or-shine event. Since the festival draws such a large and diverse audience there is a wider range of pre-existing perspectives, and many attendees simply showed up to play the game or explore the exhibits without have a pre-conceived notion of what to expect. As such, both parents and children played the game, and comments during the festival were indicative that they understood what the game was trying to convey about action painting, with several remarks to the fact that they were "painting while playing". It is also worth noting that a couple of the festivalgoers that spent significant time with the game were students in the art education program at Nazareth College.

The second event, at SAAM, was likely the event that most critically examined the game as an art education experience. At this event, while the general public crowded around the display and had clearly come for the "arcade-style" event, there were numerous attendees, estimated at approximately 30% of the total audience that had specifically come of the event in the context of it being an art show at an art museum. As such, they were engaging with the piece in a markedly different way than those approaching it as a game, often asking "What is the purpose of the work?" or "What is this hoping to say?" even before engaging in playing it. This audience understood the concept of relating arcade games and action painting almost instantly. There were numerous art historians, educators, and connoisseurs in the audience, with insightful questions and challenges to the work, but often with little to no working knowledge of games beyond a casual familiarity of highly popularized classic arcade titles.

Turn Left at the Fork in the Road

It is important to realize that although the team did not specifically set out from the start to create an educational experience with explicit learning outcomes and assessment opportunities, the team came to realize that the combination of the gameplay and the action painting processes did provide the opportunity for potentially deeper and meaningful interactions with the game, and learning opportunities relative to the associated artistic movement. Rather than seeing the game as something that helped to investigate or reinforce cognitive targets, it was clear that the game had potential to unlock curiosity about a given form and practice. It was hoped that players would be able to make the connection between playing and making and that they would be able to discuss their experience in both game and art terms. However, as outlined in the previous sections, things were not entirely successful in the transfer of these goals and objectives.

Developers

It was evident that there was still a mismatch between what the design team was trying to convey to the development team and what was manifesting with the student developers' priorities in development, scheduling, and testing. In turn, the focus on gameplay as opposed to any discussion of the creative aspects was one of the main reasons for the delay in implementing the features of saving or sharing the painting until after the term was over and most of the students had moved on to other projects. While students had an experience of making a game, they did not make the deeper connection between the game itself and the experience it represented.

Player Groups

While all three of the player groups had responses that were different at some level, they did share a common theme. The players connected with the game as a game but not necessarily as an experience through which to engage in creative expression. As such, the creative element was seen as a novel addition, but not central or intrinsic to the experience and even with the third group at festivals and showcases that did connect to it more, the connections were not as deep or profound as the design team would have hoped for.

Feedback from an Educational Games Community

It should also be noted that there was discussion of the educational aspects of the game at the Games+Learning+Society conference in 2016 where the game was a finalist for 'best education game' in the Learning Arcade. Feedback during judging provided valuable insight, providing positive comments on the visual and aesthetic qualities of the game and game play itself. However, judges had concerns that the game was not truly educational given it didn't have a formal assessment mechanism built into its design.

In many ways, this is a mirror to the response from the developer and playtest groups. Whereas the prior groups focused upon the gameplay elements, this group focused upon the cognitive and assessment capabilities of the game. This speaks to the need to challenge our preconceived notions of what educational games must be, and to re-evaluate our notions of success and transfer relative to the potential of interactive media in an educational context.

Changing Course

In reflection, the interactions with the different groups may have been profoundly different had the team worked with an art educator from the start. We would have been able to develop clear goals, objectives, and outcomes that would have allowed us to situate the game within the curricular materials exploring action painting. We would have been better equipped to answer design and development questions that dealt with the educational targets and would have been able to evaluate the game with assessment mechanisms to see if learning actually occurred when utilizing the game.

While the opportunity of including an educator from the start may have been desirable, not all was lost. The team was seeing potential of the game in a number of venues, including the use of the game to create and share expression among players, the use of the game with other creative forms (such as music) to provide new experiences to an audience, and questions challenging us and others to do more with the game in an educational context. Therefore, we sought out an opportunity to create a scaffolded educational experience around the game in its current form.

The Splattershmup Teacher's Guide

For the 2017-2018 school year, we worked with an elementary art education teacher (Sara M. Cometto) and asked her to think about how this game could be used in the elementary art classroom. The culmination of this effort is the Interdisciplinary Teacher's Guide (Cometto, n.d.) which is designed for classroom teachers grades 3-8, but could be adapted for grades 2-12. The guide addresses both National Core Art Standards (National Core Arts Standards, n.d.) and the ISTE standard for students as an innovative designer (ISTE, n.d.).

The guide presents several lessons that allow the student to both experience the game through play while weaving content about Jackson Pollock and modern art throughout the experience. The students are also asked to frequently reflect upon what they had experienced in the game and relate it back to what they see in Pollock paintings. For younger students (grades 3-5) a book, *Action Jackson* (Greenberg & Jordan, 2007) is recommended as part of the classroom experience for the teacher to read to the students. This book is partially a biography of Pollock, but also discusses the methods and techniques he used to create his works. Pollock's method was inspiration for the gameplay of *Splattershmup*.

One of the key features of the lesson plan is the discussion points, particularly around dispelling the negative notions around modern abstract expressionism, which are dismissive of the art because it does not seem to some to be as detailed, as realistic, or as meticulous as other works of art. As noted in the teacher's guide, Pollock himself was aware of these criticisms and the guide provides the following quote from the artist to respond to the critique:

> *"When I am painting I have a general notion as to what I am about. I can control the flow of the paint…There is no accident, just as there is no beginning and no end."* (National Gallery of Art Washington, 2009)

Teachers are also encouraged to have the students to play the game in zen mode in order to create their own works of art in the style of Pollock. As a key part of the art education process, students should then present their creations to the class and demonstrate the similarities and differences to the Pollock works they had previously studied. Lastly, the guide presents other in-class art activities to allow students to create their own (non-digital) action paintings.

For the team that worked on creating the game, the lessons and classroom activities really bring to life the intent and focus behind the design. With the scaffolding of the teacher's guide, students are guided through elements of cognitive growth in their knowledge of modern art techniques and artists as well as experiencing it through the affective domain by actually creating the art themselves.

Pilot Offering (2017-2018 school year) and Observations

It was very fortunate that the educator who developed the Teacher's Guide also implemented the lessons in her art classroom in the spring of the school year. The students were in grades 3-5 at an intermediate school in suburban Western New York. The students worked with the game in two art class periods and an art station at the students' end of the year activity day. Art classes at the school occur once every six school days.

After implementation, the authors discussed the results with the art teacher to determine what the students were able to accomplish and to get her impressions of using both the game and the lessons in the classroom. We were particularly interested in whether or not this treatment helped the players (students) make the connections between the game and the art.

We were very encouraged by the fact that the teacher reported that the students did see the connections and were able to seemingly go between talking about the game and game play and the art concepts.

Building on the excitement of playing a video game in class, the teacher introduced the *Splattershmup* game to the students. They first began by working on their laptops individually in arcade mode. After one initial game play, the students were asked to reflect upon what they did using the artful thinking strategy "I see, I notice, I wonder" (Project Zero, n.d.). Two of the questions that were vocalized during the "I wonder" portion:

- How can I get more colors?
- How can I make more splatters?

While both of these are aspects of the game, they are also aspects that directly relate to the art of the game as opposed to the game play.

Next, students were asked to take their "I wonder" questions back to the game in arcade mode and try to answer them through more game play. The students were encouraged to talk their classmates as they were trying out the game again at this time.

After some time in arcade mode, the students were instructed to try zen mode for the game and then they were asked to discuss the results. They were asked to compare and contrast the two modes of play and the different results. Students once again used art words in describing the product they produced (words like color, lines, thick, thin, splatters, dots) in the appropriate ways.

The work of Jackson Pollock was introduced via a projected image of one of his works. The teacher then asked the students about their strategy used to create their work of art. In particular, how did they use the spaceship to create the art? In addition, how could they use it to create art that looked more like the piece shown? Some of the answers included:

- Not get killed/playing as long as you could *(This refers to arcade mode.)*
- Work totally in zen mode
- Try to shoot more
- Changing the colors

These answers almost totally embody game play elements, which is expected because the question asked about game strategy. However, what we feel is important to note is that the students understood very quickly how to use the game to produce the art. We asked the art teacher if she felt the students knew they were creating art and she definitely believed they did, primarily because they could answer the question about how the end product was created. She shared that the answer that came up was "by moving the spaceship". She believed that observation was key in the connection between how the game worked and the art that was produced.

By the end of the first class, several other observations could be made about the students. The first is that many were trying to write down the information on how to play the game when they went home (the URL for the game). The teacher was asked to put a link to it on her school website (which she did). The second is that when given the opportunity to play the game multiple times, students began working together on the same laptop to play the game. During this collaborative play, one student would control the ship and the other would shoot. When asked why they were doing this, the students explained that they could play the game longer and make more art if they worked together. This clearly refers to playing the game in arcade mode rather than zen mode, but it wasn't clear from observation whether they stopped working together in zen mode or continued to do so because they could be more effective working together.

On the second art class day (occurring six days after the first due to the school's schedule), students arrived ready to play the game again, but some of them came prepared. Some brought a mouse from home (the school laptops do not have mice) and others brought headphones to plug in to listen to the music while playing in zen mode. Students reported playing the game at home since the last class. Our conclusion from this is that students who play games at home (or played this game at home) brought equipment with them to make this classroom game experience more like their home game experience.

The second set of activities revolved more around creating the connections between the work in the game and the work of Pollock and the abstract expressionist art movement. To that end the teacher read aloud the book *Action Jackson* (Greenberg & Jordan, 2007) to the students and discussed his work. As a fortunate accident of serendipity, the 5th grade class had just visited the local art gallery as a field trip and the art gallery has a Pollock painting in its permanent collection. In the 5th grade classes, students were asked if they remembered the painting and asked to talk about what it was like to see it up close. The students in the other grades did not have the same field trip, but discussed Pollock's work as well.

After the reading of the text, the students were asked to go back to zen mode and to purposefully work to create a painting inspired by Pollock's work. After they completed this exercise, they were asked about the strategies they used to create their art in zen mode. They once again discussed their work in terms of some of the game play needed to create the work, but were describing their work in the appropriate art terms.

On the second-last full day of school, all students participated in *Field Day*, an annual end of year event that brings the school together in a series of carnival-like social activities. This year, the teacher created an activity outside of the normal athletic events typical on this day. Students came into the art room and were assisted by parent volunteers in creating their own drip paintings. Image 3 shows the students interacting with the volunteers to create the paintings and Image 4 shows the student artwork. This activity elicited excitement from the students who enjoyed the opportunity to create something in this way.

Image 3: Students being guided to create their own drip paintings on activity day.

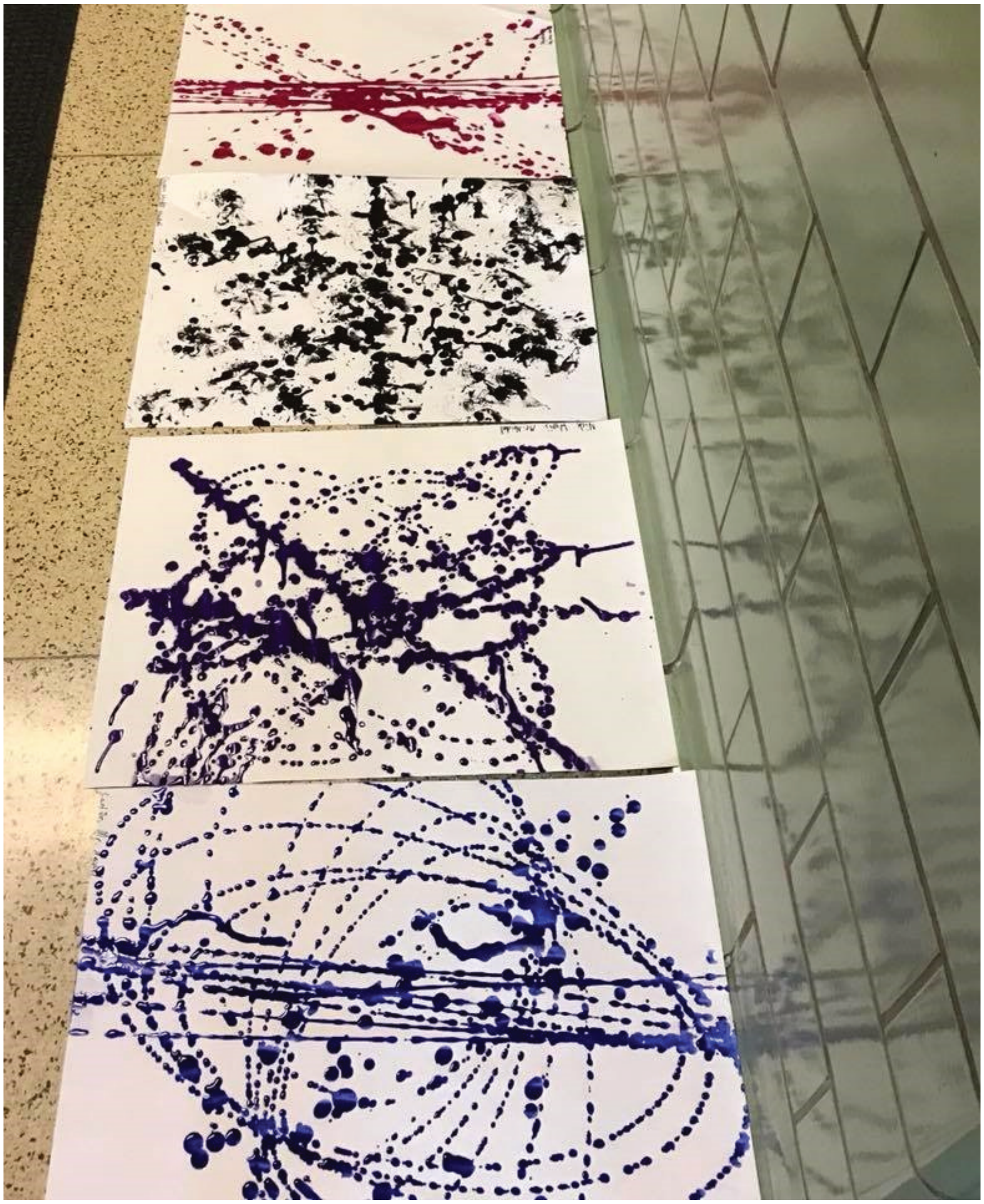

Image 4: Finished paintings drying in the hallway.

During this first implementation of the teacher's guide, we were fortunate enough to be able to capture some quotes from the students (3rd grade) using the game and participating in the activities.

- "You get to shoot stuff and actually get to make art."
- "In zen mode, you can just draw."
- When asked why the student liked the game, they responded "Because you can attack people like in the usual games I play."
- One student commented that they liked arcade mode better "because you can do abstract art and attack."

We believe this first implementation of the teacher's guide to be a success on several levels:

- 1) The teacher was able to implement the lessons.

- 2) The students were able to engage with the material, and they had a positive response to it.
- 3) They reported that they engaged with the game at home and the art teacher received feedback from parents that students were playing the game at home.

In fact, the school principal reported to us (as we were leaving the building from our follow-up interview about the pilot) that his children, who are students in the school, were playing the game at home that weekend. The principal did not know that we were in the building that day to discuss the implementation of the teacher's guide. The comment was solely directed at the art teacher to indicate that the current unit was having an impact on the students outside the classroom.

We asked our art teacher colleague what the students thought of the experience overall and while we spent a lot of time reflecting on all aspects of the activities, we felt that this quote from her summed it up nicely, "the students loved it".

Discussion

In reflecting upon the pilot and the evidence presented in our follow-up interview with the art educator about implementation, the authors are forced to consider how the involvement of the education expert has shaped the experience for the students while playing this game. While our first two groups, the initial student developers and the players of the original release, did not engage with the art and creative aspects of the game experience, it is clear that the elementary school students did. This was, in no small part, due to the structuring of the lessons around the game and the addition of appropriate content to bolster the educational value.

Consideration beyond the cognitive domain and standard assessment

When we address the issue of outcomes and assessment, we often forget that the potential of any video game exceeds the lower levels of the cognitive domain of skills (Bloom, 1956). Game systems themselves are sets of rules and behaviors that the player must address through trial and error to ascertain the nature of a system (Egert & Phelps, 2011). In addition, there is also the value of a game to function not just as a standalone, assessable element, but rather to unlock the value of affective domain skills (Bloom, Krathwohl, & Masia, 1964) and to pique curiosity into new areas of exploration. Rather than mere metrics of cognition and learning, there are also opportunities for valuing trial and error (i.e. learning through initial failure), along with creative potential that extends beyond typically measured outcomes.

Within this pilot, it is clear that there is a successful intersection of the cognitive and affective domains with the ability of the students to see the connections between the output of the game experience and the modern expressionist art they were exposed to in the classroom. The students were also able to use the game to create their own expression in the same style as the classroom examples.

Considerations of augmentation and empowerment

In our case, the game experience itself is not the artifact of learning, but serves as an augmentation or enhancement to traditional classroom presentation of material. As such, the learning may not be internal to the game, but instead externally constructed through a series of encounters or through connecting multiple interventions in a meaningful way.

Within this context, the impact of the game and the lessons is not just the cognitive outcomes or assessment, but engagement with the entire experience and process. We feel that one important aspect to this being successful is the ability for students to engage with the game in a meaningful way and see it as an experience onto itself and not simply as another classroom activity. In this regard, we feel we were extremely successful. First, we can observe that students were interested in doing better at the game by working together to ensure success and get the output they were looking for and by customizing their experience with the game in the second art class through the use of their own peripherals. Also, and perhaps even more encouraging is the fact that the students (and parents of students) reported that they played the game at home, not as an assigned piece of schoolwork, but because they wanted to. In many ways, there is no greater form of success for this type of game.

Conclusions and Future Work

We have many reasons to believe that our experience with Splattershmup was a success. The students made a game, and that game was released commercially and on multiple public channels. A wide and varied audience has downloaded and played the game and reported enjoying the experience. The game has been ranked and judged by professionals within the field, resulting in presentation and inclusion in prestigious venues. Moreover, we have made progress with respect to unlocking the power of the game as an educational tool. All of this, however, has left us with many more questions and much work to do. If we want to make formal claims about the educational value of both the game and Teacher's Guide, a systematic study of its impact needs to be performed, either with the same age group as the pilot or with multiple age groups and skill ranges. We also would like to get information from other teachers who have used the materials in their classroom, in other districts and with different backgrounds and approaches.

It would be very interesting to see if scaffolding could be integrated in the game experience so that those outside of a formal school setting could be exposed to more of the underlying meaning of the game. This needs to be handled carefully, however, as it needs to be an authentic part of the experience and should not detract from the initial intent and ability to enjoy the game for simply its entertainment value.

This experience has also allowed us to reflect on the role of an educator in the game design experience, the role of assessment in educational games, and the role of games in education. While in this case, the educator provided us with a framework for using our game in an educational environment and provided a good amount of scaffolding to support the learning, it was in support of a game that already existed. What would this game have looked like if the educational mission was front and center? Would assessment have been built into the game? How would that have changed the experience? Should all games with an educational mission have an educator in the process from the beginning?

We brought in an educator at a much later stage in our process than is typical for an educational game, but our initial goals were not to build an explicitly educational game. While that has drawbacks in the way the educational content is integrated into this game, it afforded us opportunities that would not exist had the game been totally created with a strictly educational focus. It is unknown what design decisions would have to have been made to support assessment of the educational goals and outcomes, but it is clear that the game would be different and potentially not have the ability to resonate with players as a game after the fact.

While there is much discussion about using games in classrooms and for educational purposes, most commercially successful games are not built with that goal in mind. Therefore, they are often not easily integrated into any part of a standard curriculum. Further, technology is always a barrier in these types of integrations. Even our game that can run directly in a web browser, suffered from problems in the classroom of older laptops taking a long time to start up and connect to the internet.

Our game had at its outset, underpinnings of an educational mission, which may have ultimately led to success in building additional educational scaffolding around the experience while still creating an experience that can stand on its own as a game with entertainment value for the player.

References

Bloom, B.S. (1956). Taxonomy of educational objectives. Vol. 1: Cognitive domain. New York: McKay.

Bloom, B. S., Krathwohl, D. R., & Masia, B. B. (1964). Taxonomy of educational objectives. Vol. 2: Affective domain. New York: McKay.

Cometto, S. (n.d.). Splattershmup: An interdisciplinary teacher's guide. Retrieved from http://splattershmup.rit.edu/downloads/Splattershmup_Teacher_Guide.pdf

Decker, A., Egert, C. A., & Phelps, A. (2016). Splat! er, shmup? A postmortem on a capstone production experience. In The 46th Annual Frontiers in Education Conference (FIE) (pp. 1-9). Erie, PA: IEEE.

Decker, A., Phelps, A., & Egert, C. (2017). Trial by a many-colored flame: A multi-disciplinary, community-centric approach to digital media and computing education". In S. Fee, A. Holland-Minkley, & T. Lombardi (Eds.) New directions for computing education: Embedding computing across disciplines (pp. 237-257). Cham: Springer.

Egert, C. & Phelps, A. (2011). Motivating Science Education through games. In M. Khine (Ed.) *Learning to play: Exploring the future of education through video games 53,* (pp. 129-151). New York: Peter Lang.

Greenberg, J. & Jordan, S. (2007). *Action Jackson.* Square Fish.

ITSE. (n.d.). Retrieved from https://www.iste.org/

Kleiner, F.S. (2010). *Gardner's Art through the Ages: The Western Perspective, Volume II (13th ed.)*. Boston: Wadsworth Cengage Learning.

National Core Arts Standards. (n.d.). Retrieved from http://www.nationalartsstandards.org/

National Gallery of Art Washington (2009). Inside scoop Winter 2009. Retrieved from https://webarchive.library.unt.edu/eot2008/20090114032505/http:/www.nga.gov/kids/scoop-pollock.pdf

Project Zero. (n.d.). Artful thinking. Retrieved from http://www.pz.harvard.edu/projects/artful-thinking

Rojas, F. (2012). *What is a shmup?* Retrieved from https://gaminghistory101.com/2012/02/29/shmup/

Splattershmup (n.d.). *Splattershmup: A game of art and motion.* Retrieved from http://splattershmup.rit.edu/

FOR PLAY: LEARN TO CODE FOR LOOPS THROUGH PLAY

Learn to Code For Loops Through Play
DURELL BOUCHARD

Abstract

Many students drop out of computer science programs, in part, because they find the work to be tedious and boring. Incorporating play into the learning process can help make learning how to program more fun. To bring the joy of programming to more students, I present the educational browser game *For Play*. The game helps players learn to write code using several common programming patterns that use for loops, a common programming construct that facilitates executing repeated code. *For Play* is designed using research from game design to make it fun and engaging and research from computer science pedagogy to improve learning outcomes.

For Play: Learn to Code For Loops Through Play

Many of the students that enter college intending to major in computer science ultimately graduate with a different major. One reason for this is that not all students find learning computer science enjoyable. Biggers, Brauer, and Yilmaz found that students who dropped out of a computer science program reported that one reason was that the work was tedious and boring (2008). Games, in contrast, are fun. So, by incorporating educational programming games into computer science curricula, learning to program can be more fun.

Duckworth (2016) argues that the motivation required to develop skill at a task is engendered by having a deep interest in it. And an interest is cultivated when the task is initially fun. So, if more students experience the fun and joy of programming early in their education, they will be more likely to develop an interest that will motivate them to persevere through the less fun deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993) required to become proficient at programming and obtain a degree in computer science.

I have created a game, For Play, that helps students learn to write programs that utilize for loops. A for loop is a programming control structure that facilitates creating repeating code. They can simplify the solutions to complex problems and are a fundamental part of any sophisticated program that deals with large amounts of data. While for loops are themselves a simple concept, their use can be quite complicated when paired with other concepts such as variable updating. This makes for loops an excellent choice for deliberate practice in a game.

There are a plethora of existing educational programming games. In fact, an ITiCSE working group surveyed over 100 games for computer science education (Johnson, et al., 2016). None of the games surveyed, however, focus solely on for loops. For Play's limited scope reduces its interdependency with other programming topics and makes it easier for instructors to insert it into an existing curriculum.

For Play's design uses research results from the fields game design and computer science pedagogy to help players become proficient at writing code with for loops. The game helps students learn by scaffolding the coding process by providing partially complete code gradually increasing the difficulty level. It promotes active learning by using rapid, low-stakes, visual feedback of program execution. It engages and motivates players by using ephemeral, positive, visual feedback and personified error message reporting. And finally, it encourages players to create clean code with a reward system that values simpler solutions.

Game

For Play is an educational browser game written in JavaScript. In the game, players take the role of an eminent particle physicist overseeing a research lab. The lab's goal is to model the behavior of exotic particles in order to create a unifying theory of physics and ultimately find the answer to the ultimate question of life, the universe, and everything. The lab's technicians have gathered data on unexpected phenomena in the flux of dilithium crystals and have begun writing programs to simulate the phenomena. However, the technicians were unable to finish; they need the player's genius to finish the simulations' code.

The game's user interface presents the player with a small amount of program code, optionally in Python or Java/C++, that uses a for loop to repeatedly call a function to draw a line graph that represents the simulation output. However, the code is missing several key sections. The player must complete the code to solve the puzzle by filling in the missing pieces to reproduce the observed line graph and produce the correct simulation. Different levels of the game require different coding design patterns and omit different sections of the code to help the player practice different for loop programming paradigms. Figure 1 shows the user interface of For Play including the incomplete code at the top, the line graph visualization of the simulation in the middle, and the player feedback at the bottom. Note that the goal line graph is gray, and the line graph produced by the player's input is blue. A video demonstration of the game that better illustrates the gameplay can be found on its website (For Play, 2018).

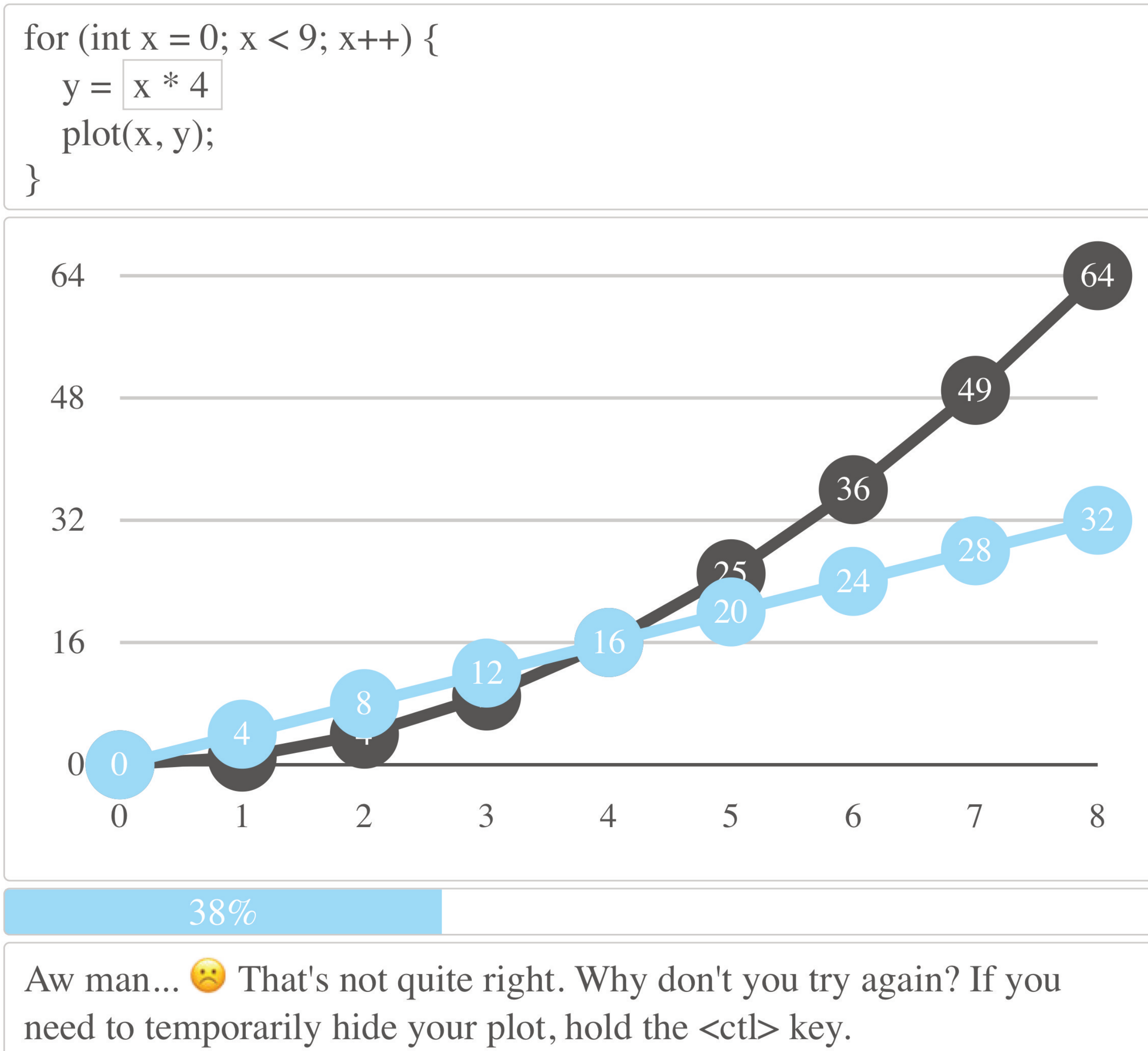

Figure 1. A Puzzle from Level 2: Loop Control Variables.

The game gives feedback to the player in the form of encouragement and program errors in the message pane at the bottom of the user interface. Above the message pane, the game displays the percentage of puzzles that have already been solved as a progress bar. Clicking on the progress bar reveals the puzzle selection pane. In this pane, the individual puzzles are represented as stars and are organized into different levels that focus on different for loop programming patterns. The player can select puzzles to attempt by clicking on the puzzle's star. The puzzle selection pane can be seen in Fig. 2.

The player can modify and reattempt a puzzle without any penalty. In this way, the game encourages the player to experiment and play with the code and to establish a connection between the visualization and the different editable parts of the code. Just like in programming, there are multiple solutions to every puzzle, but simpler solutions are better. Each puzzle is completed by reproducing the given graph, but players are encouraged to find the simplest solution by awarding colored stars for efficient solutions on the puzzle selection pane.

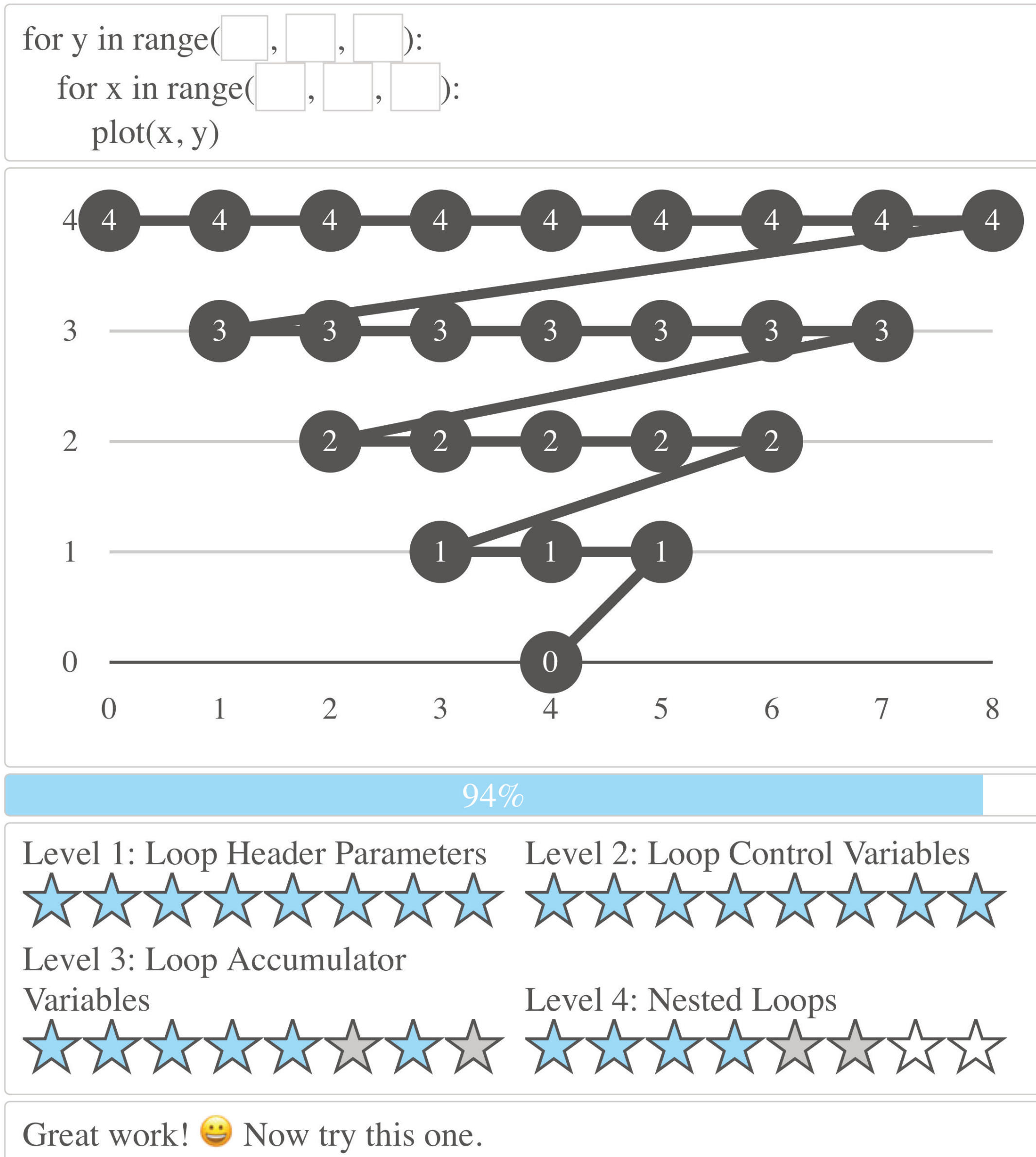

Figure 2. A Puzzle from Level 4: Nested Loops.

Each of the levels of For Play focuses on different programming patterns that can be used to solve problems using for loops:

Level 1 – Loop Header Parameters: On level one, the player must complete the missing sections of a for loop header, the start, stop, and step in Python or the initialization, condition, and afterthought in Java/C++. The missing sections are the parameters of the for loop that determine the value of the loop control variable during each iteration of the loop. The loop control variable is used by the plot function in the loop body to produce the graph. See Fig. 3 for an example of a level-one puzzle. The player can experiment with the loop parameters' values and instantly see the impact on the graph visualization. This helps players learn how to write for loops by allowing the player to explore the relationship between the different parts of the loop and the behavior of the loop.

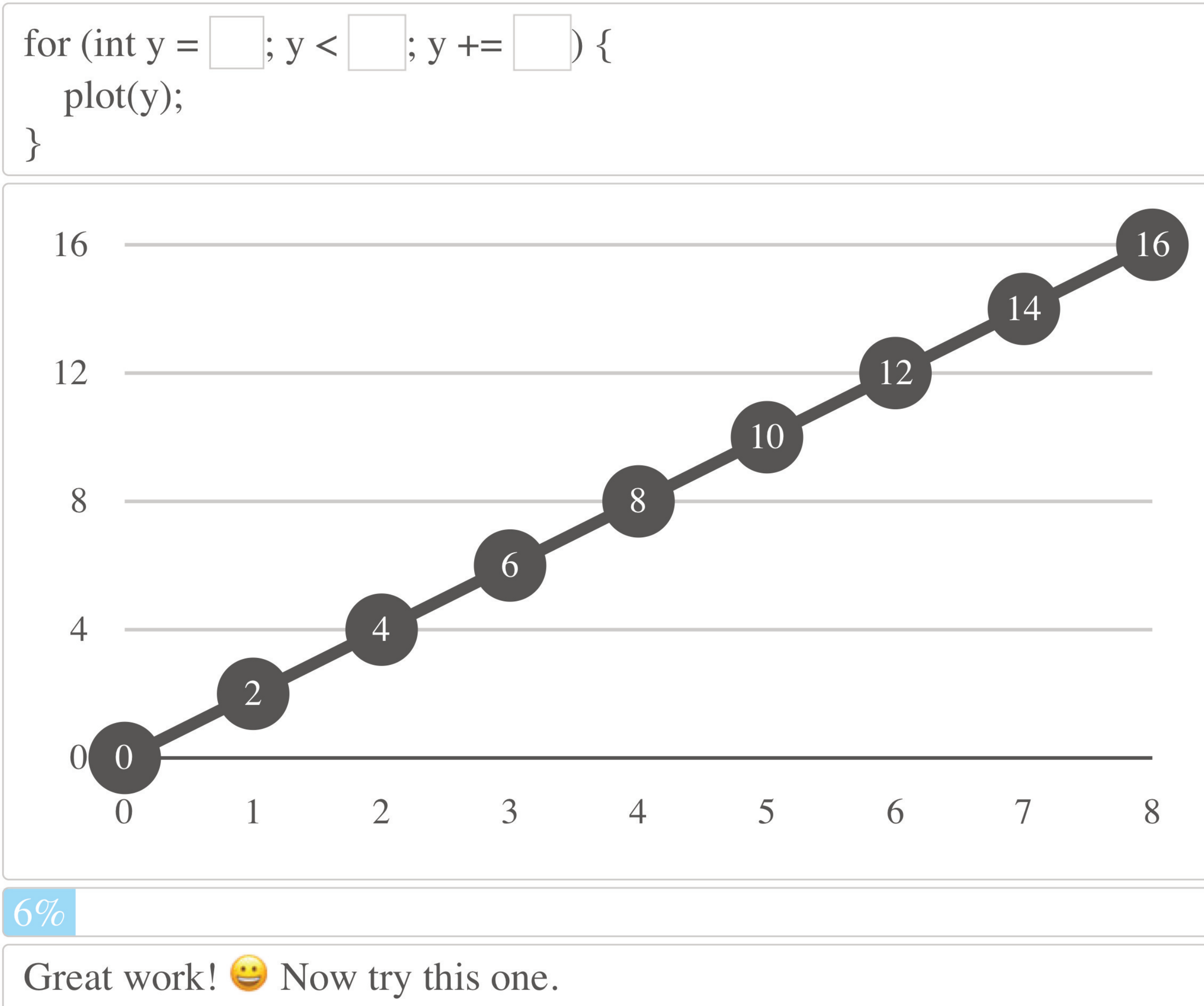

Figure 3. A Puzzle from Level 1: Loop Header Parameters.

Level 2 – Loop Control Variables: On level two, the player cannot modify the loop header parameters. Instead, the player must create mathematical equations using the loop control variable to change the values passed to the plot function. See Fig. 1 for an example of a level-two puzzle. Some of the graphs in level two are identical graphs in level one, but because the player's control of the visualization is different, it encourages the player to make the connection between different approaches to solving the same problem. Level two also contains puzzles with non-linear plots that encourage the player to experiment with equations that are more complex and interesting.

Level 3 – Loop Accumulator Variables: On level three, the player cannot modify the loop header parameters or use the loop control variable. Instead, the player must use an accumulator variable. An accumulator variable is a variable that is defined before the for loop and is updated inside of the loop body using an equation that defines a new value for the accumulator variable using its current value. Figure 4 shows an example of a level-three puzzle and an accumulator variable. Using a variable's value in a calculation of itself is often confusing for novice programmers, especially when it is done inside of a loop. Puzzles on level three give players practice with simple uses of an accumulator variable by reusing graphs from levels one and two. Level three also allows players to establish the relationship between the accumulator variable’s definition and its update statement.

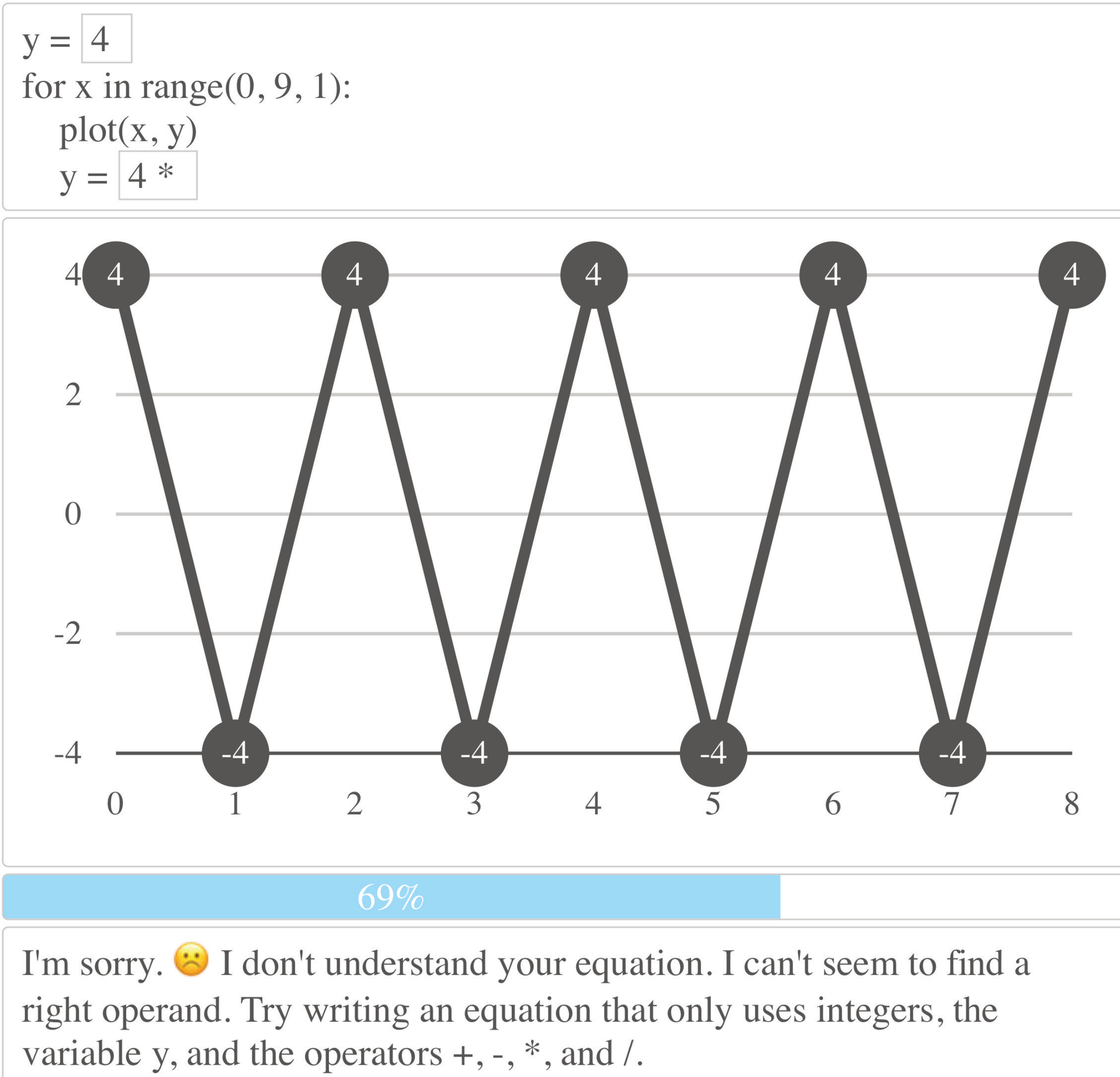

Figure 4. A Puzzle from Level 3: Loop Accumulator Variables.

Level 4 – Nested Loops: On level four, the player must complete the missing sections of two for loop headers, one nested in the body of the other. Figure 2 shows an example of a level-four puzzle. Nested loops can be tricky to write for novice programmers because the value of the control variable of the outer loop, which changes, can be used in the header of the inner loop. So, the interior loop not only runs repeatedly, but it can behave differently each time it runs. Puzzles on level four allow players to experiment with the header parameters of both the inner and outer loops which helps players establish the impact of the outer loop’s control variable on the behavior of the inner loop.

Discussion

The design of For Play is guided by research in both game design and computer science pedagogy to make learning to code for loops easier and more enjoyable in several ways. Most importantly, the game's play mechanic, reading and writing code, is integral to the game's intended learning outcome, proficiency coding common loop programming patterns. Habgood and Ainsworth (2011) have shown that players learn more and play longer if the learning objective of an educational game is well integrated with and dependent on the game's primary play mechanic. Paras and Bizzocchi (2005) add that the gameplay should also include opportunities for reflection on the learning activity. For Play provides reflection opportunities by providing the player with rapid visual feedback input code execution and by not attaching game dynamics to the timing of the player's input. This gives the player unlimited time to reflect on their previous input which allows the player to draw conclusions and construct a new plan of action. This cycle is the process of experiential learning as described by Kolb (1984) which has been found to have learning benefits in many contexts.

The experiential learning feedback and reflection cycle of For Play also encourages play by using low stakes and rapid visual feedback. The game is low stakes because there are no penalties for incorrect solutions and there is no limit to the number of attempts or the amount of time between attempts. This encourages players to experiment with different inputs. For Play produces a visualization of code execution that allows the player to quickly see and comprehend why an input produces a particular output. Quickly seeing how a solution is incorrect helps players correct their mental model of program execution so that getting answers wrong is a useful part of the learning process. This process of experimentation is a form of active learning which has been shown to be beneficial to learning in many subjects, including computer science (Freeman et al., 2014). Odekirk-Hash and Zachary (2001) have also shown that rapid automated feedback can reduce the amount of help that learners need, and time spent solving problems without compromising learning outcomes.

Like all games, For Play uses rewards to influence player behavior. In the case of an educational game, the design and implementation of rewards are critically important as the rewards must not undermine the learning goals of the game. For Play uses several different rewards to encourage the player to complete the puzzles. The game uses both animations and textual messages for positive ephemeral feedback rewards. When a puzzle is completed, the visualization graph scales out while a congratulatory message is displayed. See the gameplay demonstration video on the game's website for an example of the animation (For Play, 2018). Bracken, Jeffres, and Neuendorf (2004) have shown that praise in the form of textual feedback can increase a user's intrinsic motivation and perceived ability.

For Play also uses rewards to encourage players to play longer and complete more puzzles with a completion progress bar, a puzzle completion checklist, and a level unlocking mechanism. In the puzzle selection pane, each of the programming patterns is represented as a separate level and each puzzle is represented as an outline of a star that becomes filled in when the puzzle is solved correctly. See Fig. 2 for an example of the completion checklist stars. Players can select any puzzle that has already been attempted in the current or previous level, but subsequent levels are not available until all puzzles in the current level are completed. Research by Mekler, Brühlmann, Opwis, and Tuch (2013) has shown that progress indicators and levels can increase play time without decreasing intrinsic motivation.

For Play also uses rewards for a secondary game objective. In computer programming, readable code is desirable because it facilitates communication on multi-person projects. So, the secondary objective of For Play is to create solutions that are simpler. On the puzzle select pane, the stars are filled in blue, instead of gray, when the player finds the simplest solution possible, as measured by the number of arithmetic operators used in the solution. Gaston and Cooper (2017) found that a similar three-star reward system encouraged replay and more thoughtful play, as measured by time spent searching for solutions.

Mayer's cognitive theory of multimedia learning posits that "people learn better from words and pictures than from words alone" (2014, p. 8). For Play uses a visualization to express both the puzzle objectives and the result of the execution of the player's input. For Play also animates the execution of a player's input so that the connection between the player's input code and the output visualization is made clearer. Vázquez-Iturbide, Hernán-Losada, and Paredes-Velasco (2017) found that using a visualization in a programming task increased learner motivation. While Grissom, McNally, and Naps (2003) found that students learn more from algorithm visualizations that are interactive. And the visualizations of For Play are inherently interactive.

For Play uses a visualization to provide feedback of program execution, but if there is an error or mistake in the player's input that prevents it from being correctly interpreted, a syntax error, For Play reports the error using personified messages. For example, in the Python programming language when a program contains an equation that is missing the right operand, attempting to execute the program will display the message "SyntaxError: invalid syntax". While For Play will display the message "I'm sorry. ☹ I don't understand your equation. I can't seem to find a right operand." See Fig. 4 for an example of this type of message in the game. Lee and Ko (2011) have demonstrated that personified feedback in a programming tool has a positive impact on learner engagement.

For Play is focused on learning to code for loops, so it uses a subset of the Python and Java/C++ languages. This greatly reduces the scope of issues that the player may encounter which also reduces the scope of errors that the game must detect. For example, if a loop does not run at all, it reports this as an error, while the Python and Java interpreters do not consider this an error as it is a useful behavior in some contexts. The reduced programming language syntax also makes it possible for the game to perform a lexical analysis of the player's input beyond whether the code is syntactically correct. This allows the game to detect common mistakes and to create customized error messages. Marceau, Fisler, and Krishnamurthi (2011) have found that error messages should use simple language and not make recommendations for solutions because learners tend to trust the error message's recommendation even if it is incorrect. So, For Play finds and succinctly reports errors, but it does not make any suggestions for how to correct the error.

Remembering the entirety of a programming language's syntax can be daunting for novice programmers. Moreover, making syntax errors can be aggravating because seemingly insignificant differences in code can cause fatal errors. For Play provides the player with much of the required syntax and allows the player to adjust just those parts of a code that are relevant to the programming pattern of a particular level. This is a form of scaffolding; a "process that enables a child or a novice to solve a problem, carry out a task, or achieve a goal which would be beyond his unassisted efforts" (Wood, Bruner, and Ross, 1976, p. 90). Structuring programming tasks in this way can give learners more confidence and a better understanding of the applicability of the subtasks being learned. Scaffolding has been shown to be useful in many educational contexts as it allows learners to solve complete problems before they have accrued all the skills that are required to solve complex and motivating problems. Linn (1995) has shown that scaffolding in computer science education can improve learning. It is worth noting that effective scaffolding requires fading, the reduction of the assistance given so that learners can gradually become more independent. For Play provides fading in the levels and puzzles that gradually scale up in difficulty. However, the game must also be part of a larger scaffolding that introduces the concepts of for loops before using For Play and challenges learners to independently write programs after playing the game.

Conclusion

I have described the educational browser game For Play that is designed to make learning to write code using for loops more fun. It does this by building off of research on rewards and feedback from game design research and on active learning and visualization from computer science pedagogy research. The game and its source code are freely available on its website (ForPlay, 2018). I encourage developers and educators to modify and use the game to make learning to code more fun for more people.

References

Biggers, M., Brauer, A., & Yilmaz, T. (2008). Student perceptions of computer science: A retention study comparing graduating seniors with CS leavers. *ACM SIGCSE Bulletin*, 40(1), 402-406.

Bracken, C. C., Jeffres, L. W., & Neuendorf, K. A. (2004). Criticism or praise? The impact of verbal versus text-only computer feedback on social presence, intrinsic motivation, and recall. *Cyberpsychology & Behavior*, 7(3), 349-357.

Duckworth, A. (2016). *Grit: The power of passion and perseverance*. New York, NY: Scribner.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological review*, *100*(3), 363-406.

For Play (2018). Retrieved from https://github.com/DurellBouchard/ForPlay

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 111(23), 8410-8415.

Gaston, J., & Cooper, S. (2017). To three or not to three: Improving human computation game onboarding with a three-star system. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, 5034-5039.

Grissom, S., McNally, M. F., & Naps, T. (2003). Algorithm visualization in CS education: Comparing levels of student engagement. In *Proceedings of the 2003 ACM Symposium on Software Visualization*, 87-94.

Habgood, M. J., & Ainsworth, S. E. (2011). Motivating children to learn effectively: Exploring the value of intrinsic integration in educational games. *The Journal of the Learning Sciences*, 20(2), 169-206.

Johnson, C., McGill, M., Bouchard, D., Bradshaw, M. K., Bucheli, V. A., Merkle, L. D., … & Zhang, M. (2016). Game development for computer science education. In *Proceedings of the 2016 ITiCSE Working Group Reports*, 23-44.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

Lee, M. J., & Ko, A. J. (2011). Personifying programming tool feedback improves novice programmers' learning. In *Proceedings of the Seventh International Workshop on Computing Education Research*, 109-116.

Linn, M. C. (1995). Designing computer learning environments for engineering and computer science: The scaffolded knowledge integration framework. *Journal of Science Education and technology*, *4*(2), 103-126.

Marceau, G., Fisler, K., & Krishnamurthi, S. (2011). Mind your language: On novices' interactions with error messages. In *Proceedings of the 10th SIGPLAN Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software*, 3-18.

Mayer, R. E. (Ed.). (2014). *The Cambridge handbook of multimedia learning*. Cambridge, United Kingdom: Cambridge University Press.

Mekler, E. D., Brühlmann, F., Opwis, K., & Tuch, A. N. (2013). Do points, levels and leaderboards harm intrinsic motivation?: An empirical analysis of common gamification elements. In *Proceedings of the First International Conference on Gameful Design, Research, and Applications*, 66-73.

Odekirk-Hash, E., & Zachary, J. L. (2001). Automated feedback on programs means students need less help from teachers. *ACM SIGCSE Bulletin*, 33(1), 55-59.

Paras, B., & Bizzocchi, J. (2005). Game, motivation, and effective learning: An integrated model for educational game design. In *Proceedings of the 2005 DiGRA International Conference: Changing Views – Worlds in Play*.

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of child psychology and psychiatry*, *17*(2), 89-100.

Velázquez-Iturbide, J. Á., Hernán-Losada, I., & Paredes-Velasco, M. (2017). Evaluating the effect of program visualization on student motivation. *IEEE Transactions on Education*, 60(3), 238-245.

AVATAR EFFECTS IN A STEM-GAME WEBSITE

LETÍCIA CHERCHIGLIA AND RABINDRA RATAN

Abstract

The *STEM Game Crew* was developed as a portal to online STEM games. The website was used to test the expectation that science-related (versus non-science related) avatars and avatar customization would enhance users' STEM attitudes (i.e., STEM-learning self-efficacy and STEM interest). Data collected in a Midwestern public middle school (N = 53) partially supported this expectation. Science-related avatars were associated with higher STEM attitudes for boys only. Unexpectedly, avatar customization was associated with lower STEM attitudes across gender. STEM attitudes were positively associated with avatar identification and avatar embodiment, though gender differences were observed. This study illustrates the potential benefits and limitations of utilizing avatars in educational game websites, but also provides insights into the ways that avatars can be designed to enhance student learning and motivation.

Data from the U.S. Bureau of Labor Statistics (2014) suggests there will be a shortage of professionals in Science, Technology, Engineering, and Math (STEM) fields unless heavy incentives are provided to spark students' interest in pursuing STEM careers. It seems the earlier students become interested in STEM topics the better: 8th graders reporting high interest in science are three times more likely to pursue STEM careers in the future (Tai, 2006), which coincides with Maltese and Tai's (2010) finding that STEM graduate students and scientists usually report that their interest in technology topics started before or during middle school. One way of making middle-school students more interested in STEM topics is through the use of digital games in the classroom (Barab & Dede, 2007; Maltese & Tai, 2010). Although STEM games are prolific online, there is a lack of structure and pedagogy in most of the websites hosting those games.

Driven by this need, the *STEM Game Crew Website* (http://www.stemgamecrew.org/) was developed through a partnership between Michigan State University and WKAR television program *Curious Crew* (http://www.wkar.org/programs/curious-crew/). In the website, users can find more than 65 STEM online games related to different STEM topics and episodes of the *Curious Crew* science-learning show. Based on the Proteus Effect (Yee & Bailenson, 2007) and Bandura's (1977) Social Cognitive Theory, this study aims to examine whether science-related avatars can influence users' self-efficacy and STEM learning interest, and to investigate possible differences across gender.

Learning Science Through Digital Games

There is a growing body of literature connecting digital games and science education. Science learning games can facilitate learning, especially when the games are designed in ways that support social interaction, practicing science, and involvement in socio-scientific inquiry (Barab & Dede, 2007). Science games appeal to students because of their potential for engagement and fun (Marino, Israel, Beecher, & Basham, 2012). However, science teachers may struggle when including digital games in their curricula. The present project aims to address three specific challenges in this regard.

First, the *STEM Game Crew website* aims to simplify the process of identifying STEM games; games on the site were curated by the research team to be topically consistent with each *Curious Crew* episode. Second, a hypothesis-testing structure was used to guide game playing in order to motivate students to develop an inquisitive mindset, to broaden their definition of science, and to help augment their interest and self-efficacy in STEM fields (Bandura, 1977). Before playing a game, users are asked to create hypotheses based on the game's name and description. Then, after playing the game, users report reflective observations based on their gameplay experiences. Finally, the site aims to enhance engagement in the games and STEM attitudes through the use of avatars. Previous research shows that avatars can impact users' behaviors even after the mediated experience is over (i.e., a phenomenon known as the Proteus Effect; Yee & Bailenson, 2007), with the strength of such effects depending on the psychological attachment between users and their avatars (Ratan & Dawson, 2015). Such avatar-user attachment can include perceptions of avatar identification (i.e., feelings of similarity with the avatar's identity and appearance) or embodiment (i.e., feelings of physical presence in the avatar's body). These aspects of avatar perceptions may enhance the experience and outcomes of avatar use (Klimmt et al, 2010).

Gender Gap and Stereotypes in STEM

According to data from the National Science Foundation (2003), starting from middle school, girls consistently show lower scores on standardized science and math tests compared with boys of the same grade. This gender gap in STEM can be seen as an outcome of stereotype threat (Steele & Aronson, 1995), i.e., the phenomenon that people conform to negative stereotypes associated with identity when reminded of those stereotypes. The gender gap is part of a vicious circle driven by negative stereotypes regarding girls' abilities in hard sciences: because girls are led to believe they will perform worse than boys, they become less interested in pursuing STEM activities, which then detracts from their actual performance in these domains. This supports the stereotype and the gap widens. Initiatives such as the *STEM Game Crew* are designed to bridge the gender gap in STEM by showing that science games can engage young people regardless of gender. Moreover, the use of different types of avatars in the website might help users feel more motivated to learn about STEM topics.

Avatar Effects

In the context of mediated environments such as the *STEM Game Crew* or educational games, avatars can be used to increase engagement and boost learning (Falloon, 2010). However, most previous studies related to the Proteus effect have relied on adult populations, thus research on the use of avatars in mediated education environments for children is still scarce. Addressing this gap in the literature, the present study explores how different aspects of avatar design can impact STEM attitudes in the context of a STEM-game portal website (i.e., the STEM Game Crew site). People tend to conform behaviorally to their avatar's identity traits, for example, gaining confidence after using a taller avatar (the Proteus effect; Yee & Bailenson, 2007), thus, we expect users with avatars containing scientific characteristics to show more positive STEM attitudes. Specifically, we expect users with science-related avatars to be influenced by these scientific characteristics and thus be drawn to science and STEM in general, as hypothesized:

H1: Science-related (versus non-science related) avatars will lead to more positive STEM attitudes.

Moreover, avatar customization has been found to facilitate the Proteus effect because through customizing the avatar, the user perceives the avatar as more relevant to the self (Ratan & Dawnson, 2015; Ratan & Sah, 2015). Avatar identification, embodiment, and idealization may also facilitate the Proteus effect because they reflect a psychological merging of the user's perception of self and the avatar (Klimmt et al., 2010). These psychological aspects of avatar use have been conceptualized together (Van Looy, Courtois, De Vocht, & De Marez, 2012) but not with respect to avatar customization, so they are examined separately in this study. These provide the foundation for the following hypotheses:

H2: Avatar customization (versus non-customization) will lead to more positive STEM attitudes

H3: STEM attitudes are positively related to avatar perceptions — identification (H3a), embodiment (H3b), and idealization (H3c).

Finally, because the *STEM Game Crew* aims to help bridge the gender gap in STEM, we would like to explore how boys and girls are influenced differently by their avatar use. Avatars can trigger stereotype threat in STEM-related media, harming performance for minority users, when avatars display stereotyped demographic traits (e.g., race) compared to when they are devoid of such characteristics (e.g., displayed as a simple shape; Kao, & Harrell, 2015a; Kao, & Harrell, 2015b). The present study tests for gender differences in the effects of interest, proposing the following research question:

RQ1: Are there gender differences in the effects of avatar types and customization?

Methods Participants

Participants were middle-school students attending technology-related courses from a Midwestern public middle school (*N* = 53). Participants' age ranged from 12 to 14 years-old (M = 12.43) and 54.7% of the sample were girls, 45.3% were boys. Most of the participants were in the 7th grade (84.9%), 15.1% in 6th grade. Most of the participants were Caucasian (73.6%), and other percentages for ethnicity are the following: Native American (7.5%), Middle Eastern 3.8%, Hispanic/Latino (1.9%), Mixed (1.9%). Moreover, 11.3% of participants did not answer the ethnicity question.

Design and Procedures

We conducted a 2 (science-related avatar vs. non-science related avatar) x 2 (customizable avatar vs. non-customizable avatar) experiment for this study using the *STEM Game Crew*. Given the previously discussed findings that avatars that contain demographic identity traits have the potential to trigger stereotype threat (Kao, & Harrell, 2015a; Kao, & Harrell, 2015b), avatars were designed as simple shapes with eyes and mouths that users could customize (depending on condition). Science-related avatars were represented by beakers and non-science related avatars were represented by squares (see Figure 1).

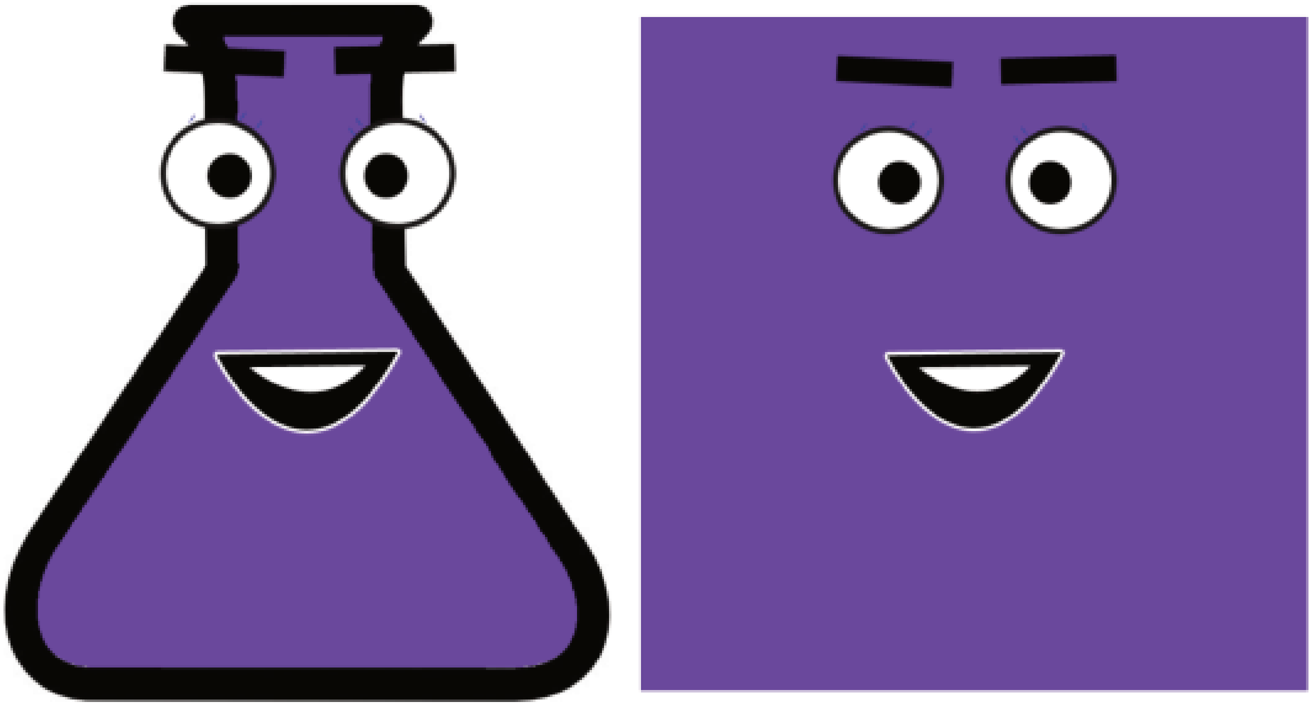

Figure 1: Examples of avatars: science-related (left) and non-science related (right).

Groups with customizable avatars performed the customization as soon as they entered the website ("Avatar Creation" page). The five customizable characteristics were: body color, shape of eyes, shape of eyelashes, shape of eyebrows, and shape of mouths (10 different possibilities for each – see Figure 2).

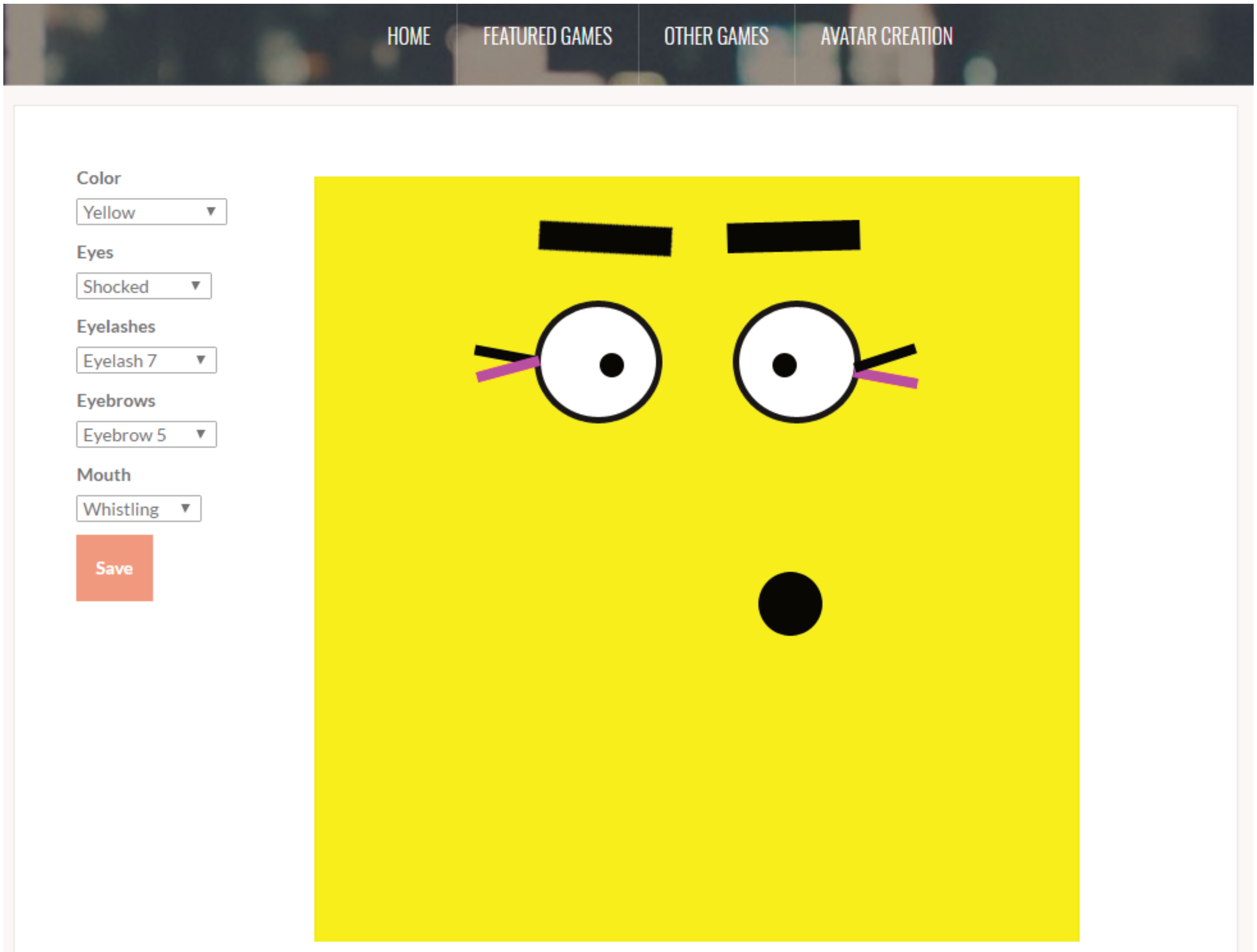

Figure 2. Example of customizable non-science related avatar in the "Avatar Creation" Page.

Groups with non-customizable avatars looked at their assigned avatar ("Your Avatar" page) and were asked to reflect on how to describe it in terms of the same five characteristics (see Figure 3). This procedure was essential because it forced participants to consider their avatar identity carefully even if they did not customize it.

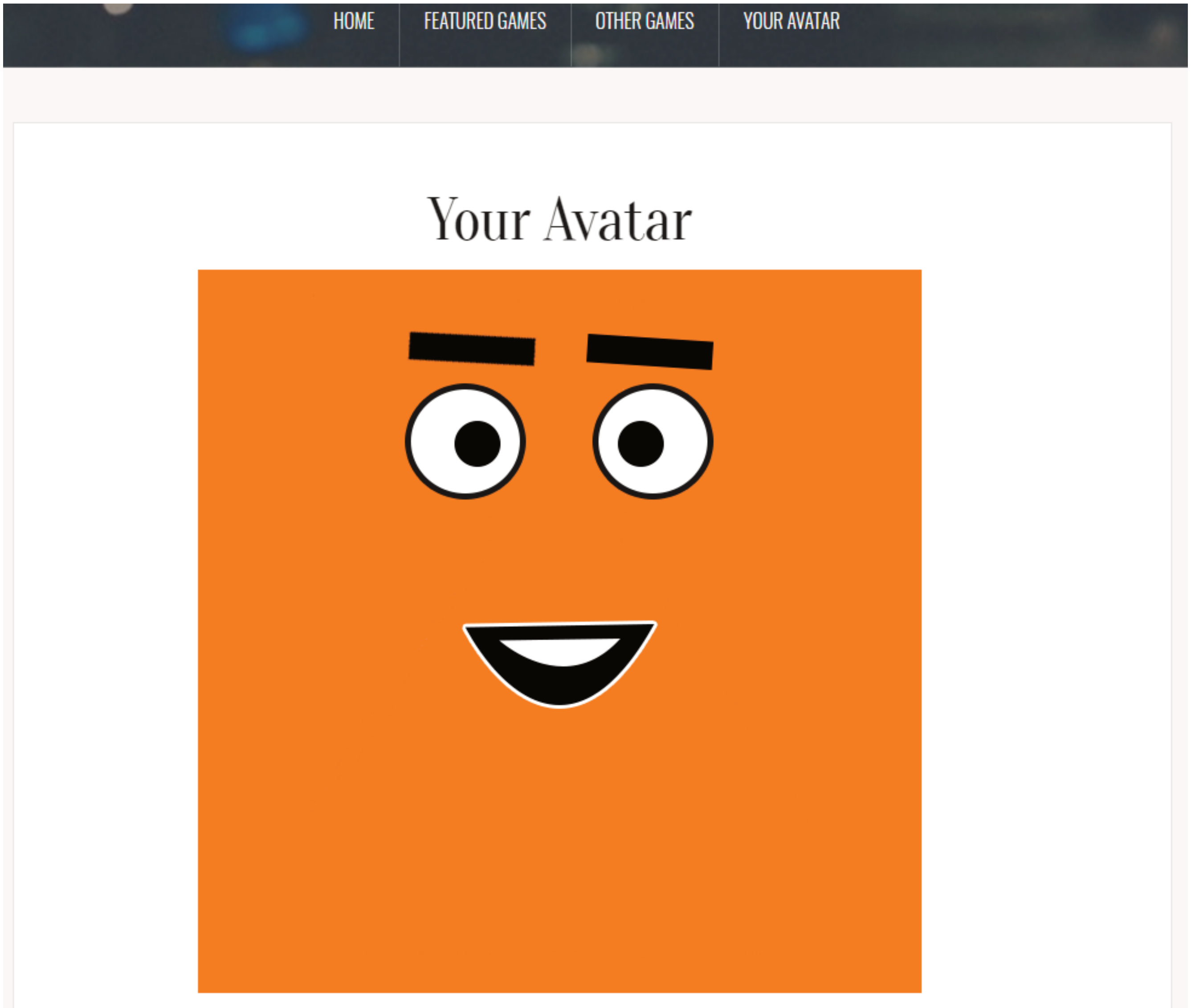

Figure 3. Example of a non-customizable non-science related avatar in the "Your Avatar" page.

Besides the avatar customization/visualization pages, avatars were displayed in the header of all pages and next to user IDs (see Figure 4). Moreover, on game pages, users' avatars were displayed next to user IDs and the game information (see Figure 5). Although the *STEM Game Crew* does not incorporate users' avatars into the games themselves, the avatars are expected to impact users' motivation in engaging in learning activities within the website because these images served as persistent reminders of the user's avatar identity in the website.

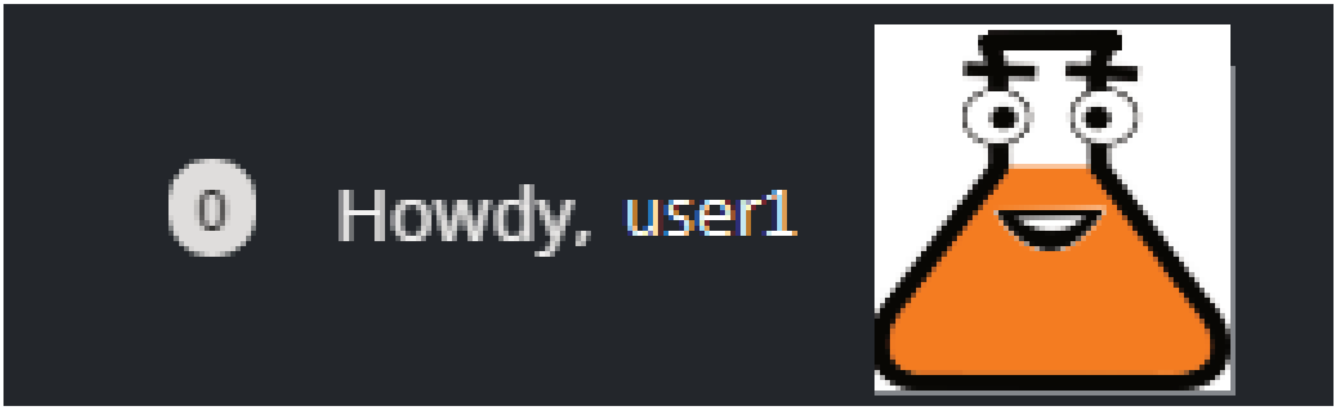

Figure 4. Example of avatar display (header).

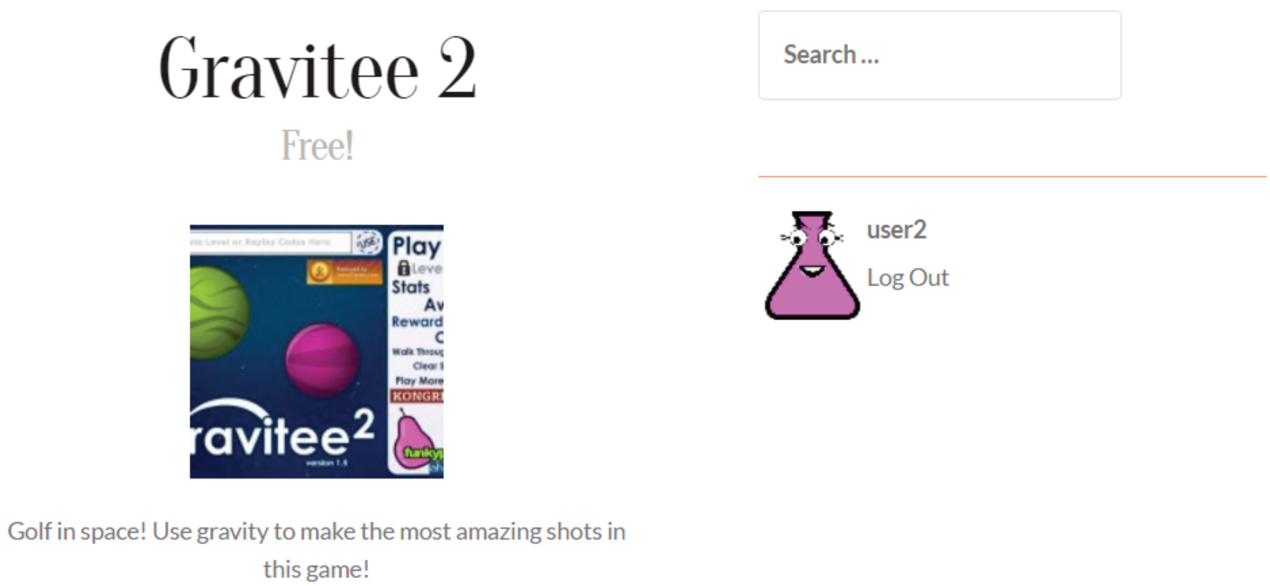

Figure 5. Example of avatar display (games' pages).

Data was collected over one randomly selected regular school day, during six class periods of 50 minutes each. Students were in 6th or 7th grade, all taking technology-related courses with the same teacher. Consent forms were sent one week in advance and students not taking part in the study were assigned another activity separately from study participants. The teacher was responsible for randomly assigning participants to one of four groups and dividing them across different computer labs. Each group had access to one of the four different versions of the website representing the four different study groups, and each participant used a unique but randomized identifier (thus maintaining anonymity) to log into the website. Before logging in, participants answered questions about STEM attitudes. After logging in, participants either customized their avatars or looked at them for 1-2 minutes. Then, participants described their avatars' visual and reflected on feelings towards their avatars via an online survey. This task was intended to enhance the participants' awareness of their avatar's identity. Next, participants were asked to play STEM games for about 30 minutes. Before playing each game, participants rated their perception of the game as fun, simple, capable of teaching something, and capable of explaining science ideas (predictive hypotheses) on a scale of one to five stars. After playing each game, participants rated the game again following the same item (reflective observations). After the play was over, participants answered questions measuring STEM attitudes, avatar perceptions, and demographics.

Measures

STEM Attitudes. There is a broad literature on traditional learning environments and interest in STEM fields and/or STEM self-efficacy (Diekman, Brown, Johnston, & Clark, 2010; MacPhee, Farro, & Canetto, 2013; Rittmayer & Beier, 2009; Soldner, Rowan-Kenyon, Inkelas, Garvey, & Robbins, 2012). In this study, Bandura's (2006) children's self-efficacy scale was adapted to measure STEM-learning self-efficacy. For the question "How well do you think you would be able to perform the following tasks?," students responded on a 5-point Likert-type scale (from "Not able at all" to "Absolutely able") to items asking their "ability to learn" in multiple specific STEM fields (i.e., Math, Physics, Engineering, Chemistry, and Computer Programming) were included in the present analyses. Items were averaged into composite STEM-learning self-efficacy metrics for the pre- (α = .77) and post-survey (α = .81). For STEM interest, a scale was developed based on students' respondes to the question "How interesting do you find the content of the following fields?" on a 5 point Likert-type scale (from "Not interesting" to "Absolutely interesting") for Science, Technology, Engineering, Math, and Computer Science. Items were averaged into composite STEM interest metrics for the pre- (α = .75) and post-survey (α = .80).

Avatar Perceptions. To measure participants' avatar perceptions, they were asked "Regarding your avatar in the website, rate how strongly you agree with each statement," with items rated on a 5 point Likert-type scale, from "Strongly Disagree" to "Strongly Agree". The Items, taken from Van Looy et al. (2012), measured avatar identification (6 items; e.g., "my avatar is like me in many ways"), embodiment (6 items; e.g., "I feel like I am inside my avatar when in the website"), and idealization (5 items; e.g., "I would like to be more like my avatar"). These items were averaged into separate metrics for each construct (avatar identification α = .94; avatar embodiment α = .93; avatar idealization α = .88).

Attention Checks. *Two attention check measures were used (e.g., "Please select 'strongly agree' for this question").*

Results

Overall, results suggest that: **H1** (Science-related (versus non-science related) avatars will lead to more positive STEM attitudes) was supported for boys but not girls; **H2** (Avatar customization (versus non-customization) will lead to more positive STEM attitudes) was contradicted for all participants; **H3** (STEM attitudes are positively related to avatar perceptions – identification (H3a), embodiment (H3b), and idealization (H3c)) was supported for boys and girls in different ways; and insight was provided for **RQ1** (Are there gender differences in the effects of avatar types and customization?) in different ways.

A 2-way ANOVA was conducted with avatar type, avatar customization, and gender as fixed factors, avatar perceptions as covariates, and STEM-learning self-efficacy as the dependent variable. A statistically significant main effect was found for avatar customization ($F(1,47) = 8.37$, $p<.01$, $\eta2 = .19$) and gender ($F(1,47) = 24.72$, $p<.01$, $\eta2 = .41$) on STEM-learning self-efficacy. STEM-learning self-efficacy was higher for participants who did not customize an avatar ($M = 3.71$, $SD = .74$) compared to those who did ($M = 3.51$, $SD = 1.03$), which contradicts **H2**; and higher for boys ($M = 4.05$, $SD =.71$) than girls ($M = 3.16$, $SD =.85$), which provides insight into **RQ1**.

There was also a significant 3-way interaction between avatar type, avatar customization, and gender ($F(1,47) = 6.30$, $p = .02$, $\eta 2 = .15$) on STEM-learning self-efficacy. To interpret this effect, the analysis was rerun separately for boys and girls. For boys only, there was a statistically significant 2-way interaction effect of avatar type and avatar customization on STEM-learning self-efficacy ($F(1,24) = 16.11$, $p<.01$, $\eta 2 = .49$). STEM-learning self-efficacy was highest for boys who did not customize a science-related avatar ($M = 5.90$, $SE = .55$) compared to those who customized one ($M = 3.90$, $SE = .25$) and those who used non-customized or customized non-science avatars ($M = 3.65$, $SE = .21$; $M = 4.10$, $SE = .23$, respectively), which partially supports **H1**. Because avatar customization was connected with the lowest values of STEM-learning self-efficacy, this finding contradicts **H2**.

There was also a significant main effect, for boys, of a positive relationship between avatar identification and STEM-learning self-efficacy ($F(1,24) = 6.46$, $p = .02$, $\eta 2 = .28$), a finding consistent with **H3a**. For girls only, there was a statistically significant main effect of customization on STEM-learning self-efficacy ($F(1,23) = 8.26$, $p = .01$, $\eta 2 = .34$), with STEM-learning self-efficacy higher for those who did not customize an avatar ($M = 3.51$, $SD = .70$) versus those who did ($M = 2.62$, $SD = .79$) which contradicted **H2**. There was also a significant main effect, for girls, of a positive relationship between avatar embodiment and STEM-learning self-efficacy ($F(1,23) = 4.84$, $p = .04$, $\eta 2 = .23$), a finding consistent with **H3b**.

Similarly, a 2-way ANOVA was conducted to examine the effect of avatar type, avatar customization, and gender on STEM interest, with avatar perceptions as covariates. There was a statistically significant main effect of avatar customization ($F(1,47) = 9.20$, $p<.01$, $\eta 2 = .20$), gender ($F(1,47) = 28.92$, $p<.01$, $\eta 2 = .45$), avatar identification ($F(1,47) = 4.10$, $p = .05$, $\eta 2 = .10$), and avatar idealization ($F(1,47) = 4.68$, $p<.05$, $\eta 2 = .12$) on STEM interest. STEM interest was higher for participants who did not customize an avatar ($M = 3.52$, $SD = 1.02$) compared to those who did ($M = 3.39$, $SD = 1.02$), which contradicts **H2**; and higher for boys ($M = 4.00$, $SD = .86$) than girls ($M = 2.90$, $SD = .85$), which provides insight into **RQ1**.

Avatar identification was positively associated with STEM interest (which supports **H3a**), but avatar idealization was negatively associated with STEM interest (which contradicts **H3c**). Moreover, we found a significant 2-way interaction effect between avatar type and avatar customization ($F(1,46) = 6.78$, $p = .01$, $\eta 2 = .16$) on STEM interest. STEM interest was highest for participants with non-customizable science-related avatars ($M = 4.40$, $SE = .35$) compared with non-customizable or customizable non-science avatars ($M = 3.42$, $SE = .19$; $M = 3.32$, $SE = .23$, respectively) and lowest for those with customizable science-related avatars ($M = 2.99$, $SE = .22$), which partially supports **H1**. Because avatar customization was connected with the lowest values of STEM interest, this finding contradicts **H2**.

There was also a significant 3-way interaction between avatar type, avatar customization, and gender ($F(1,47) = 4.73$, $p<.05$, $\eta 2 = .12$) on STEM interest. As done before, the analysis was rerun separately for boys and girls. For boys only, there was a statistically significant 2-way interaction effect of avatar type and avatar customization on STEM interest ($F(1,24) = 13.91$, $p<.01$, $\eta 2 = .45$). STEM interest was highest for boys who did not customize a science-related avatar ($M = 6.10$, $SE = .67$) compared to those who customized one ($M = 3.73$, $SE = .30$) and those who used non-customized or customized non-science avatars ($M = 3.64$, $SE = .25$; $M = 4.05$, $SE = .27$, respectively), which partially supports **H1.**

Because avatar customization was connected with the lowest values of STEM interest for boys, this finding contradicts **H2**.

There was also a significant main effect, for boys, of a positive relationship between avatar identification and STEM interest ($F(1,24) = 8.98$, $p<.01$, $\eta 2 = .35$), supporting **H3a**. For girls only, there was a statistically significant main effect of avatar customization ($F(1,23) = 5.76$, $p = .03$, $\eta 2 = .27$) on STEM interest. STEM interest was higher for girls who did not customize an avatar (*M* = 3.21, *SD* =.94) compared to those who did (*M* = 2.40, *SD* =.32), again, contradicting **H2**.

Discussion

The present study examined how the use of different avatars in a website dedicated to STEM-learning games can influence STEM attitudes. STEM-learning self-efficacy and STEM interest were highest for boys (but not girls) who used science-related non-customized avatars. Regarding avatar customization, STEM attitudes were unexpectedly lower for users of customized avatars, regardless of gender or avatar type. Avatar identification and embodiment were positively associated with STEM attitudes, as expected. Conversely, avatar idealization was negatively associated with STEM attitudes. Gender differences were found, with STEM attitudes higher for boys than girls. Furthermore, STEM attitudes were positively associated with avatar identification for boys only, and with avatar embodiment for girls only. Overall, these findings present consistencies and contradictions with previous research on the effects of avatars, providing insights into the limitations and potential to harness them in educational contexts.

The finding that science-related, non-customized avatars led to more positive STEM attitudes for boys is consistent with the Proteus effect. This suggests that avatars can be designed in ways that promote intended outcomes in educational games and other media. Specifically, the science-related identity characteristics imbued in the avatar influenced the website user's perception of being capable of or interested in STEM fields. This finding is notable because it contributes to the sparse existing literature on the use of the Proteus effect in educational media for children. Designers and practitioners may apply these findings to develop more effective STEM education platforms that include avatars. This finding also raises an important theoretical question regarding the gender difference in the effect of avatar identity. Why did the science-related avatar only improve STEM attitudes for boys? As a post-hoc approach to addressing this question, we tested for gender differences in the avatar perception measures. There was a significant interaction between avatar type and gender for avatar identification ($F(1,47)= 15.25$, $p<.01$, $\eta 2 =.28$), embodiment, and idealization (similarly significant, also with medium/strong effect sizes). Across all three measures, girls reported stronger connections with beaker avatars than shape avatars, while boys reported the opposite. A visual inspection of the girls' qualitative descriptions of their avatars indicated that many recognized that the avatar was a beaker and some even mentioned science in their descriptions, suggesting that this difference was not driven by a misinterpretation of the avatar shape. However, the same visual inspection suggested that girls' interpretation of the avatar's feelings was associated with negative emotions (e.g., the same avatar was described as "happy" by boys, but "concerned" by girls). This further complicates the interpretation of the previous finding. Although girls felt more strongly connected to the beaker avatars, these avatars did not influence their STEM attitudes as it did for boys. One interpretation is that the gender gap in STEM is already so deeply ingrained by middle school that the avatars in this context were not a strong enough intervention to positively influence girls' STEM attitudes. Future research could test this explanation by utilizing more immersive science-related (versus non-science) avatars with this population and testing for gender differences.

The unexpected finding that avatar customization hindered STEM attitudes may relate to the design of the specific media environment used in this study. The avatars in the website were abstract, non-gendered entities, limiting enjoyment of avatar customization. Although this design decision was guided by the idea that abstract avatars would help circumvent gender stereotypes, this approach seemed to have unintended consequences. Perhaps avatars could be kept androgynous at their core, but be more anthropomorphized than simple shapes in order to enhance the enjoyment of customization. Or perhaps customization detracted from engagement in the website's main activities — rating and playing STEM games. Future research could examine such a potential explanation by having all participants customize an avatar, but then having only one group of participants assigned to use the customized avatar.

The findings that avatar identification and embodiment were positively associated with STEM attitudes are consistent with the expectation that these psychological aspects of avatar use may serve as mechanisms of the Proteus effect. However, this evidence should be considered with the caveat that causality cannot be determined definitively from this cross-sectional data. While the theoretical argument that avatar identification and embodiment should precede the STEM attitudes generated through site use, the possibility exists that participants with more positive STEM attitudes were more prone to experience avatar identification and embodiment. Future research should tease apart this issue by manipulating (instead of only measuring) avatar identification and embodiment directly.

The finding that avatar idealization was negatively associated with STEM attitudes contradicted the hypothesis but was not entirely unexpected. Avatar-self discrepancy (i.e., the perception of an avatar as being better than the self) is associated with lower well-being (Bessière et al., 2007). In this case, if the avatar is idealized and the user reports wishing to be more like the avatar, this may signal such self-discrepancy. Again, causality cannot be determined from this cross-sectional data. Using an avatar the participants idealized may have induced self-discrepancy, thereby hindering STEM attitudes. Alternatively, participants with more negative STEM attitudes (or negative psycho-social well-being in general) may have been more likely to idealize their avatars. Future research could tease apart this issue with a direct manipulation instead of measurement. Regarding other gender differences, the finding that STEM-learning self-efficacy and STEM interest were higher for boys than girls is consistent with previous research regarding STEM self-efficacy and interest in STEM fields (Ratan et al., 2016). This finding aligns with the gender gap in STEM, illustrating that girls show less interest in STEM-related content and less confidence in being able to learn such content. Furthermore, the findings that STEM attitudes were positively associated with avatar identification for boys only, and with avatar embodiment for girls only, are consistent with a previous study illustrating gender differences in the effects of using ideal-self avatars (Ratan et al., 2016). Together with the present findings, this may suggest that female avatar users are more susceptible to the negative effects of avatar idealization and thus avatar embodiment might be a better approach to augmenting the Proteus effect than avatar identification. Future research could test this expectation by manipulating avatar identification and embodiment separately, through different avatar characteristics and control settings, respectively.

The limitations of this study should be noted. First, the sample size was relatively small, due to a large rate of participants who did not fully engage in the study. This may have skewed the sample toward students who are more interested in STEM fields in general. Still, the differences found within the sample tested provide important theoretical and practical insights regarding the constructs of interest. There is no reason to believe that the Proteus effect is only relevant to more motivated students. Another limitation was the population sampled: although there was an approximately equal number of male and female participants, the sample was skewed toward 7th-graders and Caucasians. Future research should aim to include more representative populations. A final limitation is that the avatars in the website were not used extensively because they were not part of the games themselves. Thus, the effects of the avatar's traits on the users are potentially limited.

Conclusion

This study has shown that the Proteus Effect may be valuable in STEM Game context, though further research and analysis should be conducted. Future work includes making design changes in the website, modifying study design to better control participant activities, and including qualitative aspects of analysis to better understand user's thought processes. Overall, this study has illustrated that avatar type and customization can impact STEM attitudes, and that gender differences exist in terms of avatar effects. These findings are especially useful for designers and practitioners when developing education platforms.

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References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In *F. Pajares & T. Urdan (Eds.). Self-efficacy beliefs of adolescents,* (Vol. 5., pp. 307-337). Greenwich, CT: Information Age Publishing.

Barab, S., & Dede, C. (2007). Games and Immersive Participatory Simulations for Science Education: An Emerging Type of Curricula. *Journal of Science Education and Technology, 16*(1), 1–3.

Bessière, K., Fleming Seay, A., & Kiesler, S. (2007). The Ideal Elf: Identity Exploration in World of Warcraft. *Cyberpsychology & Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society, 10*(4), 530–535.

Diekman, A. B., Brown, E. R., Johnston, A. M., & Clark, E. K. (2010). Seeking Congruity Between Goals and Roles. *Psychological Science, 21*(8), 1051–1057.

Falloon, G. (2010). Using avatars and virtual environments in learning: What do they have to offer? *British Journal of Educational Technology: Journal of the Council for Educational Technology, 41*(1), 108–122.

Kao, D., & Harrell, D. F. (2015a, August). Toward avatar models to enhance performance and engagement in educational games. In *Computational Intelligence and Games (CIG),* 2015 IEEE Conference on (pp. 246-253). IEEE.

Kao, D., & Harrell, D. F. (2015b, September). Exploring the Use of Role Model Avatars in Educational Games. In *Eleventh Artificial Intelligence and Interactive Digital Entertainment Conference*.

Klimmt, C., Hefner, D., Vorderer, P., Roth, C., & Blake, C. (2010). Identification With Video Game Characters as Automatic Shift of Self-Perceptions. *Media Psychology, 13*(4), 323–338.

MacPhee, D., Farro, S., & Canetto, S. S. (2013). Academic Self-Efficacy and Performance of Underrepresented STEM Majors: Gender, Ethnic, and Social Class Patterns. *Analyses of Social Issues and Public Policy, 13*(1), 347–369.

Maltese, A. V., & Tai, R. H. (2010). Eyeballs in the Fridge: Sources of early interest in science. *International Journal of Science Education*, *32*(5), 669–685.

Marino, M. T., Israel, M., Beecher, C. C., & Basham, J. D. (2012). Students' and Teachers' Perceptions of Using Video Games to Enhance Science Instruction. *Journal of Science Education and Technology*, *22*(5), 667–680.

National Science Foundation (2003). New Formulas for America's Workforce Girls in Science and Engineering. Retrieved April 14. 2017 from http://energy.gov/diversity/downloads/reports-and-publications-women-and-girls-stem

Peña, J., Hancock, J. T., & Merola, N. A. (2009). The Priming Effects of Avatars in Virtual Settings. *Communication Research*, *36*(6), 838–856.

Ratan, R.A., & Dawson, M.(2015). When Mii Is Me A Psychophysiological Examination of Avatar Self-Relevance. *Communication Research*, 0093650215570652.

Ratan, R., Rikard, R.V., Wanek, C., McKinley, M., Johnson, L., & Sah. Y. J. (2016). Introducing Avatarification: An experimental examination of how avatars influence student motivation. In *2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 51-59). IEEE.

Ratan, R, & Sah, Y. L. (2015). Leveling up on stereotype threat: The role of avatar customization and avatar embodiment. *Computers in Human Behavior*, 50, 367-374.

Rittmayer, A. M., & Beier, M.E. (2009). Self-efficacy in STEM. In B. Bogue & E. Cady (Eds.). Applying Research to Practice (ARP) Resources. Retrieved April 14, 2018 from http://www.engr.psu.edu/AWE/ARPresources.aspx

Soldner, M., Rowan-Kenyon, H., Inkelas, K. K., Garvey, J., & Robbins, C. (2012). Supporting Students' Intentions to Persist in STEM Disciplines: The Role of Living-Learning Programs Among Other Social-Cognitive Factors. *The Journal of Higher Education, 83*(3), 311–336.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology*, *69*(5), 797–811.

Tai, R. H. (2006). CAREER CHOICE: Enhanced: Planning Early for Careers in Science. *Science*, *312*(5777), 1143–1144.

U.S. Bureau of Labor Statistics. (2014) STEM 101: Intro to tomorrow's Jobs. Retrieved April 14, 2018 from http://www.bls.gov/careeroutlook/2014/spring/ art01.pdf

Van Looy, J., Courtois, C., De Vocht, M., & De Marez, L. (2012). Player Identification in Online Games: Validation of a Scale for Measuring Identification in MMOGs. *Media Psychology, 15*(2), 197–221.

Yee, N., & Bailenson, J. (2007). The Proteus Effect: The Effect of Transformed Self-Representation on Behavior. *Human Communication Research, 33*(3), 271–290.

INTEROCEPTIVE AWARENESS: THE "BEING" DIMENSION OF "BEING THERE" IN GAMES AND VIRTUAL WORLDS

The "being" dimension of "being there" in games and virtual worlds

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In this paper we introduce, operationalize, and test a theoretical conceptualization of interoceptive awareness (IA) in games and virtual worlds that parallels neurobiological explanations of interoception and embodied presence. We developed a scale to measure state IA during a Virtual Reality (VR) experience by adapting the Multidimensional Interoceptive Awareness (MAIA) scale that was originally created to measure the effects of meditation programs on general propensity for interoceptive awareness in daily life (trait IA).

Interoception is the capacity and propensity to direct and sustain attention to a state of perceptual presence in the body and a particular quality of awareness (Mehling et al., 2012) where the mind stays in a mode of perception (being), rather than action (doing) (Farb et al., 2015). IA can be defined, from the perspective of neuroscience, as sustained interoceptive awareness — “a state of discerning somatosensory attentional orientation” (Heeter, 2016, p. 1). There are large individual differences in IA, and the capacity and propensity for IA can improve with mental training such as meditation (e.g., Mehling et al., 2012; Bornemann et al., 2015; Heeter et al., 2017). IA can also be enhanced through meditation experiences that focus attention on present moment sensations (Heeter and Allbritton, 2015; Brewer et al., 2011; Mrazek et al., 2013).

Most conceptualizations of presence in virtual worlds identify technology as the main causal agent of presence. State IA is defined by an individual’s attentional orientation, with or without technology. After all, our mind’s natural tendency is to wander, and the natural world and the virtual world are both experienced by the body. The body perceives, interprets, and reacts to visual sensations, sounds, emotions, and thoughts. When we pay attention to the present moment, whether the present moment involves a virtual world or not, we do so by paying attention to the experience of the body. In doing this we feel present and alive. Thus, one of the goals of the current study is to bridge these two approaches to presence, focusing on the relationship between state IA and spatial presence.

We should see a positive correlation between state IA and feelings of self-location’s spatial presence because an individual with high state IA during a Virtual Reality (VR) experience is directing attention to present moment bodily sensations and feelings (of being in the virtual world). In all previous presence research, the stimulus was not specifically designed to activate interoceptive awareness. VR technology and meditation afford an excellent opportunity to compare a virtual environment presence measure with state IA measures.

We examined the relationship between IA and the self-location subdimension of spatial presence. Experimental subjects were randomly assigned to either Samsung Gear VR or HTC Vive conditions where they experienced a 10-minute meditation that guided attention to breath and other present moment feelings. The meditation is grounded in the tradition of yoga and yoga therapy (Chandrasekaran, 2012; Desikachar et al., 2005; Mohan and Mohan, 2004) and was designed to activate state IA. Participants were seated and wore a VR headset enabling them to look around inside a 360-degree virtual representation of a peaceful Colorado River scene that seamlessly combined video, animation, and audio. For comparison, a third condition experienced the meditation with eyes closed.

Results suggest that: 1) state IA was correlated with and significantly higher than trait IA; 2) state IA during the meditation was not different between eyes closed and VR conditions, also VR display technology did not influence state IA; and 3) higher state IA was associated with significantly stronger feelings of spatial presence, whereas display technology had no relationship to spatial presence.

The main contributions from the current study are the introduction of IA to virtual world's presence research and the suggestion to consider IA in virtual worlds and game design. We examined the relationship between trait and state IA during a meditation experience designed with the goal of activating IA by relaxing the body, calming the mind, and directing attention to interoceptive bodily sensations including breath, movement, and the feeling of stability. On average, not only was state IA higher than trait IA, but trait IA predicted state IA. This finding suggests that designed experiences can activate interoceptive awareness beyond an individual's normal propensity for IA. We also explored potential differences in state IA between participants when experiencing the meditation through a VR headset or with eyes closed, audio only. Surprisingly, state IA for participants with eyes closed was nearly identical to state IA for VR participants. Finally, we investigated the relationship between different types of immersive VR headsets and state IA and self-location spatial presence, and did not find any. Overall, due to the significance and clarity of the findings, it seems that IA is a pivotal dimension for explicating spatial presence. Involving meditation experts on VR design teams could yield ways of directing the user's attention towards IA during non-meditation VR experiences.

State IA and trait IA are potentially important constructs for the study of presence in games and virtual worlds. Clearly meditation is a specialized VR experience, one where IA can be expected to be high. Our future research moves to consider IA in gaming experiences – how to measure state IA and whether, when, and how state IA is experienced during gameplay. The extent of state IA and its relation to other presence scales could be examined in non-meditation VR experiences. State IA could be manipulated, perhaps by doing a meditation exercise prior to games and other non-meditation VR experiences, potentially enhancing presence.

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References

Bornemann, B., Herbert, B.M., Mehling, W.E. & Singer, T. (2015). Differential changes in self-reported aspects of interoceptive awareness through 3 months of contemplative training. *Frontiers in Psychology* 5, 1504.

Brewer, J.A., Worhunsky, P.D., Gray, J.R., Tang, Y.Y., Weber, J. & Kober, H. (2011). Meditation experience is associated with differences in default mode network activity and connectivity. *Proceedings of the National Academy of Sciences* 108(50), 20254–20259.

Chandrasekaran, N. (2012). *Principles and practice of yoga therapy: A complete guide for learning and practice of yoga therapy*. Chennai, India: VHP Publications.

Desikachar, K., Bragdon, L. & Bossart, C. (2005). The yoga of healing: Exploring yoga's holistic model for health and well-being. *International Journal of Yoga Therapy* 15(1), 17–39.

Farb, N., Daubenmier, J., Price, C.J., Gard, T., Kerr, C,, Dunn, B.D., Klein, A.C., Paulus, M.P., & Mehling, W.E. (2015). Interoception, contemplative practice, and health. *Frontiers in psychology* 6. 763.

Heeter, C. (2016). A Meditation on Embodied Presence and Meditation. *Presence, Teleoperators, and Virtual Environments* 25(2), 175–183.

Heeter, C., & Allbritton, M. (2015). Being There: Implications of Neuroscience and Meditation for Self-Presence in Virtual Worlds. *Journal for Virtual Worlds Research* 8(2).

Heeter, C., Lehto, R.H., Allbritton, M., Day, T., & Wiseman, M. (2017). Effects of a Technology-Assisted Meditation Program on Healthcare Providers' Interoceptive Awareness, Compassion Fatigue, and Burnout. *Journal of Hospice and Palliative Nursing* 19(4), 314–322.

Mehling, W.E., Price, C., Daubenmier, J.J., Acree, M., Bartmess, E., & Stewart, A. (2012). The Multidimensional Assessment of Interoceptive Awareness (MAIA). *PLoS ONE, 7*(11), e48230.

Mohan, A.G., & Mohan, I. (2004).. *Yoga therapy: A guide to the therapeutic use of yoga and ayurveda for health and fitness*. Boston, MA: Shambhala.

Mrazek, M.D., PhillIAs, D.T., Franklin, M.S., Broadway, J.M., & Schooler, J.W. (2013). Young and restless: validation of the Mind-Wandering Questionnaire (MWQ) reveals disruptive impact of mind-wandering for youth. *Frontiers in Psychology* 4, 560.

JUST MODIKA: PERILS OF MODDING IN DOKI DOKI LITERATURE CLUB

Perils of Modding in Doki Doki Literature Club
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Abstract

Game modifications, or mods, often provide a way for fans and gamers to interact with game content and characters beyond the limitations of the developer's original work. However, when modders invent new content and storylines for independent activist or art games, they can disrupt the developer's intended message. This is the case with two mods, *Monika After Story* and *A Brand New Day* that were created for the popular independent game, *Doki Doki Literature Club* (*DDLC*). The unmodded version of *DDLC* is a psychological horror game that critiques both the cultural hegemony that drives the dating simulator (dating sim) genre and the concept of player control over narrative games. Both mods restore the dating sim's original tropes to the narrative by allowing the player to "save" all of the doomed characters or continue to romantically pursue the game's antagonist, Monika. To complicate the relationship between the game and its fans, developer Team Salvato has released a policy expressly prohibiting mods created with the intention of replacing the original game; all *DDLC* mods must be extensions of the experience to be played after the game rather than standalone products. Through this complicated relationship, the themes of psychological terror and loneliness present in the original game are replaced with heartwarming sentimentalism and even humor traditionally found in dating sims. Thus, both mods erase the activist message even as they provide solace to players who were initially disturbed by *DDLC*'s characters and themes.

Introduction

Doki Doki Literature Club (Version 1.1.0, Team Salvato, 2017) one of the most popular games of 2017, begins with a warning that it "is not suitable for children or those who are easily disturbed." The warning appears in stark contrast to the aesthetics of the title screen, which depicts a quartet of cute anime high school girls. They are the girls of the school's newly formed literature club—Monika, Natsuki, Sayori, and Yuri, each clad in the typical short pleated skirts and knee socks of the anime schoolgirl, and each with her own visual quirks like vibrantly-hued hair. It doesn't take long for the first-person main character to agree to join the club, not only because he is pressured by his childhood best friend, Sayori, and the club president, Monika, but because he sees an opportunity to build a relationship with one or more of the club's attractive members. After all, what could be better than membership in a club in which he has his choice of the four women who are competing for his attention? However, small hints reveal that this club is more than poetry-sharing and frivolous flirting. As the main character states just before the first club meeting, "And thus, today marks the day I sold my soul for a cupcake." With the game's initial warning in the back of their mind, the player can do little but watch these hints slowly build into horror as the game reveals its true narrative: Monika is sentient and in love with the player. Monika's desire slowly becomes desperation, and she manipulates the game to psychologically destroy and then delete the other three characters and all settings aside from herself and a single, stark room.

However, Monika cannot remove all traces of the former club members. The player feels each friend's absence as glitches in the game. For example, when Sayori dies, the game restarts with a scene that is supposed to include her, but her name is replaced by randomly generated text. The player remembers her, because she has just died graphically, but the characters and narrative skip over her as though she never existed, even though ghosts of her presence remain. There is no mourning her loss; the ease with which she is expunged emphasizes that Sayori is a collection of coded lines to create a digital entity. The game removes each character in this way, and the sense of solitude the player experiences increases. There is no way for the main character to save his friends, and there is no closure when they are gone. As the "game" continues to its conclusion, the gamer feels a prevailing sense of loneliness that cannot easily be allayed. The lack of memories and absence of mourning speaks to the ephemeral nature of the digital, and the player's lack of control over the narrative outcome highlights the fact that gamers have little control over games in general, even when those games purport to offer myriad possibilities.

As an art game and cultural commentary on the relationship between games, players, and code, *Doki Doki Literature Club* (*DDLC*) subverts the traditional tropes of the Japanese dating simulation and challenges players' perceived notions of control within visual novels and video games as a medium. In response, several fans have released mods that undermine developer Dan Salvato's intent, creating an experience that re-imagines the game as a more traditional and comical dating simulator, and allows players to regain their lost control. We take an interdisciplinary approach to address how two popular mods, *Monika After Story* (Version 0.8.2, ThePotatoGuy, 2018) and *A Brand New Day* (Version 1.0, Phathom, 2018), take away from the ethics of *DDLC*'s terrifying message that the gamer does not have any control. Therefore, these modifications provide a unique juxtaposition of a game designed to operate under serious and harrowing undertones in the era of interactivity by replacing them what fans prefer to see.

The Dating Sim

Though *Doki Doki Literature Club* presents many of the visual and narrative tropes of dating simulators (or dating sims), the story quickly breaks the standard tropes to reveal an activist angle that presents a challenge to the heteronormative conventions of the dating sim and perceptions of gamer control in video games generally. In this section, we define dating sims as a genre, and then discuss how *DDLC* positions itself within that genre. Little academic literature is written about dating sims, but there is fortunately enough to establish what the genre is. Dating sims are most well-known among Japanese gamers, and there are important distinctions between what comprises a dating sim and what constitutes the closely related visual novel. While the name "dating sim" explicitly defines the purpose of the genre, Roseanne Tompowsky (2013) provides three dominant sub-genres: bishōjo gēmu ("beautiful girl games"), otome gēmu ("maiden games"), and eroge ("erotic games") (p. 4). Bishōjo gēmu games are traditionally marketed towards male gamers, who are generally given the option to date multiple young women. Otome gēmu games are marketed towards women, and these may also include homosexual love interests. Eroge games are defined by their explicit pornographic content

(Tompowsky, 2013, p. 4). According to Emily Taylor (2007), "Dating sims remain confined, for the most part, to the Japanese video and computer game market. While uncommon in the American and European gaming market, they form a significant portion of the Japanese market, with the sales of some games surpassing one million copies" (p. 193). Taylor's article was published in 2007, so gamers now have easier access to visual novels or dating sims thanks to sites like Steam, Humble, and itch.io. However, not all dating simulators are easily ported, and popular video games with dating sim elements that make it to Western audiences generally combine genres, thus making the dating sim secondary to the intended genre (Navarro-Remesal and Loriguillo-López, 2015, p.10). For example, gamers might be familiar with some conventions of the dating sim thanks to the Japanese role-playing game (RPG) series *Persona*, in which the player can gain ranks with characters (or "social links") by spending time with them and giving them gifts they might like; though *Persona* also has complicated battle mechanics and a storyline that doesn't revolve around dating, the relationship between the main character and female character can become romantic once it reaches a particular level, and the choice of who to date is often carefully considered. One might say that *Persona*'s social link system is a dating sim inside of an RPG, even if a social link includes rewards that benefit the combat system.

DDLC is actually an American game, though the aesthetic and mechanics follow many of the same conventions as Japanese dating sims. In *DDLC*, the player controls a high school male character who is coaxed by his longtime friend and next-door neighbor, Sayori, into joining a newly founded literature club at school. The club has three other members, all of whom are female. In a traditional dating sim storyline, the player would, through dialogue and interactions like gift-giving, woo and eventually date the club member of their choice. Emily Taylor (2007) describes this particular type of simulator as "bishōjo" and postulates, "The gamer plays a male character who interacts with various female characters as well as secondary characters such as family members, neighbors, and teachers" (p. 194). One of the primary goals of this particular genre is to establish interpersonal relationships with other characters in the game. Most of the time, they happen to be young women, as is the case in *DDLC*, in which the player never actually interacts with any characters beyond the four club members. In a dating sim, if the gamer wants to establish a relationship with the character of their choice, they have to keep track of characters and what they might like, so they can curry favor with them. In *DDLC*, this favor mainly shows up in the words the player chooses to include in their poems, which they write each evening and share the next day as part of the Literature Club. Certain words are weighted to impact club members. Yuri, for example, is a romantic who likes dramatic words like "effulgent," whereas Natsuki likes cute things and favors words like "fluffy." There are also some dialogue interactions that influence the story, in which the player decides who to spend time with when preparing for an upcoming festival. This emphasis on remembering character types and tailoring interactions to make particular characters happy is a key quality of dating sims, and one that separates dating sims from visual novels, in which there is less opportunity to influence the character relationships and story.

Taylor (2007) identifies a few other tropes of dating sims. From a visual standpoint, for example, location, background art, and character poses are mainly static and are reused throughout the story. These poses can often serve as cues for the characters' emotions (Taylor, 2007, p. 194). This reuse of game content is one way in which visual novels and dating sims are alike. In *DDLC*, much of the action occurs in the classroom where the club meets, at least until the end, when Monika transports the player to her room for eternity.

The final trope of dating sims is that the options presented to the gamer are usually binary and trivial. As Taylor (2007) observes, "Interestingly, any life-changing decisions in the game, such as whether the main character will donate a kidney, are often not decided to the game player" (p. 194). Thus, the dating sim relies on trivial decisions to lend a semblance of narrative control to the gamer, while the main plot points are pre-determined. According to Brent Ellison (2008), a game can present trivial decisions as more important than they actually are by using branching dialogue, a common and well-known narrative tactic in role-playing games like Bioware's *Mass Effect* (2007) and Bethesda's *Fallout* (2008) series. Ellison states, "One common technique employed to give the player a greater illusion of freedom is to have multiple responses lead to the same path. . . .Therefore, branching dialogue usually curves back in on itself such that while an individual choice may immediately produce a unique response, the rest of the conversation is typically not unique to that choice" (2008, p. 1). Based on this trope and some of the ways designers implement it, we can posit that in a dating sim (as in most games) the player has little actual control over the story. From a generic standpoint, it might be more accurate to call *DDLC* a visual novel posing as dating sim, as it ultimately uses the tropes of the dating sim to highlight the lack of control players have in games in general, breaking with the dating sim genre to present a more activist message.

The Dating Sim and Activism

In many ways, *DDLC* adheres to generic conventions of the dating sim genre. However, as the player progresses through the story, they find clues that indicate the narrative might be more subversive than they first thought. The first is subtle, as some of the words that excite the chibi caricatures (Japanese slang for short) when the gamer composes poetry seem out of place given the initial upbeat tone of the game. Eventually, the young women begin to divulge troubling information in explicit or implicit manners: Sayori is clinically depressed, Yuri likes knives and cuts herself, and Natsuki's father is abusive. The young women either share this information with the player-character or reveal it in poems of their own. These poems are prophetic because the main character's romantic interests become increasingly mentally ill, committing disturbing acts such as self-mutilation and suicide. Further, the club president, Monika, reveals to the player that she has been tampering with the game's code to increase the stress of the characters and enhance social divisions within the club. In a fourth-wall-breaking confession, Monika states that she is in love with the person playing the game—not the main character—and has deleted all other characters so the player must date her, and only her, forever. In doing so, she emphasizes that she is the sole romantic choice by coining the popular fan phrase, "Just Monika." To succeed in the game and reach the "true" ending, the player must go so far as to access the game's source files and delete the Monika character.

The revelation that one of the characters is self-aware is important for a few reasons. First, the player realizes that, unlike in the conventional dating sim where the focus is on the player's freedom to influence the outcome, they are not driving this narrative. The choice of which character to date is really no choice at all because the game is rigged. Second, the game draws attention to the problematic and gendered nature of the dating sim as a purveyor of heteronormative culture. Emily Taylor (2007) asserts that "dating-sim games will remain remarkable windows into Japanese popular culture, social expectations, gender relations, and the meanings of work and leisure in contemporary Japan" (p. 206). This point is confirmed by Roseanne Tompowsky (2013) who notes that even if there are some exceptions, many Japanese dating sims rely on gendered language (p. 53). However, despite following the visual conventions of a Japanese dating sim, *DDLC* was designed by an American, Dan Salvato, a point that might explain some of the irreverence toward the generic structures as evidenced by some direct American localization. For example, Sayori, Yuri, and Natsuki are Japanese names, but Monika is unmistakably Western. Salvato himself never seems to comment on the fact that the genre he borrows most from has its roots in Japanese culture, though he does admit to being heavily influenced by the visual novel. We can only speculate on some of the cultural influences that may have led him to make design and narrative choices with the aim of subverting the dating sim. However, in a reddit "Ask Me Anything" thread, Salvato (2017) mentions some of his motives: "I wanted to help demonstrate the capabilities of interactive fiction, providing some kind of experiences that only a video game could provide. I wanted to disturb people and make them think about life and uncomfortable things. And I just wanted to make a decent story with characters worth caring about." With this in mind, it appears his goal was to create an engaging interactive narrative that showed the strengths of the genre but at the same time questioned and poked fun at some of its norms to invoke a state of discomfort and a reflection on other issues brought up in the game, like mental health. The genre's place in Japanese culture, however, does not seem to have been critiqued or considered.[i]

In the traditional dating sim, several female characters vie for the attention of a single male character. In some examples, as is the case with one of the mods we discuss below (*A Brand New Day*), the game promotes the realization of the harem fantasy, in which the male character does not have to choose a single romantic interest, but can date all female characters. Though we might view this trope as a healthy promotion of queer or polyamorous relationships, the way in which the fantasy is handled more often than not privileges male desire. Even games with socially conscious messages, like the *Persona* series, very rarely allow for anything outside the heteronormative standard, though there are more examples of queer characters and relationships in the visual novel genre as evidenced by the sub-genre yaoi ("boy's love") that features prominent male romantic relationships.

Given these tropes, it is hard to imagine the dating sim as an activist genre. However, despite not having an activist message in the sense that it encourages a particular political action for a candidate or issue, we argue that the game contains activist messages in two ways: narrative and procedural. Firstly, regarding *DDLC*'s success as an activist narrative, it fits the definition of what Susana Ruiz defines as Games as (Politicized) Art. For Ruiz (2015), "This lens argues that the still contested framing of games as art offers a productive lens for understanding games as part of the legacy of politicized and experimental art, rather than a culturally legitimizing function." As discussed above, the dating sim's generic emphasis on the male main character wooing several attractive female characters at once legitimizes (to use Ruiz's term) the hegemonic practice of male dominance over women, particularly because women in dating sim narratives are often required to exchange their attention and affection for gifts from the male main character. The genre thus emphasizes a sense of entitlement that leads many men to believe that women must "put out" either sexually or romantically if they accept gifts. Part of the blame for this expectation falls, however, upon game procedure. In his discussion of political and activist games, Ian Bogost (2006) defines procedure as related to, but not limited to, computer science, as well as, ". . . tied to authority, crafted from the top–down, and put in place to structure behavior and identify infringement. Procedures are sometimes related to ideology; they can cloud our ability to see other ways of thinking" (para. 8). In this sense, *DDLC* opens the dating sim genre to new ways of thinking by overturning those procedural tropes. In the game, it does not matter who the main character woos or whether they choose the appropriate and affection-garnering responses. Monika becomes the romantic interest regardless of the player's behavior via the in-game choices, and *DDLC* becomes more of an activist game than was immediately apparent.

One additional classification of activist games comes from Mary Flanagan (2009), who writes, ". . . they are not purely conceptual exercises, but rather, games that engage in a social issue through, most commonly, themes, narratives, roles, settings, goals, and characters; and less commonly, through game mechanics, play paradigms, interactions, or win states to benefit an intended outcome beyond a game's entertainment or experiential value alone" (p. 13). Certainly, *DDLC* is an entertaining and memorable experience, and that allowed it to reach more players than most activist games. However, its themes, narrative, roles, goals, and characters work with experimental game mechanics and interactions (such as requiring the player to delete portions of the source code to progress) to highlight the problems of the dating sim and leave the player with a decidedly non-dating-sim-like outcome. The outcome was so contrary to the norm that many players, as we identify below, preferred the modded versions for their return to the safety of dating sim convention. As Flanagan (2009) describes, "Subversion is an action, plan, or activity intended to undermine and institution, event, or object" (p. 10). *DDLC* offers all the entertaining aspects of a dating sim, then slowly takes them away via its experimental game mechanics, making it an activist game not only in the sense of Ruiz's politicized art games, but through the use of ideological procedure as identified by Bogost and subversion as defined by Flanagan.

DDLC accomplishes these goals even while it does not explicitly ask the player to consider the role of the dating sim as a culturally legitimizing function that promotes the hegemony, and it does not ask the player to stop playing the more traditional dating sims, but it does stand as a critique of the generic norms. It is an activist text through its ability to question and, via subversion, defy that culturally legitimizing function in several ways. First, the game denies the player basic affordances of not only the genre, but the medium of games. As the story progresses, the player slowly loses these technological affordances, like saving and loading the game, to Monika. This loss takes from the player one of the pleasures of the dating sim, and of video games in general, the ability to return to a previous point in the narrative and see what would have happened if they had chosen a different option or path. After a certain point, this option is not possible in *DDLC* without completely deleting the game and starting over. In her discussion of video game narrative structure, Shira Chess (2016) argues that games as a genre have the ability to create a queer narrative structure—one that privileges small moments over the singular climax of Freteg's pyramid. Chess (2016) writes, "Video games offer alternative pleasures because they exist in the space of narrative denial, reveling in a dilatory narrative middle where satisfaction is both immanent and impossible" (p. 92). Removing affordances like the ability to save the game creates a more seemingly static narrative over which the player has little control, but the addition of elements like the need for the player to find and delete Monika's character file to view the game's ending actually enhances the queer elements of the narrative, or at the very least upholds its illusory impact as such a profound act of rebellion is still very much a part of the visual novel's code. Only by leaving the story can the player realize its full potential.

Furthermore, unless the player deletes Monika, they are trapped in a room with her, scrolling through her dialogue endlessly until they chose to delete the game file. The setting is akin to purgatory and demonstrates a complete lack of narrative action or climax. The game visually represents the unraveling narrative through the introduction of "glitches" into some of the stock scenes and character portraits discussed earlier, disrupting the steady flow of images and poses that the player has likely gotten used to reading as visual cues. This subversion of the standard game narrative affordances and signposts dovetails with a second way in which *DDLC* subverts the dating sim genre, the removal of choice, or at least the removal of the perception of choice. While there are some ways in which the player has control over the order of the events in the narrative, it is quite clear by the end of the game that Monika is in control. In a twisted way, the game questions the norms of the dating sim by privileging female pleasure over male desire and choice. Self-aware Monika refuses to play her role and allow the main character to choose a partner. Rather, she wants him for herself. Though she becomes unquestionably evil in her quest to win the main character, her victory removes male pleasure as the narrative focus.

That said, the trope of the dangerous and oversexualized example of feminine artificial intelligence is one way in which *DDLC*'s Monika might fail in an activist sense. As we will discuss below, both *Monika After Story* and *A Brand New Day* remove Monika's grip on the game world and reinstate male desire as the primary narrative driver, returning the game to the comfortable norms of the dating sim. Finally, the game deals with themes of abuse and mental health. Sayori, for example commits suicide visibly and graphically as part of the narrative, and the player learns in the process that she has long struggled with depression. A focus on mental health not only overturns common dating sim tropes, which keep its characters focused on cute and light anime themes, but places it more clearly in the realm of activist games, where themes of mental health are more common. Though we will not specifically discuss this theme, we will examine how *A Brand New Day* covers any serious discussion of mental health and self-care with a more "cute" version of the narrative.

Mods and Doki Doki Literature Club

For purposes of our analysis, we focus on two mods created for *DDLC—Monika After Story* and *A Brand New Day*—that inhibit the game's themes and take away from the political and activist elements of the story. It is important to note that, perhaps because of this, the creator of *DDLC*, Team Salvato, has put forth a rather strict policy against mods and fan content in general. In relation to mods, Team Salvato's (2018) policy states, "You may NOT create, copy, or distribute any fan game that is designed to be played in lieu of the official *DDLC* game. Any fan games, including mods, that 'replace' *DDLC*, or imply that it should be played before the original, are forbidden. This includes mods that add new content to the *DDLC* base game, including, but not limited to, new art, new scenes, new visual effects, or voice acting. Fan games may ONLY be created with the assumption that the player has already completed the original *DDLC* game, and is looking for fan content" (Team Salvato, 2018, para. 16). Based on this statement, it seems that Team Salvato acknowledges that modding the game takes away from the message and reinstates the troublesome dating sim norms. Both mods that we discuss follow Salvato's protocol by explicitly stating that they are supplementary fan content, and are not intended to be played before or in lieu of the original game.

We define mods as user-generated content that alters or modifies an extant video game. The legality of video game modifications is a tinderbox in economic and legal discourses, but many video game developers tend to turn a blind eye as long as terms of service are not violated (as evidenced by Salvato's "guidelines"). Alexander Unger (2012) provides four classifications of mods, which are mutators/tweaks, add-ons, "mods," and total conversions (p. 518). Mutators/tweaks are minor changes that will not impact the game beyond slight aesthetic or gameplay dynamics like game speed or weather (p. 518). Add-ons produce slight modifications like armor, maps, game patches, and new companions (p. 518). "Mods," as defined by Unger's taxonomy, "try to establish a new fraction, setting, or narration" (p. 518). Finally, total conversions ultimately produce a brand new game despite utilizing an existing game or engine (p. 518). Team Salvato expressly forbids the creation of total conversion mods: "Any mods must NOT be distributed as a complete game. They should contain only the files that are necessary to install the mod (usually files that are added to the *DDLC* game folder)" (Team Salvato, 2018, para. 25). Therefore, *Monika After Story* and *A Brand New Day* exist because they are meant to be added to the original *DDLC* game folder after the original game has been played. Even though both mods do not drastically alter the game like a total conversion mod would, both change the original *DDLC* in manners that are divergent from Salvato's creation.

Monika After Story

In this mod, the player can spend eternity with Monika in her room, but the game adds additional features and mini-games so the player does not have to simply sit and listen to Monika talk for hours. However, Monika is initially hesitant to spend eternity with the gamer because they deleted her in the original game. Monika even asks the gamer, "Do you really want to torture me until I kill myself?" Eventually, Monika forgives the gamer for deleting her and is happy that they ultimately returned to her. *Monika After Story* allows the player and Monika to do things like play chess, pong, and piano, and sing songs. There's also a calendar feature that allows Monika to help the player remember important dates. According to Unger's taxonomy, *Monika After Story* could qualify as an add-on or "mod"; though it does not add significant narrative elements or any new settings, it adds several mini-games and interactions with Monika.

A Brand New Day (ABND)

This mod allows the player to live out the fantasy of the harem ending, in which they may date all of the characters, and would quality as a "mod" mod according to Unger's taxonomy. It creates a humorous story out of the horror of the original *DDLC* by replacing jump scares with jump humor. Jump scares, both visual and aural, are central to the original game, which is further proof that the mod destroys the game's original intent. In the unmodded game, for example the player learns one of the characters, Natsuki, has an abusive father. In the original game, the player never meets him, but in the mod, the player meets a hilarious version of him that has Natsuki's trademark pink pigtails. Of course, in the lighthearted mod, the player saves Natsuki from him. It is possible that this mod would not be so funny if the original game were not so horrifying and dark. Part of the allure is in its ability to turn *DDLC* into a more conventional dating sim, allowing the player to be with and interact further with characters who were harshly and suddenly removed from the original game. For example, in the mod, Yuri clumsily hits her head at a point where, in the actual game, she stabs herself repeatedly in the chest. In the mod, of course, she is not permanently injured; in the game, she dies slowly, and the main character sits with her lifeless body from Friday afternoon, when the incident occurs, until Monday when school resumes.

With their focus on fulfilling player fantasies and reinstating some amount of player control, both mods succeed in removing some of the more groundbreaking messages in the *DDLC* narrative, but they also raise some questions about the underlying game structure. If the player wishes to see the unmodded *DDLC* narrative through to the end, they must follow Natsuki's final advice and "delete her." That is, they must access the game files and delete Monika's character file. Likewise, if the player wishes to install a *DDLC* mod, they must access the game files and add the mod's files. In a way, Team Salvato asks the player to tamper with the files, essentially modding the game for the purposes of the narrative, then limits how much the player can mod the game for the purposes of fandom; this feels like a mixed message at best and hypocrisy at worst. However, what happens after the player deletes Monika in the unmodded game might indicate why the rules are so heavily in favor of limiting the amount of mods for the *DDLC*.

After deleting Monika in the unmodded game, the player finds that she still has control of the game, so tampering with the files did not actually give the player any control. Thus, by asking the player to exercise developer-like control and then taking that control away, the game becomes somewhat of a commentary on the life of coded artifacts themselves. The player has little control over the life of the narrative, and the designer has little control over the life of the game, even if they seek to limit tampering by players and fans. Like Monika, the code and narrative can take on a mysterious life of its own, reappearing in new projects and interacting in unexpected ways.

Why Mod a Game with a Message?

Independent and activist games are often not modded, perhaps because they are created by the independent developer community, which also creates the majority of mods. The lack of choice as a trope in activist games might also discourage the practice of modding artistic and activist texts, as they often have defined and purposeful messages and storylines, whereas AAA titles might encourage deeper development in some characters and areas. One example of this tendency is the 2006 activist game *Darfur is Dying* by interFUEL, LLC. The game explores the refugee crisis in Darfur, putting the player in the shoes of a refugee to show how difficult and dangerous simple tasks like gathering water become in a refugee camp. As the game's description states, "The content and the creative are woven together throughout the game, beginning with the first phase where the user selects an avatar to forage for water. Upon success or failure, they learn that their chances of succeeding were predetermined by their gender and age" (Games for Change, 2006, para. 2). While different characters might have varying strengths and weaknesses in the RPG genre, these differences are often stated up front. In an activist game, players might not learn the impact of their choices until it is too late to change, lending them little actual agency.

DDLC's unorthodox nature likewise raises questions about player agency and allows it to be viewed through a plethora of lenses. On one hand, it is a free game that reached over a million downloads in the first few months of its release (Salvato, 2017). It is also a horror game that operates under subtle undertones in which the real horror lies in not only taking agency from the gamer (and explicitly calling choice a farce), but repeatedly challenging the player's sense of immersion in that the game uses technological "glitches" to advance certain events in the story. Additionally, and even though it is outside the scope of this paper, *DDLC*'s cult following has allowed it to jump from relative obscurity, since it is an indie game with no corporate backing, to an international phenomenon. With all of these components in mind, should a modder choose to mod *DDLC*, they may be offering more "choice" so to speak, but the game's central message is its lack of choice. If this central message is dismantled and the game becomes something else entirely, any activist or political artistic connotations that can be derived from the game are also dismantled.

As stated above, fans might choose to mod or play a modded version of *DDLC* because mods like *A Brand New Day* allow them to have what the game otherwise denies: relationships with Sayori, Yuri, and Natsuki in addition to Monika. *ABND* has a significant following on reddit, and is updated fairly often. As one gamer states: "Just played the newest version. The mod is awesome so far! I get the whole 'everyone still has problems, but you can save them' idea now. You've put a lot of effort into this, it really shows. I can't wait to see what's next in release Beta 2 ;)" (lennieplop60, 2017). As this player identifies, the ability to "save" the characters is enticing, because it is undeniably difficult and disturbing to watch them die gruesomely in the unmodded game after growing attached to them. An ending in which the main character helps them each overcome their troubles and illnesses is satisfying for players who want the game's narrative to match the dating sim aesthetic. Additional comments support this desire. Of *ABND*, another player writes, "Overall, I really, really appreciate the effort put into it. The vanilla game left me amazed but severely heartbroken, and it's people like you that help fix that, and also keep the *DDLC* community alive. THANK YOU" (MRorPA, 2018)! For this player, the mod helped ease the sadness caused by the unmodded game, perhaps because it keeps the beloved characters alive and happy.

Furthermore, mods provide world-building for a universe that fans feel needs to be developed and continued. As fandom scholar Henry Jenkins (2006) argues, "More and more, storytelling has become the art of world building, as artists create compelling environments that cannot be fully explored or exhausted within a single work or even a single medium" (p. 116). Fan responses to *ABND* support Jenkins' remarks, with one player stating, "I recommend you it from the bottom of my heart. Since it's a Demo still, you'll have a crap ton of content… If you don't play it in a straight maraton like I did for 9 hours.. That's right, 4 hours more than the original game" (JAMMITY ® FriskyNicks, 2018), and another player writing, "I really like this mod, It basically extends Doki Doki with a cool new story, I like the incorporation of The third eye theories. The dialogue feels realistic and i like the sound effects in certain areas, they really add to the humour. 8/10" (Darkupri, 2018). In these cases, the mod becomes a way for the players to spend more time with the characters if they feel the game ended prematurely, did not have a happy ending, or was too short.

To revisit one of the most absurd (and hilarious) twists in the *ABND* mod, Natsuki's father has a featured role. The source of Natsuki's pain in *DDLC* is a modded creation known as Dadsuki, who bears a striking resemblance to Dio Brando from *JoJo's Bizarre Adventure*. Players of the mod then read about a ridiculous narrated fight to the death in which the protagonist emerges victorious. Such an inclusion speaks to the world-building nature of transmedia storytelling. However, while *DDLC* certainly has memorable characters and a twist, those alone do not define the experience that Salvato perhaps intended. At the center of what is a psychological thriller exposing the illusion of control in games while masquerading as a dating sim is a prevailing sense of loneliness that is meant to stay with the gamer. Sayori commits suicide no matter what the protagonist attempts, and then Monika mercilessly erases her from the game as she is forgotten by everyone. Natsuki snaps her neck during what many gamers call the most unsettling scene in the entire game, and her storyline ushers in Yuri's without any say from the gamer. Yuri, too, stabs herself in front of the gamer-player, who is forced to wait with her decomposing corpse. Finally, Monika transports the gamer to her eternity room, but there is an oppressive feeling that it can't last if the gamer wishes to see the "game" to its "proper" conclusion. This is to say nothing about her own sense of loneliness as she reveals she is aware that she is a video game character. Yet Monika's room is hauntingly peaceful, much like save rooms in *Resident*

Evil in which no harm can befall the player-character. Ironically, the only true moment of respite in such a jarring game is disrupted when the gamer decides to erase Monika's character file, thus deleting her as she says goodbye. Even when the gamer performers mundane tasks, such as walking in school hallways or writing poetry, there are no other traces of life in this universe. All characters eventually leave the gamer, producing a sense of loss that isn't easily replicable in interactive media where even the game's primary antagonist reveals that she loves the gamer because they are the only real thing in her existence. Arguably, this sense of loss is what truly defines *DDLC*. As a parallel example, this sense of dread is akin to the fog in a series like *Silent Hill*: if removed, the entire complexion of the game changes because the element is that integral to its design.[ii] When a video game like *DDLC* is modded, gamers are allowed to bypass this oppressive sense of loneliness. While they may feel better about these new endings (and maybe themselves), the atmosphere that allowed such initial experiences to germinate is not allowed to exist in these fan-inspired creations. There is no *Silent Hill* without fog, and there is no *DDLC* without existential dread.

Because dating sims often have multiple endings that support multiple playthroughs, the mod fulfills the desire for exploring myriad relationships outcomes in dating sim fans. In other words, as *ABND* demonstrates, gamers might get new dialogue, locations, events, and scenarios from mods, but—at least in the case of *DDLC*—the story's original intent is lost in the shuffle. And it does seem that at least some fans are unhappy with mods like *ABND*. In this case, the mod forces the harem ending while the unmodded game forces the "Just Monika" ending. As SlappyThePoptart on reddit writes, "I'm enjoying the mod so far but I have one huuuuge problem with it. It's *Doki Doki Literature Club*, not Doki Doki Harem Club. Why is MC flirting (and hugging, and kissing, and dating) everyone? Is it impossible for him to 'save' them without romance" (SlappyThePoptart, 2018)? By subverting the game's themes, the mod is actually playing right into them. The player still has no actual control over who they date, and, thus, players will still be unhappy with the outcome when the choice that they see as "appropriate" is taken away.

In the case of *Monika After Story*, modding removes Monika's agency and adjusts her behavior by adding more topics of conversation to her dialogue and mini-games the player can do with her. This mod is not as sweeping as mods like *ABND*, which updates most of the game's narrative. In *Monika After Story*, the narrative remains the same, but the player has more opportunities to interact with Monika rather than delete her. As coltsfanca on reddit states, "Just beat the game last night and, having just seen this for the first time, I love this so much. It took my [sic] a couple days to even have the guts to delete Monika in the original game and now I can replay the game and don't have to!" (coltsfanca, 2017). This mod is meant for players who would choose to "date" Monika in the unmodded version of the game, but it raises questions about who actually has control over the narrative. Monika, who has recently become sentient, cannot share simultaneous control over the narrative with the gamer—so who is actually playing this game? If we don't mod, it's Monika who ultimately determines the outcome, even if we try to delete her. If we do mod, we are asserting our dominance as the player to choose our own ending. Choosing the desired outcome via installing mods in the case of *DDLC* becomes a further act of rebellion because the developer does not fully condone their creation.

Conclusion

Modding an activist game like *DDLC* can lend the gamer a sense of closure and a respite from the feelings of loneliness and despair that the unmodded game creates. Modding *DDLC* can also reinforce the heteronormative or hegemonic structures that many fans of dating sims find appealing. However, *DDLC* is purposely meant to be unsettling. Though modding as a practice can help players create and find depth in games, or participate in world-building (albeit in a fanfiction sense at best), it is unnecessary and potentially disruptive to a game with such a defined and groundbreaking narrative. Resurrecting Monika from the dead or "saving" all girls are certainly creative endeavors, but both destroy and minimize the emotional impact of the original game to the point that it is reduced to the very conventions it was railing against. At present, *A Brand New Day* in particular leaves viewers with two final impressions (although the modding team is apparently still working on the mod). First, the girls all get drunk on wine and have a sleepover with the main character. Second, a faux April Fool's video was released in 2018 in which the girls kill the main character for attempting to date all of them. The absurdity of the scenario highlights how far fan fantasies can diverge from the intended message. Is it homage or depreciation? Fans and critics will be divided on this question. However, one truth remains: The tagline is "Just Monika," not "Just Modika."

References

Bogost, I. (2006). Playing politics: Videogames for politics, activism, and advocacy. *First Monday*, 7 (Sept. 2006), https://doi.org/10.5210/fm.v0i0.1617

Chess, S. (2016). The queer case of video games: orgasms, heteronormativity, and video game narrative. *Critical Studies in Media Communication*, 33(1), 84–94. http://dx.doi.org/10.1080/15295036.2015.1129066 coltsfanca. (2017, December 4). *Monika After Story* v0.6.0 released with new expressions and loads of new features! [msg 1]. Message posted to https://www.reddit.com/r/DDLC/comments/7hh4db/monika_after_story_v060_released_with_new/dqrn56q/

Darkupri. (2018, January 21). *A Brand New Day* (Beta WIP) [msg 1]. Message posted tohttps://www.reddit.com/r/DDLC/comments/7hh4db/monika_after_story_v060_released_with_new/dqrn56q/

Ellison, B. (2008, July 8). Defining dialogue systems. Gamasutra: *The Art and Business of Making Games*. Retrieved from https://www.gamasutra.com/view/feature/3719/defining_dialogue_systems.php.

Flanagan, M. (2009). *Critical play: Radical game design*. Cambridge: MIT Press.

Games for Change. (2006). *Darfur is dying*. Retrieved from http://www.gamesforchange.org/game/darfur-is-dying/

JAMMITY ® FriskyNicks. (2018, February 19). Does anybody suggest the: *A Brand New Day* mod [msg 4]. Message posted to https://steamcommunity.com/app/698780/discussions/0/1620600279677936418/

Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York: NYU Press.

Lennieplop60. (2017, December 27). *A Brand New Day* (Beta WIP) [msg 5]. Message posted to https://www.reddit.com/r/DDLCMods/comments/7ib62j/a_brand_new_day_beta_wip/dr8r3q1/

MRorPA. (2018, January 6). *A Brand New Day* (Beta WIP) [msg 1]. Message posted to https://www.reddit.com/r/DDLCMods/comments/7ib62j/a_brand_new_day_beta_wip/dsap6xp/

Navarro-Remesal V., & Loriguillo-López, A. (2015). What makes gêmu different? A look at the distinctive design traits of Japanese video games and their place in the Japanese media mix. *Journal of Games Criticism*, 2(1), 1-17. Retrieved from http://gamescriticism.org/articles/navarro-remesalloriguillo-lopez-2-1/

Phathom. (2018). *A Brand New Day* [Software]. Available from http://www.reddit.com/r/DDLCMods/comments/7ib62j/a_brand_new_day_beta_wip/

Ruiz, S. (2015). *Playing For Change: Crafting Creative Intersections Between Social Justice, Non-Fiction Storytelling And Gameful Design* (Doctoral dissertation). Retrieved from http://scalar.usc.edu/anvc/playing-for-change/index

Salvato, D. (2017, November 18). Hello, my name is Dan Salvato. I created Doki Doki Literature Club. Ask me anything [msg 2]. Message posted to http://www.reddit.com/r/DDLC/comments/7dvb70/hello_my_name_is_dan_salvato_i_created_doki_doki/dq13r3v/?context=3

Salvato, D. (2017, December 10). 1 million downloads! [web log comment]. Retrieved from http://teamsalvato.com/blog/1-million-downloads/

SlappyThePopTart. (2018, January 17). *A Brand New Day* (Beta WIP) [msg 1]. Message posted to https://www.reddit.com/r/DDLCMods/comments/7ib62j/a_brand_new_day_beta_wip/dsu9nwb/

Taylor, E. (2007). Dating simulation games: Leisure and gaming of Japanese youth culture. *Southeast Review of Asian Studies*, 29, 192-208. Retrieved from https://pdfs.semanticscholar.org/f789/057922bcbf331d205e6b68647e9b5fe1a42c.pdf

Team Salvato. (2017). *Doki Doki Literature Club* [Software]. Available from https://teamsalvato.itch.io/ddlc

Team Salvato. (2018). IP Guidelines. Retrieved from http://teamsalvato.com/ip-guidelines/

ThePotatoGuy. (2017). *Monika After Story* [Software]. Available from https://github.com/Monika-After-Story/MonikaModDev/releases

Tompowsky, R. (2013). An exploration of gender-specific language in Japanese popular Culture: Gender stereotypes in Japanese dating-simulation games. Retrieved from https://gupea.ub.gu.se/bitstream/2077/35154/1/gupea_2077_35154_1.pdf

Unger, A. (2012). Modding as part of game culture. In *Computer Games and New Media*

Cultures (pp. 509-523). Springer, Dordrecht.

[i] Coincidentally, the concept of sentient artificial intelligence was explored in the 2012 Japanese video game *Danganronpa 2: Goodbye Despair*, which also pokes fun at dating sim conventions like gift-

giving and spending time with friends. It is eventually revealed that one character, a young gamer named Chiaki, is an AI being designed to monitor the other characters in the game. It is unknown if Salvato was inspired by *Danganronpa* when he developed *Doki Doki Literature Club*.
[ii] In fact, the 2012 *Silent Hill HD Collection* was panned by fans in part because the fog looked worse on the PlayStation 3, or it was removed entirely during key scenes.

MERGING EDUCATION, ASSESSMENT, AND ENTERTAINMENT IN MATH GAMES: A CASE STUDY OF FUNCTION FORCE

A Case Study of Function Force

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Abstract

Games for education and games for entertainment tend to follow different development paths according to their respective purposes. Entertainment game development follows the traditional best practices of games design while educational game development adds an additional constraining layer of learning objectives. The contribution of this work is a case study of a game, Function Force, that was created with the entertainment and educational design goals given relatively equal weight. In this case study, the development of the game mechanic, puzzle designs, and game level progressions will be explained and connected to relevant educational and curriculum components.

Introduction

The field of educational games has the goal of creating gameplay experiences that impact learning (Dondlinger, 2007). In this field, representing problems and concepts necessary to education is the primary focus (Squire, 2006). Games such as Sim City (Maxis, 2013), Rome: Total War (The Creative Assembly, 2004), and Minecraft (Mojang, 2011) are used in educational settings because the gameplay they provide happens to be consistent with educational objectives (Minnery & Searle, 2014; Nebel, Schneider, & Rey, 2016). Other educational games impart lessons from the humanities through environmental storytelling but lack meaningful interactive game mechanics. Other than notable exceptions (Aylett, Louchart, Dias, Paiva, & Vala, 2005; Bell, 2009; Rowe, Shores, Mott, & Lester, 2011), games that are developed explicitly as educational material that have meaningful interactive mechanics are driven by the educational objective and relegate principled game design to a lower tier of importance.

This leaves open the correlation between following the best practices of game design and educational outcomes. Through merging principles in game design with those of assessment and curriculum objectives, engaging gameplay can be created that is integrated tightly with educational practices. Such practices include: game feel/juice consisting of the visual and auditory feedback produced by the game (Swink, 2008); the balance of the gameplay mechanics and systems; the flow and designed progression of the gameplay experience (Chen, 2007); the design of the levels to achieve objectives for player experience; and the playable models that players interactive with and compose the basic interactivity loop of the game (Wardrip-Fruin, 2009).

In 2011 President Barack Obama called for investment in educational technology, challenging developers to create educational software “as compelling as the best video game.” (DeLoura, 2017). In response, the White House Office of Science and Technology Policy gathered commercial and academic game developers for the White House Education Game Jam in 2014. Here, we first prototyped Function Force. a “shoot ‘em up” game meant to intuitively teach mathematical functional transformations. The game was redeveloped in 2017 in collaboration with the Educational Testing Service (ETS) as an online game-based assessment. In this instance, the game targets students who have advanced past simple mathematical operations at roughly the 8th grade level.

Function Force was designed around the hypotheses that there is value in making the educational content directly playable and that entertainment and educational goals could be met by transforming preexisting genre tropes into emergent teaching mechanisms. Particularly, Function Force makes use of the tropes of the shoot ‘em up (or shmup) genre to give players the experience of playing with function transformations in real time to achieve game goals. We believe that the successful completion of these goals signals a progression in the education of the player.

The new purpose of the game – quantitative measurement and testing – demanded a rethinking of Function Force: gameplay had to follow established understandings of learning progression in order to produce scientific results from user studies (Arieli-Attali, Wylie, & Bauer, 2012). While the original version of Function Force aimed to allow interaction with functions in the “most fun” way, in a collaborative effort with ETS the game was redesigned to emphasize more of the core mathematical operations of function transformations and how to incrementally introduce new gameplay functionality according to established progressions. With the new version, gameplay elements needed to be revealed gradually in order to produce discrete educational lessons that build upon each other. The new game design had to confront a common issue that most educational games face: how can a game both be fun and educational, while adhering to an empirically validated curriculum, such as the Common Core Grade 6-8 Mathematics standards (McREL International, 2014).

In this paper, we contribute a case study of the game Function Force that describes the deliberate merger of game design and educational practices. With Function Force as our example, we argue that making the educational content playable, rather than layered, is a fruitful way to developing education games. We believe that Function Force does not merely utilize rewards to incentivize students during the often-rote educational sections of the game, but it rather brings about educational moments in a fun, challenging, and dynamic manner that is directly part of the gameplay. In this case study, the development of the game mechanic, puzzle designs, and game level progressions will be explained and connected to relevant educational and curriculum components.

Educational Goals

Function Force primarily aims to teach students about linear functions (specifically the concept of slope and y-intercept). Linear functions are often the first functions that students are introduced to, and rather than presenting these concepts directly, or through problem sets, Function Force gives students the opportunity to gain an intuitive understanding of these concepts through play as they demonstrate their understanding while achieving gameplay goals. As demonstrated by Squire in his work on the efficacy of games for educational purposes (Squire, 2004), the idea is that after gaining an intuitive understanding of the concepts through play, students will be more able to grasp the concepts when presented in more traditional educational environments (i.e., preparedness for future learning).

The main mathematical concept that Function Force is centered around is the equation . In that equation, the constant 'm' describes the rate of change for a result (y) as x increases. This is often called the function's 'slope'. The constant 'b' describes the 'y-intercept' of the function. The y-intercept is the resulting value of the function when the input, x, is zero. That is, this is the point from which the function begins sloping upward (or downward) as the input, x, changes.

A hypothesis of this project is that these concepts are much better understood when used in intrinsically motivated scenarios (or when a player is in a flow state, as described in some game design communities) (Salen and Zimmerman, 2003, p 336). Rather than presenting a student with these concepts abstractly, Function Force presents these concepts as tools to complete goals in an entertaining 'shmup' game.

The following section will describe how we created game mechanics, designed levels, and sequenced those levels to adhere to a progression that demonstrates that, when completed, players will have gained an understanding of how the slope and y-intercept operate in the function.

Case Study: The Design of Function Force

Function Force is a shmup game that puts the player in control of a futuristic spaceship that destroys robotic dinosaurs. Some popular shmups include Space Invaders, R-Type, and Ikaruga. Unique to Function Force, however, is that players fire upon enemies with a laser whose trajectory is determined by modifying an equation displayed on the screen.

The Ship and Weapons

Gameplay in Function Force primarily involves controlling the vertical position of a ship moving at a constant rate from left to right, avoiding and destroying enemies, and collecting and configuring power ups to change the direction of the ship's weapons.

In Function Force, the weapon plays the critical role of firing projectiles that travel along a path set by the linear mathematical function: $y = mx + b$. This function is displayed on the bottom right of the screen, and at the beginning of the game, the function displays y = x (i.e. y = 1x). In Function Force, the x represents the distance in front of the ship, and y is the distance above and below (i.e. a traditional two-dimensional coordinate plane with the ship at the origin). As the player moves forward through the first level, the player encounters two types of power ups: the plus (+) and minus (-). Each power up affects the 'm' value in the $y = mx + b$ function. In other words, when the player first starts, the equation for the laser is y=0x and shooting results in a straight horizontal line from the front of the ship (since the ship is the origin and the y-intercept is 0). If the player collects a plus (+) power up, the function displayed becomes y = 1x, and the weapon will now shoot aiming upwards at 45 degrees. Otherwise, if the player were to collect the minus (-) power up, they would be aiming downward at 45 degrees. While a player need not notice the displayed function in the bottom-right corner of the screen at the start of the game, as they encounter puzzles they will need to pay closer attention to the function's m, or slope, value.

Puzzles as Math Problems

Where the spaceship is the player's primary mechanism for interacting with the linear function, the game utilizes puzzles to test the player's mastery of the ship. If one envisions Function Force as an interactive math test, puzzles are individual problems for assessing the player's mastery of transforming the $y = mx + b$ function. In internal game design notes, these puzzles were also referred to as "static sections" of gameplay, as the game stops all forward movement until the player completes the puzzle. In these puzzles, the player must shoot a switch with their weapon to open a gate and continue forward progress through the game. The player's challenge is to determine the proper slope (m value) that must be used to aim their weapon towards the switch and adjust their weapon with power ups to activate the switch. Figure 1 shows an early puzzle that exemplifies this dynamic.

Figure 1: In an early puzzle, the player sees a switch located in the sloped tunnel above the player's ship. To activate the switch they must adjust the m value of their ship's weapon. The scene provides all the tools necessary to solve the puzzle and understand when the problem has been completed.

Within Function Force, these puzzles were designed as "scenes" and serve as "the most basic unit of pacing in [the] game" (Anthropy & Clark, 2014, p. 40). As per Anthropy et al., the various amount of screen-space dedicated to a scene is open to interpretation since they "might use completely different sizes and shapes for scenes." (Anthropy & Clark, 2014, p. 40) Scenes can be used to present players with gameplay problems to solve and give them the required means to do so within a small area of level space. These scenes, are there to introduce and develop the actions available to a player in a game

(Anthropy & Clark, 2014, p. 41), which in Function Force entails modifying the $y = mx + b$ function in various ways to progress within the game.

It was decided to have each static puzzle scene occupy a single screen's worth of gameplay space. Within this space would be the switch (or switches in later levels) that players had to hit with their spaceship's laser, level geometry that would stop the weapon, a consistent supply of power ups for adjusting the weapon, and the exit door. In this way, each assessment scene provides players with everything needed to solve them, presented in a way that maximizes usability and gameplay balance. Previous studies of level design and usability have established that a single screen is an effective space for introducing complex gameplay problems (Totten, 2014, p. 174) and the tools for solving them.

Satellites add Complexity to Gameplay and Math Concepts

At the end of level two, the player collects a power up which we call the 'satellite'. The satellite is an additional drone ship that follows the vertical movement of the player and shoots its own weapon as the player presses the fire button. The satellite's vertical offset from the player's position, and the slope of the weapon it shoots, is set by an interface where the player directly enters the m/slope, and b/y-intercept (figure 7). The origin for the satellite's function is the player's main ship, and thus, the player can adjust the relative distance of the satellite (above/below the main ship) by selecting from the available "b" values (-4,-2,0,2,4). In level three, the player collects a second satellite which they can also directly manipulate the offset and the slope of its weapon through an interface.

These satellites provide new and interesting gameplay affordances and also allow for more complex puzzles that involve hitting multiple switches simultaneously with unique combinations of $y = mx + b$ equations.

Level Layout as Math Lessons

If Function Force's static puzzle scenes represent individual mastery problems, then its levels are quiz sections that assess overall mastery of a math concept. Rogers describes levels as a "confined area of play activity" (Rogers, 2014) and further comments that levels may be distinguished from one another via distinct settings, characters, locations, gameplay mechanics, artwork, or music (Rogers, 2016). In Function Force, levels are constructed by placing several scenes together in sequence. In addition to the static puzzle scenes, levels also contain "auto-scrolling sections" where the spaceship flies forward at a fixed pace for several screens worth of space. During the auto-scroll sections, the player may experiment with modifying the m value of the weapon by collecting power ups. Enemy ships also appear in these sections, making them feel like classic shmups.

Alternating auto-scrolling sections and static puzzle scenes within levels serves several educational purposes. First, auto-scrolling sections early in the game give players opportunities to acquaint themselves with the spaceship's mechanics: how it moves, how to fire the weapon, and how power-ups affect the slope of the weapon. Secondly, they provide a variation to the gameplay and pacing (interspersed between puzzle sections) by including more traditional shmup video game experience. Shmups are a genre known for highly satisfying action that maintain player interest over long periods through "game feel" or "juice" – particle effects, sound, and visual elements that provide satisfying feedback to players (Keogh, 2017; Swink, 2008). Lastly, they allow designers to teach gameplay by designing small scenes that force player decisions. Unlike static puzzle scenes, auto-scrolling scenes force the player to steer their ship away from level geometry to continue forward progress. This type of forced decision is an effective way to teach gameplay mechanics and integrate educationally relevant behaviors. For example, in one early scene, a fork in the auto-scrolling tunnel forces the spaceship to pick up either a plus or minus power up. In this way, the player is led towards an icon they may otherwise avoid and can immediately observe the effect that the power up has on both the linear equation on the screen and how their weapon fires (figure 2.). In other areas the level geometry creates sloped tunnels that require the player to grab the correct power-ups to adjust their laser slope to match that of the tunnel space.

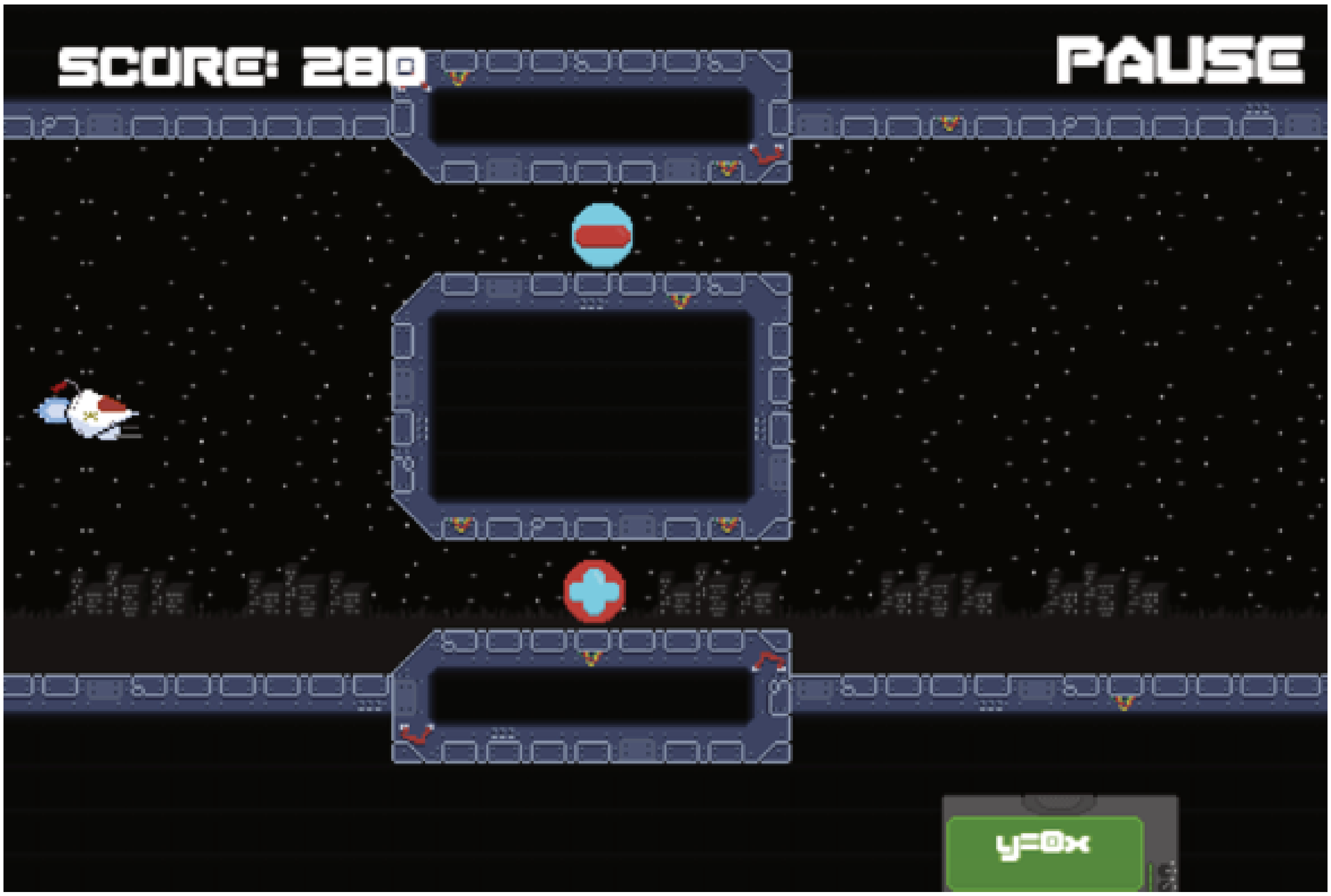

Figure 2: In this early gameplay scene, located in an auto-scrolling section of the level, the player is forced into one of two tunnels where they will collect one of the game's power ups. In this way, the game teaches the player about the function of power ups and how the linear equation is modified.

Another important function of structuring a series of related scenes in a level is enforcing existing learning progressions into gameplay. For gameplay designers, a common learning progression for teaching game mechanics to players is "kishotenketsu" (Brown, 2015), a term borrowed from Japanese manga art. *Super Mario 3D Land* director Koichi Hayashida describes kishotenketsu progression thus: "you introduce a concept, and then in the next panel you develop the idea a little bit more; in the third panel there's something of a change-up, and then in the fourth panel you have your conclusion." (Nutt, 2012) In level design terms, this means introducing a gameplay mechanic in a safe space with few obstacles, then presenting players with a more complex version of the mechanic, introducing the mechanic again in a new context (alongside another different mechanic, for example), then having a final test of the player's mastery of the mechanic. These tests are enforced by "skill gates", obstacles that stop a player from progressing forward until they perform an in-game action or actions that allow them to pass the obstacle. (Kremers, 2009)

These gameplay progressions are mirrored in common learning standards for mathematics (McREL International, 2014) and learning progressions (Arieli-Attali, Wylie, & Bauer, 2012). The Common Core standards for mathematics in particular use "subject clusters" (McREL International, 2014), which are sets of concepts (or "steps") that students must master to make it through the standards. Function Force uses these subject clusters as outlines for what the content of each level should be. Each individual step of the cluster is therefore a game level in which the game design teaching method of kishotenketsu is applied. This means that for Function Force, and games that combine traditional gameplay and educational content, level design is the instrument of administering and assessing educational content. In Function Force specifically, levels utilize kishotenketsu to introduce a mathematical concept with a simple mechanic (e.g., vertical movement and sloped laser to hit easily encountered enemies), then present a slightly more difficult version (e.g., acquire specific slope value to hit switches), a version that combines the concept with other previous concepts (e.g., add satellite drone with manipulable equations), then more difficult final test of the player's mastery of the concept (e.g., two drones with multiple switches, some which might be moving). Between the static scenes, auto-scroll shmup scenes are placed to provide more fast-paced gameplay and allow players to explore mechanics such as collecting power ups or operating new weapons (such as the satellites).

Educational Challenge Progression

As discussed previously, the Function Force team looked to educational standards such as Common Core or established Learning Progressions (LPs) to map out how game mechanics would progress over a series of levels (Arieli-Attali, Wylie, & Bauer, 2012). Common Core utilizes "clusters", sets of lessons that lead up to a learning goal, to embody topics. Within these clusters are "steps", which represent individual competencies or lessons that lead to this learning goal. Specifically, Function Force's levels follow the cluster for teaching students to "analyze and solve linear equations and pairs of linear equations" (McREL International, 2014). Again, if individual puzzles are math problems and levels are quiz sections that contain these problems, Function Force as a game with a series of levels is a lesson plan about linear functions.

The primary content of Function Force assesses players' understanding of single-variable linear equations and working with multiple linear equations at one time. Examples from the game shown in previous figures were selected from early levels that utilize single-variable linear equations to describe how Function Force levels are generally constructed. In thinking of a lesson plan as a series of game levels, the designers saw an opportunity to see how education lessons could map alongside the game designer's concept of "flow", an "optimal experience" (Csikszentmihalyi, 1990) state that game players reach when they are fully engrossed in the game. Salen and Zimmerman describe flow as a state of "focused and engaged happiness" (2004, p. 336) that occurs when the challenges of a game balance with the skills players have built while playing the game (Salen and Zimmerman, p. 351). In game development practice, flow is a useful concept for mapping out how balanced a game is over a set of challenges or even over the course of the entire game. By testing and adjusting how player skill and challenges are balanced, the designer can keep players engaged over time.

Function Force's first level represents both the game's low-level flow state: the player is inexperienced with the game and challenges are simple, and the first step in the linear functions cluster: solving linear equations with one variable. The player flies through an enemy space station with generously proportioned spaces that lets them experiment with the space ship's movement capabilities (Totten, 2014, p. 120). Slowly moving enemies also appear in this early stage so players can practice firing the ship's weapon with the rewarding feedback of seeing the "robo-dino" enemies explode. Eventually, the level presents a forced decision that leads the player to collect a power up that changes the slope of their weapon, as shown previously in figure 2. Then the player plays a similar large space with robo-dinos, but with a newly-modified laser. They learn how the power up has changed their weapon and must modify their gameplay strategy to account for this. The player eventually encounters a puzzle that tests their understanding of this dynamic, as shown in figure 1, where the game assesses them on their mastery of the changing slope concept. The level continues in this way with increasingly difficult shmup sections and puzzle scenes testing the player's understanding of the slope mechanic (figure 3).

Figure 3: Beyond the initial teaching instances of how to use the game's slope-changing mechanic, Function Force's first level leads the player through several challenges that test their early understanding of how changing the m value changes the slope of the laser.

The second level more directly tests the player's understanding of single linear functions. It does this by utilizing more difficult gameplay design and puzzles with more obscure solutions than in the previous level. In this level, the player flies through an asteroid with narrow tunnels filled with enemies and must grab the appropriate power-ups to match the slope of their laser to the slope of the tunnel (figure 4).

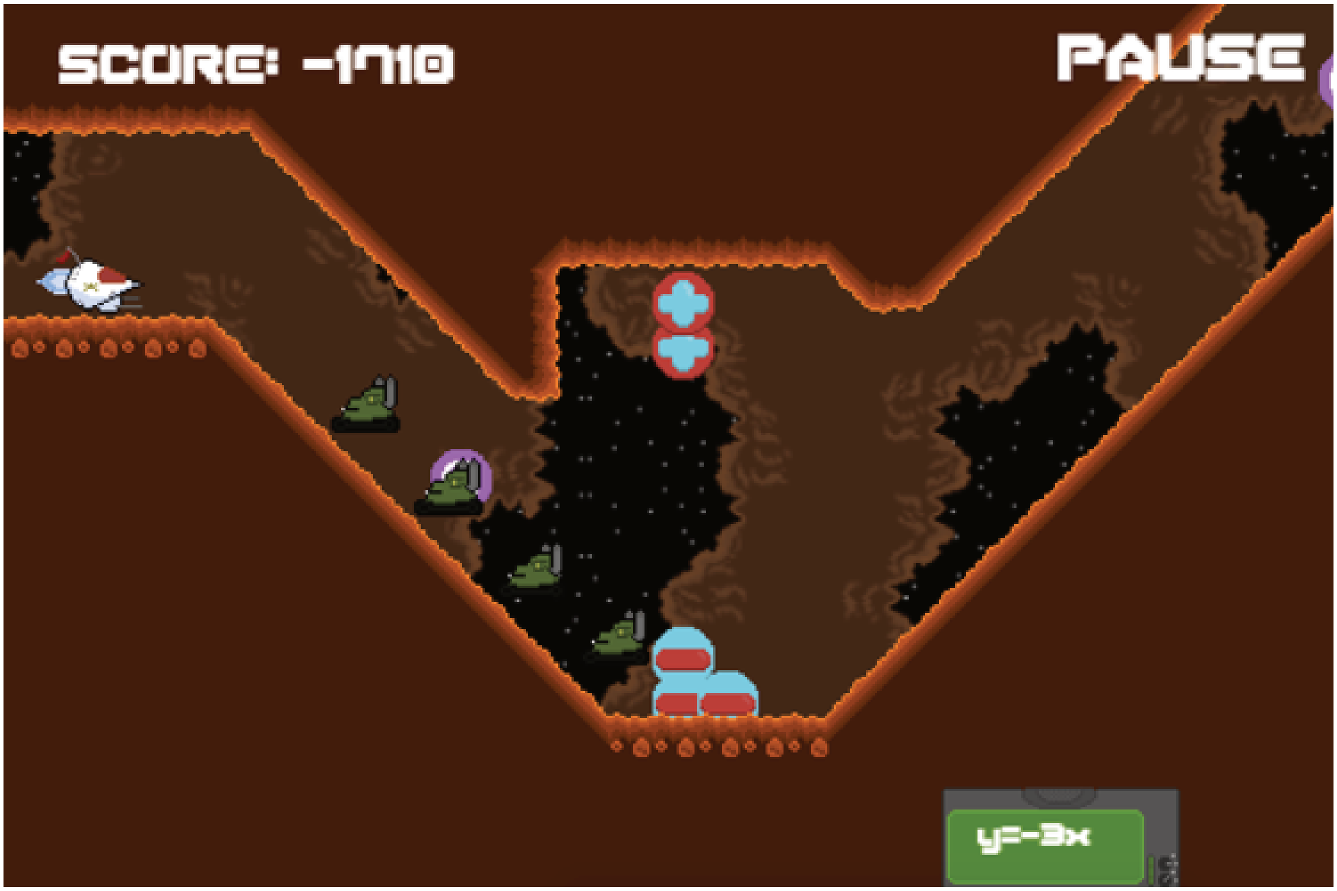

Figure 4: The second level of the game features narrow tunnels that test the player's ability to set their weapon's slope to the right setting.

These narrow tunnels limit player movement and put them into the path of enemies (Totten, 2014, p. 119). This section tests the player's mastery of changing their weapon's slope, as matching the slope value to the slope value of the tunnel is required to successfully pass this section. Figure 4 shows an instance where the level forces another decision for the player: using alcoves to avoid enemies also forces the player to pick up power ups that change their weapon's slope in the correct direction.

The static puzzle scenes in level two also increase in difficulty. Where the first level featured simple and direct tunnels between the player and the switch, the second level forces the player to fire the weapon through complicated obstacles that require the player to solve for *m* (figure 5).

In this way, the player must not only think more deeply about the value they will input for *m*, but also about where to put the function's origin (the ship itself.) In a test of both gameplay and mathematic mastery, the second level eventually features puzzles with moving barriers that can both hurt the player and require timing to fire the weapon around (figure 6).

Figure 5: A puzzle from Function Force's second level features a more complicated linear function problem for the player to solve.

Having mastered modifying the *m* value with the power ups, the third level introduces an upgrade to the game's interface that lets the player modify the weapon's slope freely. This allows the player to adjust the weapon any time they wish, eliminating the restriction and challenge of collecting power ups. However, it also removes the guided numeric changes that the power ups provided: the onus is on the player to select the proper value for m. As the level progresses, it introduces new steps in the cluster, specifically those for "analyzing" and "solving for multiple linear equations" (McREL International, 2014). The game does this by introducing satellites, mini-ships that follow the player's own ship (figure 7).

Figure 6: This puzzle tests both gameplay and mathematical mastery by featuring moving platforms that can damage the player. In this way the player must find a solution to the linear function problem and fire the weapon with proper timing.

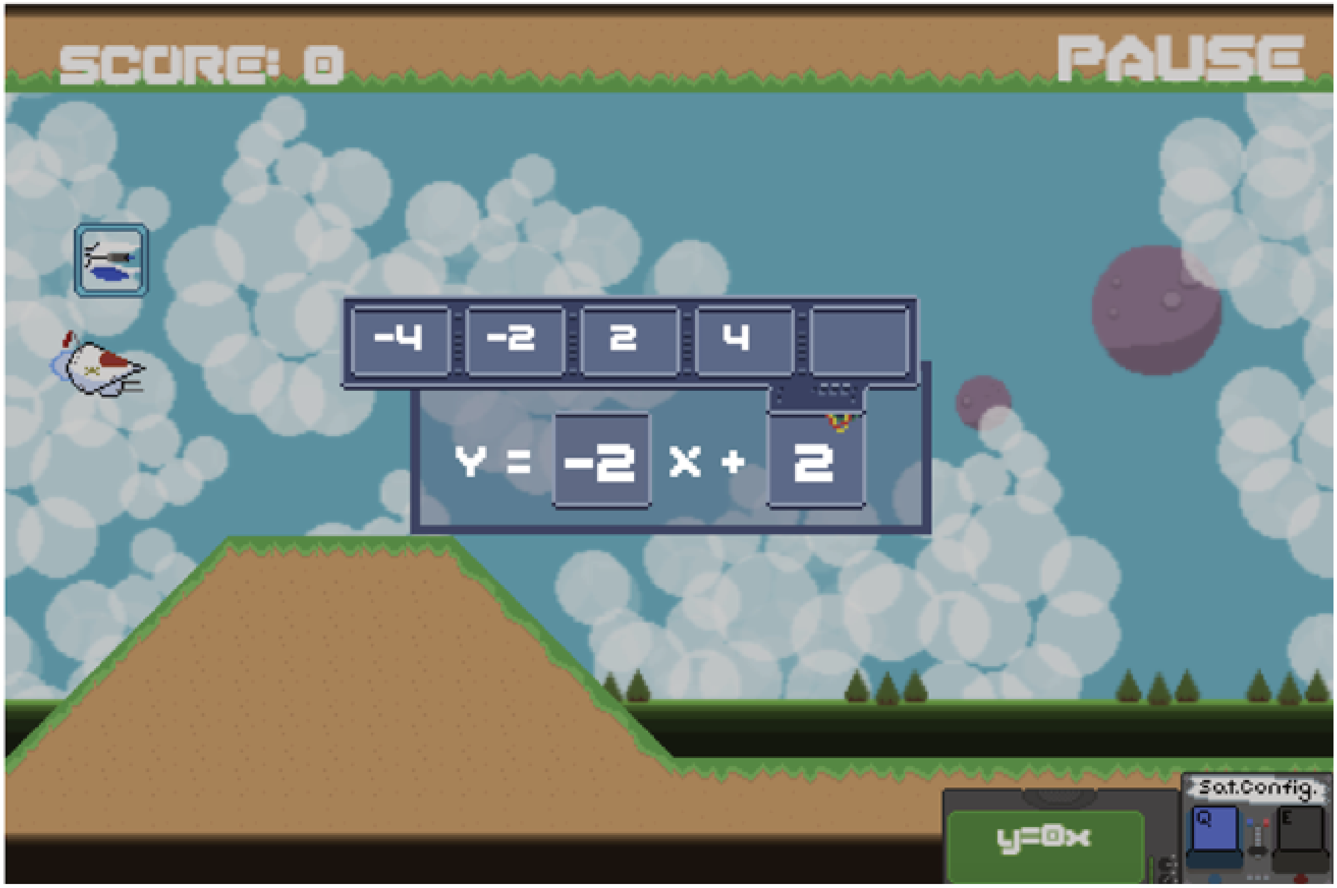

Figure 7: The third level introduces satellites which fire their own weapon along the y = mx + b value. The satellites also include the b value, representing the distance of the satellite from the origin point of the graph (the location of the player's spaceship.) The player is able to directly change each of the satellite's 'm' and 'b' values via the interface above.

The satellites have their own weapon, which like the ship's weapon, fire along the slope represented by the m value. Each satellite (there are eventually two) has a linear function independent of the player spaceship's, meaning that the player can fire up to 3 crisscrossing lasers each with their own slope. The satellites utilize the full $y = mx + b$ equation, where b represents the distance of the satellite on axis y from the origin of the graph, represented in this case by the player's spaceship. This allows for greater gameplay flexibility and greater "game feel" as the player can now fire multiple weapons (figure 8). It also continues the development of the player's flow state: they have more skills in both gameplay and the learning objectives now, so the game's challenges in these areas increase.

Figure 8: The satellites allow the player to fire multiple lasers in an attempt to create more satisfying "game feel.". It also allows the designers to ramp up both mathematical and gameplay challenges, such as introducing more waves of difficult enemies.

Figure 9: Towards the end of the game, the player must manipulate the m and b variables of multiple linear functions and have them reach multiple points at one time.

Towards the end of the third level, the player receives another satellite, further testing their management and ability to utilize multiple linear functions. At the end of the game, the player is able to manipulate both the *m* and *b* values in multiple linear functions and apply those values to puzzles, where they must hit multiple switches at the same time (figure 9). For the puzzle depicted in Figure 9 all three switches must be hit at the same time for the gate to open.

Future Directions and Conclusions

Function Force was developed as both an educational game, aimed at teaching about linear functions, and a testbed for experiments in game-based assessment. Future work is planned that may include experiments comparing Function Force to other digital tasks on linear functions as well as studies that manipulate design features of the game which are hypothesized to impact learning and engagement (e.g., providing feedback through points).

The design of Function Force also affords many more opportunities for educational experiences about function transformation, and the project may be further developed in the future. Other prototypes of the game include sine wave and parabolic function configurations for the ship's weapon. Rather than solely modifying the slope and y-intercept of the weapon, the player could be given the ability to modify the frequency and amplitude, or the coefficients of the quadratic function, while solving puzzles and defeating enemies (figure 10). Furthermore, it is worth exploring the affordances of allowing the player a way to modify the coefficients continuously. We believe that this direct feedback loop, where players quickly see the results of raising and lowering values, will allow for fluid exploration and an intuitive understanding of how various functions operate.

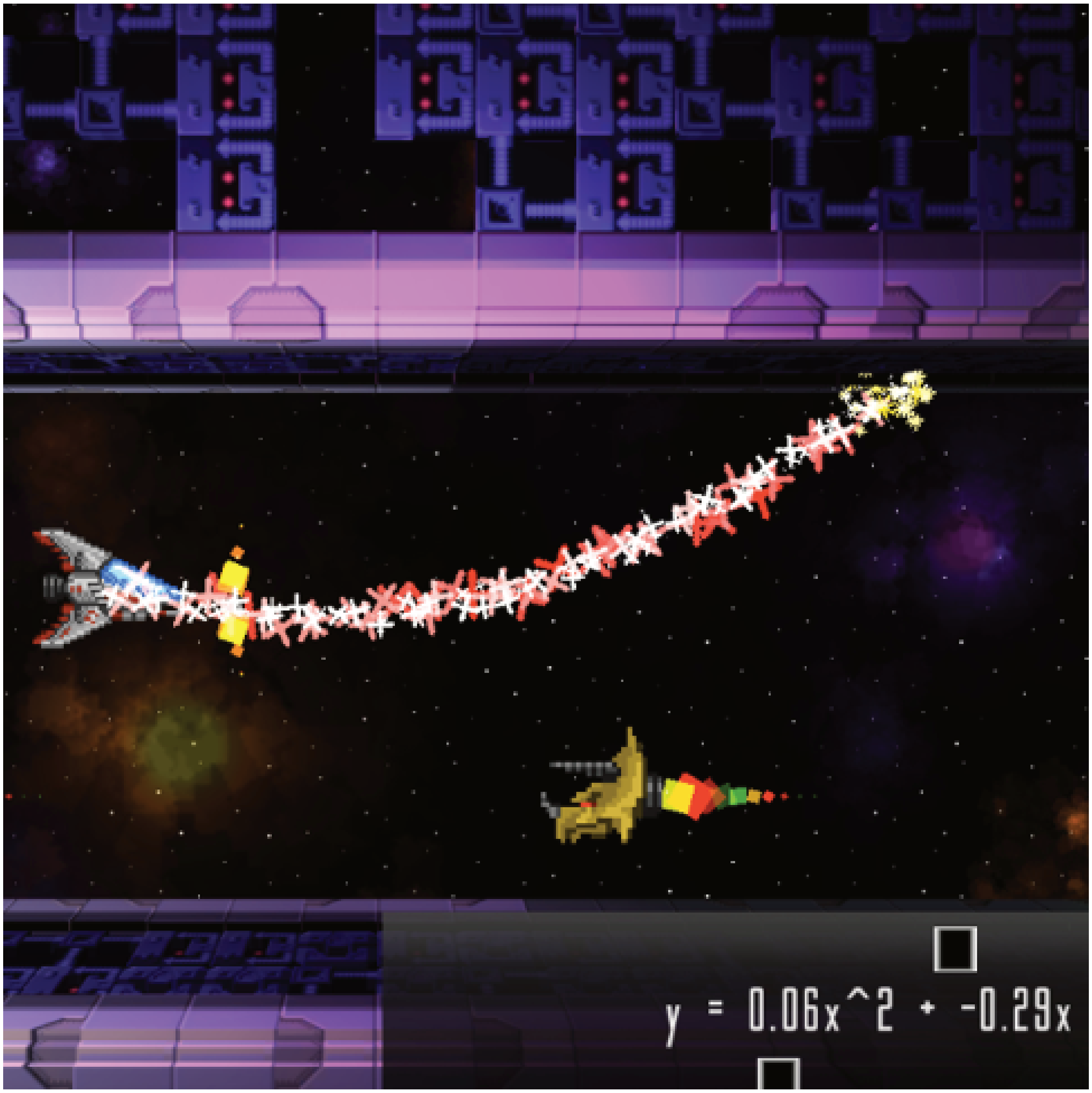

Figure 10: A prototype of Function Force where the player can continuously modify the coefficients via a slider interface. Functions in this version include parabolic and sine waves.

In conclusion, the educational and entertainment design goals were given relatively equal weight in the creation of Function Force. In this case study, the implementation and design of the basic mechanics of the game were explained in terms of the educational and curriculum design they addressed. Gameplay dynamics were explored through puzzle design and puzzles were contextualized through level design which enacts educational practices. While empirical results are forthcoming, we believe that this approach can lead to engaging games that can instill intuitive understandings about important educational material.

References

Arieli-Attali, M., Wylie, E.C., Bauer, M.I. (2012, April). The use of three learning progressions in supporting formative assessment in middle school mathematics. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, Canada.

Aylett, R. S., Louchart, S., Dias, J., Paiva, A., & Vala, M. (2005). FearNot!: An experiment in emergent narrative. In T. Panayiotopoulos, J. Gratch, R. Aylett, D. Ballin, P. Olivier, & T. Rist (Eds.), *Proceedings of the Fifth International Conference on Intelligent Virtual Agents* (Vol. 3661, pp. 305–316). Springer Berlin Heidelberg.

Anthropy, Anna and Naomi Clark. *A Game Design Vocabulary.* Upper Saddle River, NJ: Pearson Educational. 2014. pgs. 40-41.

Bell, D. (2009). Learning from Second Life. *British Journal of Educational Technology*, *40*(3), 515–525. https://doi.org/10.1111/j.1467-8535.2009.00943.x

Brown, Mark. (2015, March 16). *Game Maker's Toolkit: Super Mario 3D World's 4 Step Level Design.* Retrieved from https://www.youtube.com/watch?v=dBmIkEvEBtA.

Chen, J. (2007). Flow in Games (and Everything else). *Commun. ACM*, *50*(4), 31–34. https://doi.org/10.1145/1232743.1232769

Csikszentmihalyi, Mihaly. *Flow: The Psychology of Optimal Experience.* New York: Harper Collins. 1990.

Dondlinger, M. J. (2007). Educational Video Game Design: A Review of the Literature, *4*(1), 12.

DeLoura, Mark. "The White House Education Game Jam." The Obama White House Archive. Created October 4, 2014. https://obamawhitehouse.archives.gov/blog/2014/10/06/white-house-education-game-jam. Accessed May 19, 2017.

Keogh, Brendan. *An Incomplete Game Feel Reader.* Retrieved from: https://brkeogh.com/2017/03/31/an-incomplete-game-feel-reader/

Kremers, Rudolf. *Level Design: Concept, Theory, and Practice.* Wellesley, MA: A.K. Peters. 2009. P. 33.

Maxis. (2013). *Sim City*. Electronic Arts. Retrieved from https://www.ea.com/games/simcity

McREL International. 2014. "Common Core Mathematics 6-8." Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education: Online Edition. Retrieved from: http://www2.mcrel.org/compendium/standardDetails.asp?subjectID=34&standardID=23.

Minnery, J., & Searle, G. (2014). Toying with the City? Using the Computer Game SimCityTM4 in Planning Education. *Planning Practice & Research*, *29*(1), 41–55. https://doi.org/10.1080/02697459.2013.829335

Mojang. (2011). *Minecraft*. Mojang. Retrieved from https://iminecraft.net

Nebel, S., Schneider, S., & Rey, G. D. (2016). Mining Learning and Crafting Scientific Experiments: A Literature Review on the Use of Minecraft in Education and Research. *Journal of Educational Technology & Society*, *19*(2), 355–366.

Nutt, Christian. (2012, April 13). *The Structure of Fun: Learning from* Super Mario 3D World's *Director.* Retrieved from https://www.gamasutra.com/view/feature/168460/the_structure_of_fun_learning_.php.

Rogers, Scott. *Level Up! The Guide to Great Video Game Design.* San Francisco: Wiley. Second edition. 2014.

Rogers, Scott. "Hell, Hyboria, and Disneyland: The Origins and Inspirations of Themed Video Game Level Design." 2016. In Totten, Christopher W. *Level Design: Processes and Experiences* (101-120). Boca Raton, FL: CRC Press.

Rowe, J. P., Shores, L. R., Mott, B. W., & Lester, J. C. (2011). Integrating Learning, Problem Solving, and Engagement in Narrative-Centered Learning Environments. *International Journal of Artificial Intelligence in Education*, *21*(1–2), 115–133. https://doi.org/10.3233/JAI-2011-019

Salen, Katie & Zimmerman, Eric. *Rules of Play: Game Design Fundamentals.* Cambridge, MA: MIT Press. 2004. pgs. 336, 351.

Squire, K. (2006). From Content to Context: Videogames as Designed Experience. *Educational Researcher*, *35*(8), 19–29.

Squire, Kurt. *Replaying History: Learning World History through playing Civilization III.* Dissertation. Indiana University. 2004.

Swink, S. (2008). *Game Feel: A Game Designer's Guide to Virtual Sensation*. CRC Press. Retrieved from https://www.crcpress.com/Game-Feel-A-Game-Designers-Guide-to-Virtual-Sensation/Swink/p/book/9780123743282

The Creative Assembly. (2004). *Rome: Total War*. Activision. Retrieved from https://www.totalwar.com/eras#rome_total_war

Totten, Christopher W. *An Architectural Approach to Level Design*. Boca Raton, FL: CRC Press. 2014. pgs. 119-120, 174.

Wardrip-Fruin, N. (2009). *Expressive Processing: Digital Fictions, Computer Games, and Software Studies*. (M. Fuller, L. Manovich, & N. Wardrip-Fruin, Eds.) (First Edit). Cambridge, Massachusetts: The MIT Press.

White, Matthew M. *Learn to Play: Designing Tutorials for Video Games.* Boca Raton, FL: CRC Press, 2014.

THE LOSS OF SOCIABILITY ONLINE IN MMORPGS AS SEEN THROUGH FINAL FANTASY XI: ONLINE

NICOLAS LALONE

Abstract

The rise of toxic gaming culture occurs in concurrence with the slow loss of technological affordances that promote sociality and cooperation in Massively Multiplayer Online Role- playing Games (MMORPG). Between 2004 – 2013, *World of Warcraft* slowly removed the need for players to interact with one another. This resulted in other MMORPGs following suit with existing MMORPGs left to figure out how to deal with this new style of play. This case study examines the patch notes and *FFXI* software history of the popular MMORPG called *Final Fantasy XI Online (FFXI).* This MMORPG is unique as it was a game whose systems forced cooperation and reliance on other people. How *FFXI* changed from forced human-to-human reliance to a single-player experience is a unique case study reflecting the broader design trends in socially-oriented online play. By explicating these features, this case study provides useful context the study of the loss of cooperation and sociability in online gaming.

Introduction

In "Users as Agents of Technological Change: The Social Construction of the Automobile in the Rural United States," the authors outline a process through which the users of a system help to shape a system (Kline & Pinch, 1996). Concurrent to shaping that system, unanticipated consequences due to the differences among those users shape and reshape certain aspects of the artifact around which the socio-technical system is formed. A similar confrontation is occurring in and around the socio-technical systems that make up the Internet. Different types of people on the Internet have different interpretations about what the Internet is for and each act and are acted upon as different types of designers identify and design for different types of users.

Nowhere is this confrontation more historically evident than in the tensions between players who want to play games by themselves (solo players) and players who want to play video games with others. Massively Multiplayer Online Role-playing Games (MMORPGs) first came to exist during the height of utopian thinking about the Internet (Nakamura, 2013) and slowly declined in sales, population, and cultural power (Bartle, 2016). Their slow decline as exhibited by their affordances over time provides an excellent case study of the antagonism between players who wish to be alone, players who wish to play with others, and the consequences of designers trying to mediate those desires.

MMORPGs at their height often represented the promise of cooperation, of exploration and cultural tourism, and the infinity of possibilities Internet technology (Bartle, 2016; Brookey, 2009). Starting in or around 2005, MMORPGs began to slowly remove the, "multiplayer" affordances of their gameplay. As results, MMORPGS became mostly single-player experiences in both design and affordance (Crenshaw et al., 2017; Crenshaw & Nardi, 2016).

The sociality and necessary teamwork of MMORPGs once heralded an explosion of game- related academia that has unfortunately become little more than a "what could have been" for online gaming (e.g. (Castronova, 2008; Consalvo, 2009; Huber, 2007; Nardi, 2010; Taylor, 2009)). Much of this original research has been replaced with, "the rise of toxic player cultures" and how to deal with them (e.g. (Consalvo, 2012; Massanari, 2017; Paul, 2018)). The trend of solo-play with more-than-optional social content has become a norm in MMORPGs. Much of the history of how and what transpired in the hugely popular massively multiplayer games like *World of Warcraft* or *Final Fantasy XI Online* can be seen in patch notes. By tracing patch notes and software affordance changes, it is possible to compare and contrast what is changed in each patch as well as the consequences of those activities. This research represents a brief case study about the loss of social demands for players in *Final Fantasy XI Online (FFXI).*

Final Fantasy XI Online

FFXI is Square-Enix's MMORPG set in a fictional world called Vana'diel. This game was released in 2002 in Japan and 2003 worldwide. Vana'diel was intended to be explored via the Playstation 2 game console and was then ported to the person computer. Eventually, *FFXI* would also be ported to the XBOX 360. Each version of the game connected to the same network of servers and so, *FFXI* was cross-cultural, cross-platform, and perpetually on. The world of Vana'diel was a product of its era as it exhibited the harshness of *Everquest* and other MMORPGs at the time with a few exceptions.

First, no player could get past level 11 or 12 (of 75) by themselves. Players were forced to rely on each other gather in organized parties meant to amass experience points, kill special monsters for equipment, and to work together to make money. Failure that resulted in a character's death was punished harshly with experience point loss. This often resulted in a loss of experience points that could decrease a player's level and require a few of hours of work to regain. The increased reliance on other players also increase the pressure to perform as was often heralded as both a benefit and detriment to *FFXI's* popularity (Consalvo, 2009).

During its height, *FFXI* reported over 500,000 subscriptions and was one of the most popular MMORPGs between 2004-2007 (Consalvo, 2009). *FFXI's* decline began after the release of *World of Warcraft (WoW)* but has remained an active and subscription only game in 2018.

Players pay $12.95 a month to access their characters. Blizzard Entertainment's successes with the *Warcraft* franchise paired with the a customizable, PC-oriented interface, control schema, and gameplay has no doubt been responsible for persistent player population decline. To date, subscriptions seem to have dwindled from over 500,000 down to 200,000 according to the unofficial numbers given on the Final Fantasy XI Auction House website: ffxiah.com.

While the game's population dwindled and companies like Blizzard Entertainment began to remove social affordances in their game, *FFXI's* designers were forced to contend with a gaming atmosphere that was at odds, almost opposite of what it was released as. The designers of *FFXI* were forced to figure out how to meet player-demand for increasingly solo play. I extend research on MMORPG by presenting an historical overview of how the MMORPG *FFXI* met design trends to stay viable in the current gaming climate.

The slow shift to automation

The fulcrum upon which the slow shift to solo-play rests is the release of *World of Warcraft* in late 2004 (Crenshaw et al., 2017). Up until this time, *FFXI* rested on 3 specific demands for players:

1. No one could play alone.
2. Groups had to be balanced around the "trinity" of tank, damage, support (see: (Green, 2009))
3. The world was perpetual and tied to a 21-24-hour window for important, equipment generating monsters.

Through the first demand, players had to interact with one another and through that interaction, they had to discuss the needs of their allegiance within the particular task. Whether through guilds or simple XP parties the software of *FFXI* forced players to communicate and be partners. XP Parties were always 6 players, 1 tank, 1 or 2 support players, and the rest as damage dealers. This balance could not be shifted away from without supreme levels of effort.

The second demand forced players to broaden their available toolset. While some players would only focus on "damage" types of jobs for their character, they were the majority. Further, the game's patch system would wildly swing the demand for certain kinds of damage-jobs. This meant that players were always leveling new jobs and that their desire to play a certain kind of job was not always met.

Finally, the third demand forced players to navigate complex, large group dynamics. If players wished to obtain high level gear, then they had to team up with 12-18 or more (up to 64) other individuals plus backup characters in order to defeat those monsters that generated that equipment randomly once defeated. Further, some of these monsters only appeared in-world once a day between 21-24 hours. If your group did not claim that monster that day, players were left only with the opportunity to watch other players defeat that monster. This was the *FFXI* before *WoW.*

The Impact of WoW

The impact of the release of *WoW* can first be seen in *FFXI* shortly after its release. *WoW* offered more radical player interaction with constantly on Player versus Player action and the designers were quick to patch troublesome behaviors. For example, the *WoW* spell mind control was often used when *WoW* was released to take over a character and send them falling to their death . In July of 2005, *FFXI's* designers first released new content that would help players achieve more alone. The "Adventuring Fellow" or automated, companion NPC allowed adventurers to gain experience points by themselves at low level and generally helped to make the early leveling experience much faster and less punishing. Further, these adventuring fellows could allow certain kinds of jobs the ability to mediate the complex tanking systems in order to do much more difficult content on their own.

Also in 2005, players of *WoW* met with the plague event. The worldwide plague that heralded the coming of the first expansion brought consequences and dynamic action that players could not experience in *FFXI (Reimer, 2005; Ward, 2005).* The press coverage of the event provided a boost to *WoW* that was additionally met by the release of the successful *The Burning Crusade* in 2007. Between 2006 and 2008, *FFXI* and *WoW* kept a schedule of consistent content for players to engage. This meant that players played the game the way that it was created between these years. However, *FFXI's* players were beginning to experience issues within game.

For players in *FFXI,* the longevity of the players who were still in game paired with loss of friends and the sudden melding of Linkshells (Guilds in *FFXI*) began to make playing a little more difficult. For players in 2007, it started to become difficult to find people to gain experience points with for low-level jobs. This thinning of low-level groups also made it more difficult for new players to find anyone to play with.

To remedy the growing population issues, *FFXI's* designers introduced the "Level Sync" feature in September of 2009. This feature allowed for "XP Parties" to join together regardless of their job's level and gain experience points equivalent to their party's needs. Of interest for this system was the way that the system mediated the existing equipment for each player. Much of the math of the sync was, and still largely is unknown. Different types of jobs and gear would result in different levels of power for different jobs. This would drive the sales of "level appropriate" gear and influence the economy of *FFXI.*

Also during 2009, *World of Warcraft* players were introduced to a new feature (eventually called) Dungeon Finder (Crenshaw et al., 2017; Crenshaw & Nardi, 2016). This feature allowed players to simply press a button, declare their role, and wait for an algorithm to find other players and assemble them for a dungeon. Over the next year, *WoW* would refine this tool until it began to assemble players for group-based content across multiple servers.

Also in 2010, the designers of FFXI did the unthinkable, they raised the level cap of the game past level 75. Up until this time, the entire world was attuned to the math of Level 75 main jobs with level 34 sub job abilities. When the designers of FFIX released the level 75 level cap to first 80 and then to level 99 by the end of 2011, the resulting ability for players to do things on their own increased the possibilities for adventure inside the world of Vana'diel.

The final maximum level of 99 was paired with the removal of the "perpetual" aspect of *FFXI.* The always on, 21-24 hours system for hunting rare monsters was removed. The system put in its place allowed players to obtain an item that they traded to a spot in the floor where the monster used to spawn. Once traded, the monster was spawn and was claimed for the player who traded the item. Shifts to solo play seemed to be happening to *WoW* as well.

In 2011, Blizzard Entertainment enhanced their Dungeon Finder tool and opened it up for raids. Because Raiding often represented the most elite type of play, the opening of a raiding algorithmic assembly tool also required raids themselves to be re-designed. Raiding was generally weakened. The difficulty of the raids in *WoW* was then tiered. Players could still play the elite level of raids but in the open-raiding system, players could obtain reasonable gear and still be competitite. These features greatly weakened the level-based content as players in *WoW* no longer needed to leave town or walk anywhere. They could simply level up without leaving the spot they logged in on. In *FFXI,* the lowering social needs for players to play *FFXI* would get a boost with the release of the Trust Initiative.

The Trust Initiative began in late 2013. What this system did was remarkable. The Trust Initiative allowed for players to obtain powerful spells that could summon “Alter-Egos” of popular in-game NPCs. These NPCs would reflect the current level of the player who summoned them thus allowing for players to perpetually be inside an XP party that was balanced and powerful. This was later paired with an increase in the experience points per monster. Before the level cap was raised to 80, the average experience points per hour was perhaps around 2-5000 (level 74 – level 75 required around 43000 xp). Since its release, the Trust Initiative has seen constant improvements, edits, and allowances that allow for *FFXI* players to accomplish by themselves what used to require 6, 12, 18, or more players to accomplish in the past.

Discussion

The present research reflects an historical overview of the features of *FFXI* that correlate to the loss of sociability in similar games like *WoW.* This slow loss of sociability can also be seen in games *Star Wars Galaxies* through its infamous “New Game Enhancement” patch (Lees, 2005). *FFXI* was built around the demands for players to interact with one another. The result of the trend of a loss of sociability is that *FFXI* itself should have closed down, moved on. A brief chronological history of patches and patch notes (from *WoW* and *FFXI*) can be found in Figure 1 at the end of this paper.

However, the patch notes allow interested researchers to follow how game affordances shift. Affordances in games like MMORPGs serve as a vehicle through which player community is formed, how player community and social capital are enforced, and how players recognize one another. By highlighting these changes between 2005 and 2013, the tangential aspects of a loss of the need for social capital can not only be witnessed but experienced by logging in to the game.

Conclusion

This case study serves as “for your consideration” when giving thought to toxic online behaviors as the players who remain in *FFXI* still adhere to that sociality as best as the software allows.

The overwhelming nature of research surrounding these toxic cultures often obfuscates those individuals who have remained with the games that represented the possibilities of online cooperation since their creation.

Interestingly, these developments in *FFXI* occur in concurrence with the loss of sociability in *World of Warcraft* demonstrated in Crenshaw and Nardi (2016). This is further exemplified in Crenshaw et al. (2017) and Consalvo (2013). More research is needed about *FFXI’s* version of private game servers (e.g. The DarkStar Project) which often feature the re-instatement of the various requisite needs for sociability that was required in-game before *WoW’s* release.

Additional work that examines the concurrence of the history of the DarkStar Project (*FFXI’s* private server software), the History of *WoW’s* private servers, and the nature of methods for MMORPG preservation is sorely needed.

As of 2016, *FFXI* has removed support for their original console releases marking the end of official

Playstation 2 development. While console support has been removed, Square-Enix has noted that they will continue to provide smaller-releases but still new content for the game as long as players continue to support it. With the loss of the need for sociability, the trade-off has been that the game has a means through which to continue into the unforeseeable future. *FFXI* remains one of the only original "golden age" MMORPG that has remained with a subscription. In fact, the subscription has not changed since the game was created aside from a number of storage-related additional charges one can apply to their account. That the game survives on subscriptions should also be examined.

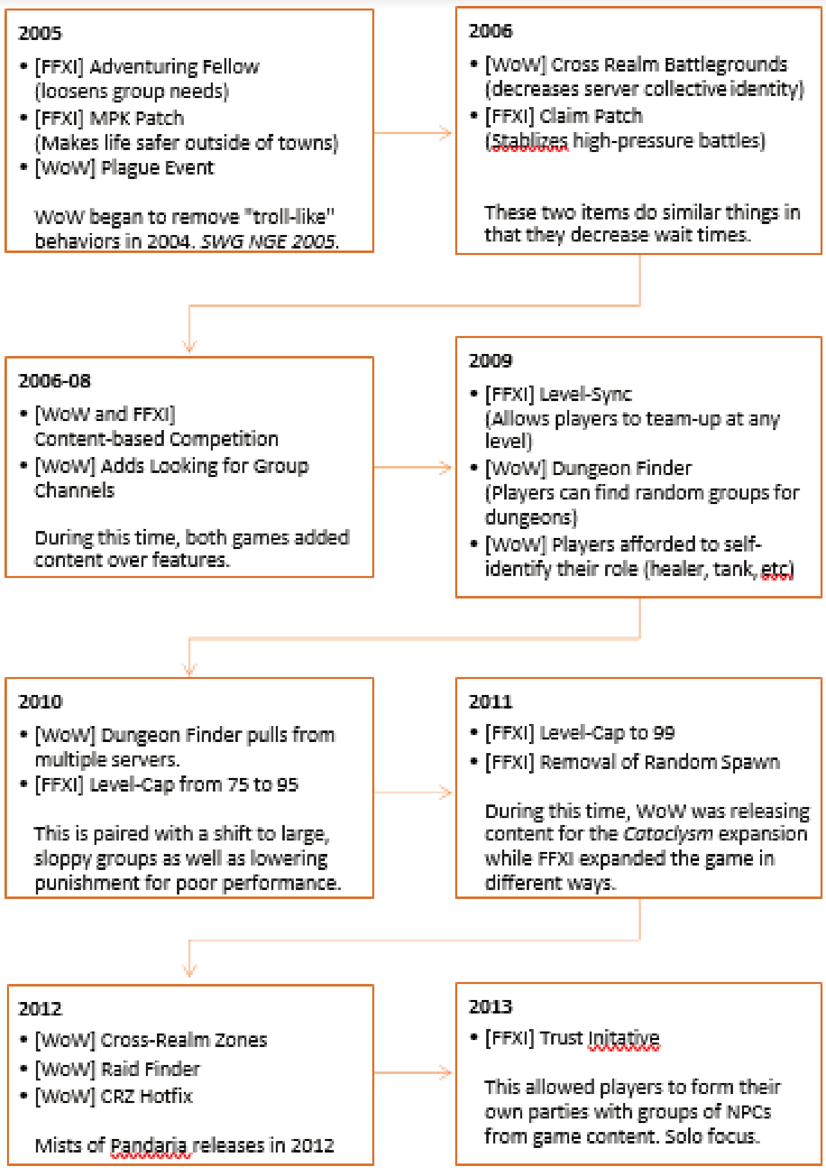

Figure 1 – Social Affordances Changes Between FFXI and WoW (2004-2013)

Links to Patch Notes:

Adventuring Fellow: July 2005:

http://www.playonline.com/pcd/update/ff11us/20050715Pm01B1/detail.html

MPK Patch: December 2005:

http://www.playonline.com/pcd/update/ff11us/20051213fMt7e1/detail.html

Claim Patch: April 2006:

http://www.playonline.com/pcd/update/ff11us/2006041883vPh1/detail.html

2006 – 2009: Attempts to add more content, more features, more PC Friendliness, more polish. Competition against WoW as norm.

Level-Sync: September 2009:

http://www.playonline.com/pcd/verup/ff11us/detail/3668/detail.html

Starting in 2010, FFXI begins to move toward large-group activities. The Abyssea expansion is the final expression of "multiplayerness" and massive group orientation.

Removal of level caps:

to level 80: June 2010:

http://www.playonline.com/pcd/verup/ff11us/detail/5571/detail.html

to level 85: September 2010:

http://www.playonline.com/pcd/verup/ff11us/detail/5835/detail.html

to level 90: December 2010:

http://www.playonline.com/pcd/verup/ff11us/detail/6035/detail.html

to level 95: September 2011:

http://forum.square-enix.com/ffxi/threads/15044

to 99: November 2011:

http://forum.square-enix.com/ffxi/threads/17017

Random Spawn to ???: April 2011:

http://forum.square-enix.com/ffxi/threads/5774

Trust Initiative: December 2013:

http://forum.square-enix.com/ffxi/threads/38761#post482610

For a discussion of *World of Warcraft*'s social affordances and how they have changed over time, please refer to: Crenshaw et al. (2017) or Crenshaw (2017). For a discussion of the sociability of "vanilla" or original *WoW*, I suggest Chen (2010).

References

Bartle, R. A. (2016). The decline of MMOs *Global Game Industries and Cultural Policy* (pp.303-316): Springer.

Brookey, R. A. J. C. S. i. M. C. (2009). Paradise crashed: Rethinking MMORPGs and other virtual worlds. An introduction. *26*(2), 101-103.

Castronova, E. (2008). *Synthetic worlds: The business and culture of online games*: University of Chicago press.

Chen, M. (2010). *Leet noobs: Expertise and collaboration in a World of Warcraft player group as distributed sociomaterial practice.* University of Washington Graduate School.

Consalvo, M. (2009). *Cheating: Gaining advantage in videogames*: Mit Press.

Consalvo, M. (2012). Confronting toxic gamer culture: A challenge for feminist game studies scholars. *Ada: A Journal of Gender, New Media, and Technology*(1).

Consalvo, M. (2013). Being social in online games: Five research areas to consider. *on Designing and Evaluating Sociability in Online Video Games*, 17.

Crenshaw, N. (2017). *Social Experience in World of Warcraft: Technological and Ideological Mediations.* (Informatics), University of California, Irvine.

Crenshaw, N., LaMorte, J., & Nardi, B. (2017). " Something We Loved That Was Taken Away": Community and Neoliberalism in World of Warcraft.

Crenshaw, N., & Nardi, B. (2016). *" It Was More Than Just the Game, It Was the Community": Social Affordances in Online Games.* Paper presented at the System Sciences (HICSS), 2016 49th Hawaii International Conference on.

Green, B. (2009). Rethinking the Trinity of MMO Design.

Huber, W. (2007). 14. Fictive Affinities in Final Fantasy XI: Complicit and Critical Play in Fantastic Nations. *Worlds in Play: International Perspectives on Digital Games Research, 21*, 169.

Kline, R., & Pinch, T. (1996). Users as agents of technological change: The social construction of the automobile in the rural United States. *Technology and Culture, 37*(4), 763-795.

Lees, J. (2005). Star Wars Galaxies' New Game Enhancements Cause Player Backlash.

Engadget. Retrieved from https://www.engadget.com/2005/11/24/star-wars-galaxies- new-game-enhancements-cause-player-backlash/

Massanari, A. (2017). # Gamergate and The Fappening: How Reddit's algorithm, governance, and culture support toxic technocultures. *New Media & Society, 19*(3), 329-346.

Nakamura, L. (2013). *Cybertypes: Race, ethnicity, and identity on the Internet*: Routledge. Nardi, B. (2010). *My life as a night elf priest: An anthropological account of World of Warcraft*: University of Michigan Press.

Paul, C. A. (2018). *The Toxic Meritocracy of Video Games: Why Gaming Culture Is the Worst*: University of Minnesota Press.

Reimer, J. (2005). Virtual plague spreading like wildfire in World of Warcraft. *Ars Technica, 21*, 20050921-20055337.

Taylor, T. (2009). *Play Between Worlds*: MIT Press.

Ward, M. (2005). Deadly plague hits Warcraft world. *BBC News, 22*.

PLAYING GAMES FOR OTHERS: CONSTRUCTING A GAMEPLAY LIVESTREAMING TYPOLOGY

Constructing a Gameplay Livestreaming Typology
ALEX P. LEITH

Abstract

Gameplay livestreaming is a rapidly growing area of new media through such platforms as Twitch and YouTube. When gamers choose to stream their gameplay, they regularly alter their play style to be more appealing to their spectators. This study examined the variation in play styles for gameplay livestreamers to construct a usable typology. The foundation for the typology is rooted in prior research that identified streamers generally being either experts or entertainers. The expert-entertainer spectrum provided to be insufficient in properly representing how streamers present their gameplay on stream. Therefore, standard streams refer to streams that are definable by their orientation toward expertise or entertainment. Nonstandard streams are streams which provide characteristics sufficiently unique to distinguish them from the expert-entertainer spectrum.

Introduction

Video game broadcasting continues to promote novel forms of gameplay. Gamers by the thousands are expressly altering their approach to gameplay to include onlookers. Onlookers are not a new element to gameplay. During the arcade boom of the 80s and 90s (Lin & Sun, 2011; Taylor, 2012), arcade patrons would often spend more time waiting to play games than playing. Family members and friends also regularly gather around a console to play games together, with the majority spectating while the minority plays. Gameplay livestreaming is an entirely new phenomenon. Unlike gamers at arcades or on consoles, streamers must prioritize their spectators to ensure a continued audience. Streamers will, therefore, take on one of the streamer roles.

As with any other form of entertainment media, various types, or genres, arise to meet the individualized needs of the consumer better. Prior research into streamers as digital buskers identified streamers are falling along a spectrum between experts and entertainers (Leith, 2015). The motivations of viewers can differ based upon where the stream falls along the expert-entertainer spectrum. Most gameplay experts are parts of esports. There are many ways in which esports compare to more traditional sports (see Taylor, 2015). In sports, fans often sought out professional athletes to learn more about them and the game they play (Gantz, 1981; Wenner & Gantz, 1998). By streaming, esports athletes are about to do precisely that while simultaneously removing some of the common barriers that traditionally existed between athletes and fans. The closer fans feel toward their favorite athletes, the more likely they are to enjoy watching them play (Zillmann, Bryant, & Sapolsky, 1989;

Zillmann & Paulus, 1993). Sports, including esports, are also watched because fans find them entertaining (Gantz, 1981; Wenner & Gantz, 1998). Streams more heavily favoring the entertainment end of the spectrum may drastically differ in their approach to gameplay and audience. For example, will gameplay or viewership be more critical to the streamer? Past research into parasocial relationships has found that respond favorably when media figures break the fourth wall, even when not speaking directly with them, becoming more loyal to the media figure (Auter & Davis, 1991; Horton & Wohl, 1956). These interactions can also prove to fill a need for social interaction (Horton & Strauss, 1957; Horton & Wohl, 1956). It should, therefore, prove beneficial to construct a streamer typology guided by the expert-entertainer spectrum, providing individuals with the actionable categories necessary for future research.

Methodology

This study sought to construct a typology for streamers by analyzing stream content. Channel selection was limited to partnered, English-speaking channels which streamed gameplay. Gameplay did not need to the be the primary focus of the channel; however, the analysis of these channels would only occur during gameplay segments. Limiting channel selection to partnered streamers (i.e., streamers who demonstrated the ability to stream regularly and maintain a sufficiently sized audience) ensured that streamer characteristics were reflective of their actual characteristics. Channel selection and analysis occurred over a six-month period, allowing for more singular occurrences and channel changes over time. The analysis included the selection of approximately 500 channels.

The study employed grounded theory methods to analyze the selected channels. A researcher collected data over six months from livestreams and archived videos-on-demand ("VODs") for open coding. Selective coding began once trends began to arise from open coding. It was during the selective coding process that the expert-entertainer spectrum was considered, while relevant. Resulting categories became a typology through organization.

Stream Categorization

Data analysis produced several intriguing findings regarding the types of streamers. Most importantly, analysis quickly revealed that most streamers, like the platform, were not monolithic. Selective coding and typology building, therefore, adapted to seek to explain streamers by the types of streams they broadcasted as opposed to broader streamer identity. The expert-entertainer spectrum was therefore slightly modified to expertise-entertainment and streams which adopt an identity superseding the spectrum became a unique category. The inclusion of a stream into the more nonstandard group does not exclude it from the standard expertise-entertainment grouping.

Standard

Most streams fall within the previously discovered expert-entertainer spectrum and classified as standard streams. Standard streams are divided between the expertise and entertainment groups based upon which characteristic it prioritizes. Each of these categories, though built from a spectrum, are constructed to be mutually exclusive within the standard group, though they may overlap with future nonstandard stream types.

Expertise. At one end of the spectrum, there are expertise streams. Expertise streams are streams in which the skill level of gameplay is the principal focus of the stream. The construction of such streams is highly diverse, including tournaments, individual professionals, and speedrunners. Tournament streams generally include many gamers, while professional and speedrun streams tend to be more individualistic.

Tournament. Broadcasting tournaments have contributed heavily to the growth of Twitch. Tournaments consist of both gamers and tournament staff (e.g., casters and analysts). The structure of tournaments streams separate stream personalities and the audience, with the only regular audience member interaction being with the occasional tournament staff member. Tournaments also vastly differ in size. For example, DreamHack regularly broadcasts major tournaments in *Counter-Strike: Global Offensive* ("*CS: GO*"), *Hearthstone*, and *StarCraft II* on their channels. Twitch also makes it easier to broadcast smaller tournaments. Games with a smaller competitive scene, such as *The Binding of Isaac: Afterbirth*, can host their tournaments online with the hopes of reaching new viewership.

Point-of-view. A byproduct of growing competitive scenes and the ease of broadcasting has also promoted instances of point-of-view ("POV") streams. *League of Legends* and *CS: GO* tournaments have included team POV streams to complement the primary streams. Team POV streams allow for fans of a particular team to spectate just the team they are interested in watching, as opposed to swapping between the teams at the discretion of the staff producing the stream. Online tournaments can also use POV streams as a tool for validation or a method for casting many concurrent individuals. *Hearthstone* often makes use of both cases. For example, Rat Race was a tournament in which a field of participants would race to legend, the highest-ranking group on the *Hearthstone* competitive ladder, over a 24-hour period. Participants were required to stream to ensure that they were not having multiple people play on the same account and so that tournament viewers and casters were able to select which participant they would like to spectate freely.

Professional. Outside of tournaments and practice, many professional also either choose or are required to stream regularly. Professional streams are therefore streams in which the streamer is verifiably an expert in the game they are streaming and the streaming content is generally leaning toward expertise instead of entertainment. Expertise is characterized by either presently or previously being on a team or by competing in high-level competitions for the streamed game. The first streamer to break 100,000 subscribers (i.e., paid followers) is a former Halo pro who has continued with a professional team but is now playing high-level *Fortnite*. Former professionals, such as *League of Legends*' Imaqtpie and Scarra still nearly exclusively play the game they professionally, and at a high level.

Game designers and developers are also able to utilize the Twitch platform for presenting their game to a broader population. Expertise is not restricted to high-level gameplay, though many game developers are highly-skilled in their gameplay. Streams by developers can give expert insights into their games regardless of mechanical skill.

Non-professional. Along with professionals, there are many streams which exhibit expertise but are produce by non-professionals. Non-professional players come in several common variations. Highly skilled streamers who play matches against professional players but are not involved with professional esports. Many competitive games, such as *StarCraft II*, *League of Legends*, and *CS: GO*, have laddering systems in which players of comparable skills will play against each other in hopes of winning and reaching a higher ranking. Teams regularly recruit players from these ladders. High-ladder players may also have no interest in going professional and, instead, prioritize streaming their gameplay.

Not all games have a competitive edge that lends itself to professional esports; nevertheless, there are individuals who put a similar amount of time into their games as professionals. A common approach to this would be streamers who add new challenges when they replay games. For example, LobosJR is an expert *Dark Souls* player who will continually return to the franchise for a new challenge run. *Minecraft* is another game that is not inherently competitive but has streamers who are unmistakably experts at the game.

A popular form of non-professional gameplay is a speedrun. A speedrun is an approach to gameplay in which the gamer attempts to complete a level, game, or set of objectives, in the shortest time possible. Speedrunners are also unique from most gamers since they have been historically required to record their gameplay to validate their completion times. Sites like Twitch were only a natural outlet for speedrunners to stream to document their runs. Trihex, the face of the TriHard Twitch emote, started streaming his speedruns in 2011. Speedrun streams are mostly a streamer attempting to play through the selected game as quickly as possible until either completion or a significant mistake. Once the streamer has finished the game or made a mistake, they will reset the game and begin again. It is not uncommon to see a speedrunner repeatedly replay the early levels of a game for hours in hopes of getting the ideal start. Attempting perfect runs also profoundly affects a streamer's ability to interact with chat, with a streamer mostly narrating their actions and addressing questions they commonly encounter until they reach more autopilot sections within the game.

Entertainment. Because expertise, by its nature, is a small subset of individuals, the majority of Twitch streamers prioritize entertainment to either compensate for or complement whatever skill they have in the game. Most of the entertainment streams are considered variety streamers, streaming any number of games, while there are examples of non-expertise single-game streamers who either exclusively, or nearly exclusively, stream a single game. There is also a small, yet growing, population of celebrities classified within this group.

Variety. The typology classifies most streams as variety streams. Namely, a streamer who either plays a recurring set of games or continually plays new games is considered a variety streamer. Variety streams are the streams from variety streamers. Unlike with the expertise streams, a viewer is more likely to watch a game they are uninterested in when they are sufficiently interested in the streamer. Variety streamers are also more likely to catch waves of new viewership when the game they are presently streaming lines up with the interest of their new viewers. A perfect example of variety streaming is CohhCarnage who will regularly play through entire franchises of a game to line up with the launch of a new game but will rarely stream a game he had previously played without it aligning with the release of new content, such as downloadable content ("DLC"). Streamers who run regular shows on their streams, such as itmeJP and the late TotalBiscuit, will often do variety streaming during other times. Some variety streamers are also former single-game streamers, either professional or entertainment, that converted into variety streaming. Some noteworthy examples of this are Destiny, who was known for *StarCraft*, and Sodapoppin, known for *World of Warcraft*.

Single-game. A unique type of entertainment streamer is the single-game streamer: streamers who nearly exclusively play a single game on stream. Single-game streamers generally fall into two categories: casual and competitive. Casual single-game streamers are the most common. For example, open-world games like *Minecraft* provide streamers like Bacon_Donut, Darkosto, Deadpine, and Matrixis over a thousand hours a year of distinct and moderately diverse gameplay. Competitive single-game streamers are rare in the entertainment category as most individuals good enough to maintain an audience on Twitch while only playing one game is either a professional or retired from professional play. *League of Legends* is an example of a competitive game which has several full-time entertainment streamers. SirhcEz, BoxBox, and Cowsep are popular streamers who have never been professional but have found strong viewership by mixing their brand of entertainment with moderate mastery of a few champions. The first and only female streamer to presently reach a million followers on Twitch, Pokimane, was a *League of Legends* streamers until she converted to a *Fortnite* streamer.

Celebrity. As with other new media, Twitch has begun to see celebrities actively using their platform. Deadmau5, the DJ, regularly streams himself in his studio or playing *PlayersUnknown's Battlegrounds* ("*PUBG*"). Demetrious "Mighty Mouse" Johnson, MMA fighter, is also a regular streamer on the platform. Along with musicians and athletes, celebrities on Twitch includes actors and television and web personalities. Coding identified celebrities as a unique category within entertainment as their celebrity status overshadows whether they are single-game or variety streamers.

Nonstandard

Along with the standard streams which reflect predominantly upon where the streamer sits along the expertise-entertainment spectrum, nonstandard streams are more concerned with the structure of the stream. It is also important to recognize that despite analysis reaching theoretical saturation, it is unlikely that these categories exhaustively represent both the present and future state of streams on the Twitch platform. Some of these categories are rarely occurring, meaning there may be other rare occurrences that were undiscovered during channel selection and there is an ever-growing number of channels seeking to make creative use of the platform.

Educational. Though inherently similar to expertise streams, educational streams produce unique dynamics between either streamers or streamers and viewers. The two primary forms of educational streams are coaching and teaching. Coaching streams consist of at least one expert player and one less skilled player. The streamer can fulfill either role and does not have to be a rank amateur. It is not uncommon to have one *Hearthstone* professional coach their specialty deck or class to another *Hearthstone* professional. It is also possible to get experts in different games to coach each other, such as *World of Worldcraft* and *League of Legends* experts teaming up to coach each other. Streamers can also be hired by amateur, non-streamers to be coached, with the coaching occurring on stream.

Streamers can also utilize the platform to teach their viewers. Teaching is a common motivation for expertise streams; however, there are instances when teaching can extend beyond common gameplay explanations. The streamer Day9 teamed up with a couple friends from his time as a graduate student in game design to create a recurring show called *Mostly Walking* in which they teach game design while playing adventure games. This approach to teaching viewers is unique in that the expectation of instruction is increased knowledge instead of greater skill.. Similar techniques can be employed to teach several topics, including STEM.

Mobile. Though far from conventional, there are mobile streams which are more ambulatory by nature. Playing a mobile game does not make a stream mobile. Perhaps the best example of mobile streams is during the Summer of 2016 when *Pokémon GO* was at peak popularity and streamers would broadcast from bars, parks, and restaurants. Though mobile streams are presently extremely uncommon, as gaming companies continue to figure out augmented reality, it is possible that games like *Pokémon GO* become more common and have lasting popularity as games for streaming.

Playerless. There are sporadic cases in which a stream is considered playerless. Playerless means that the individual or individuals on the stream, if any, are not the players. The most famous example of this is a channel that began early 2014 called TwitchPlaysPokemon ("TPP"). TPP invited viewers to issue commands in chat that a program would then input into the streamed *Pokémon* game, which was *Pokémon Red* at launch. Variations of this approach to gameplay streaming have since been duplicated, including several streams in which DisguisedToast allowed viewers to play games on his *Hearthstone* account. Another example of playerless is SaltyBet which removes the human element entirely, regularly streaming AI-driven gameplay.

Podcast. In general, podcasts and talk shows have been a regular staple of Twitch. Most of these podcasts take on a traditional talk show setting, with videos of each guest showing on screen through the broadcast. Northernlion developed the *Northernlion Live Super Show* ("*NLSS*") which formalized the habit of streamers playing games while communicating with a group of other streamers. The *NLSS* is ultimately a three-hour podcast with gameplay as a loose accompanist. Northernlion and his guests would make comments about the game they were playing together as necessary but would mostly communicate about a range of topics. Spinoffs of the *NLSS* were also created by some of its regular guests, such as the *NoNLSS* and *Squares*, though the dataset did not include other formalized podcasts that included gameplay.

Roleplay. A surprisingly common stream type discovered through content analysis was roleplay. Roleplay, in this sense, does not refer to roleplaying games, but to the streamer roleplaying. There are two common ways for a streamer to roleplay. First, streamers will often create characters on a server for an open-world game, like *Grand Theft Auto: Online* ("*GTA:O*") and then interact with others on the server as if they were the created character. A roleplay streamer that came to popularity in 2017 is SheriffEli, a *GTA:O* streamer who roleplayed a sheriff on a roleplay server. Another example of a roleplay stream is when the streamer adopts a personality that they are always using when on stream. Roleplay streamers who take on the more macro approach can choose to include costumes and props, like a DrDisRespect, or be subtler, like a Kaceytron. The subtle approach requires viewers to be aware of the roleplay to understand the stream and the accompanying chat fully. Regardless of the type of roleplay, gameplay will largely vary from how the streamer would traditionally play the game.

Tabletop. Tabletop gaming, including board games and role-playing, is increasingly popular on Twitch. Coding identified tabletop as a unique category for this typography since they are not natively digital games and the stream generally consists of a group of players. Though some games are played virtually through tools like *Tabletop Simulator* and D20, the gameplay and streams are still highly distinct from other streams. For tabletop role-playing games, streams can have all players in the same room and include no virtualization, such as GeekandSundry's *Critical Role*, or players can be connected virtually and utilize D20 for everything from dice rolling to map projection, such as itmeJP's *RollPlay*.

Telethons. Streamers regularly raise money while streaming. Most of the time, raising money is a byproduct of the stream; however, there are several major telethon-style streams on Twitch. A few of note would be Games Done Quick, Desert Bus, and the Yogscast Jingle Jam. Each of these, along with many others, occur over several days and raise millions a year for various charities. Since raising money is the prime directive, gameplay is secondary. Even Games Done Quick, which is a bi-annual event of speedrunners, prioritizes entertaining viewers and reading off donations over completing the game as quickly as possible. Many of these telethons also bare similarities to tournaments, wherein the casters and not the gamers are the one most closely connected to the audience.

Virtual. Similar to mobile streams, virtual streams are examples of streams when the streamer moves beyond the standard gameplay structure of sitting in front of a screen and playing a game. Games like *Beat Saber* invite streamers to stand up and move around the virtual space. Without modification, streamers are separated from their chats and will, therefore, communicate less regularly with them. The physicality of some virtual reality ("VR") games also creates another barrier to more traditional streaming behavior. Even more sedentary VR games, such as *Star Trek: Bridge Crew*, do not require the physicality but still have the physical barriers between the streamer and their computer.

Conclusion

After analyzing thousands of streams from hundreds of channels over many months, two things have become increasingly evident. First, the content from most streams is similar once you account for its relation to the expertise-entertainment spectrum. Second, streamers are continuing to find impressively creative ways to make use of the Twitch platform. Similar characteristics should be true of other gameplay livestreaming platforms, such as Facebook, YouTube, and Mixer, with the uniqueness of each platform providing for the greatest potential creativity of the nonstandard stream types.

Researchers should use this typology as a guide for their future research. The typology is most beneficial for research that seeks to understand streamer or viewers differences based upon either the content they produce or consume. Additional work with the typology would be necessary if any gradation or quantification were necessary. For example, the typology defines a single-game streamer according to their percentage of play. A single-game streamer can, therefore, be someone who, over a year, streams one game at least 90% of the time or streams one game 30% of the time while streaming no other game more than 5% of the time. Developing such strict definitions for each of the categories; however, more user-friendly definitions were constructed to provide for the greatest opportunity for building a common language when discussing stream types. New typologies must also be considered to better represent streamer identity, such as age, gender, ethnicity, and sexuality.

References

Auter, P. J., & Davis, D. M. (1991). When characters speak directly to the viewers: Breaking the fourth wall in television. *Journalism Quarterly*, *68*, 165-171.

Gantz, W. (1981). An exploration of viewing motives and behaviors associated with television sports. *Journal of Broadcasting*, *25*, 263-275.

Horton, D., & Strauss, A. (1957). Interaction in audience-participation shows. *American Journal of Sociology*, *62*, 579-587.

Horton, D., & Wohl, R. R. (1956). Mass communication and para-social interaction: Observations on intimacy at a distance. *Psychiatry*, *19*, 215-229.

Lin, H., & Sun, C. (2011). The role of onlookers in arcade gaming: Frame analysis of public behaviours, *Convergence*, *17*, 125-137.

Leith, A. P. (2015, November). *Busking on a digital pitch: Investigating Internet-based gameplay broadcasting*. Paper to be presented at the Games as/with/through Communication: Introducing the Game Studies Division preconference of the National Communication Association 101st Annual Convention. Las Vegas, NV.

Taylor, T. L. (2012). *Raising the stakes: E-sports and the professionalization of computer gaming*. Cambridge, MS: MIT Press.

Wenner, L. A., & Gantz, W. (1998). Watching sports on television: Audience experience, gender, fanship, and marriage. *MediaSport*, 233-251.

Zillmann, D., Bryant, J., & Sapolsky, B. (1989). Enjoyment from sports spectatorship. In J. H. Goldstein (Ed.), *Sports, games, and play: Social and psychological viewpoints* (2nd ed., pp. 241-278). Hillsdale, NJ: Erlbaum.

Zillmann, D., & Paulus, P. B. (1993). Spectators: Reactions to sports events and effects on athletic performance. In R. N. Singer, M. Murphey, & L. K. Tennant (Eds.), *Handbook of research on sports psychology* (pp. 600-619). New York: Macmillan.

THIS IS HOW WE ROLL; A PLAY ON CREATIVE THOUGHT AND THE GENERATION OF NOVELTY

A play on creative thought and the generation of novelty

MARIE BENGTSSON, JUAN RUIZ, AND RENEE WEVER

Abstract

This paper examines generation of novelty and creative dynamics in design teams that aim at arriving at something truly novel. Looking at the works by Schumpeter, Campbell and March in explorations for solutions that go beyond what could be easily foreseeable and the works of Smith, Lindsey, Cardoso among others, in the field of design fixation, this paper explores an approach taken to introduce elements of randomness in design exercises to prevent fixation and facilitate aimless and unguided explorations. The dynamic explained in this paper presents the utilization of a game-based dynamic in design teams that facilitates the generation of novel ideas.

Introduction

To arrive at something truly novel and creative is a common desire for design teams. Following Schumpeter (1934), such an outcome often relies on a re-combination of already existing concepts and materials that successfully deviates from established knowledge. Generating new combinations that deviate from what is established as the standard, requires exploration that goes beyond what could be easily foreseeable. In order to arrive in an unforeseeable solution space, we need what Campbell (1960) refers to as a blind variation. That is, an expansion of knowledge that is somewhat random, aimless and unguided. The design teams need to explore ideas seemingly unrelated to the problem space and connect distant knowledge domains since "… new provinces… can only be brought about by accidental circumstances." (Mach, 1896). Such an expansion of knowledge is however risky. History tells us that most new combinations are bad ones and that "only a small, unpredictable fraction of novel initiatives will turn out to be successful" (March, 2010). In order to arrive at something truly novel, a design team will therefore need to generate many deviating solutions. Research has shown however, that it is very difficult to let go of design solutions and start developing completely new ones. Existing solutions easily turn into design fixations.

As exemplified in the editorial by Cardoso & Badke-Schaub (2011), to imagine an alternative use of a well-known object, such as a pair of pliers, in an ideation session is challenging since previous knowledge constrains our thoughts and may make us fixed on the well-known function ('functional fixedness'). Another type of fixation is 'mechanized thought' where the same previously successful thought process will tend to become used by default and lead to the same familiar solutions. In addition, "when an example of an existing solution is presented to designers during idea generation, they often copy features and principles from such examples, ultimately reusing the example in suboptimal ways".

This is what we noticed in our student design team who were part of a nine-month design project. They had been presented with the challenge to 'find a new use and market for drones', and after careful benchmarking they struggled to get beyond conventional uses. To help them, we introduced a game that would force random elements to be added in their ideation sessions and we did so based on picture dice (Story Cubes). In what follows we first describe the game as it was used. In a next section we will then analyze the game from a fixation perspective to see how it may help design teams overcome fixation and facilitate the generation of novel ideas.

The Dice Game

Image 1: Story cubes used during the idea generation process by the participants

The dice we used are Story Cubes and originally part of a social game where participants roll a set of dice with pictures. The goal is to tell a story that includes all the rolled pictures. The original dice set includes both activities and things but can be expanded with themed extra dice sets ranging from "activities" and "medical" to "fairy tales" and "Batman". The pictures on the dice are simple line drawings and offer multiple options for interpretation. A magnifying glass can for example represent a magnifying glass, but also a detective, search, or investigation. The dice can be arranged in any order in the telling of the story.

A Design Thinking Challenge

As already mentioned, our students' challenge was to develop an alternative use and market for drones and the project was referred to as 'UAV Taxi'. What the drone was supposed to transport and in what context was part of the challenge. The aim of the project was for the

students to learn to practice Design Thinking. Design Thinking is a structured, hypothesis-driven, human-centered, innovation method inspired by designers' ways of working. It is based

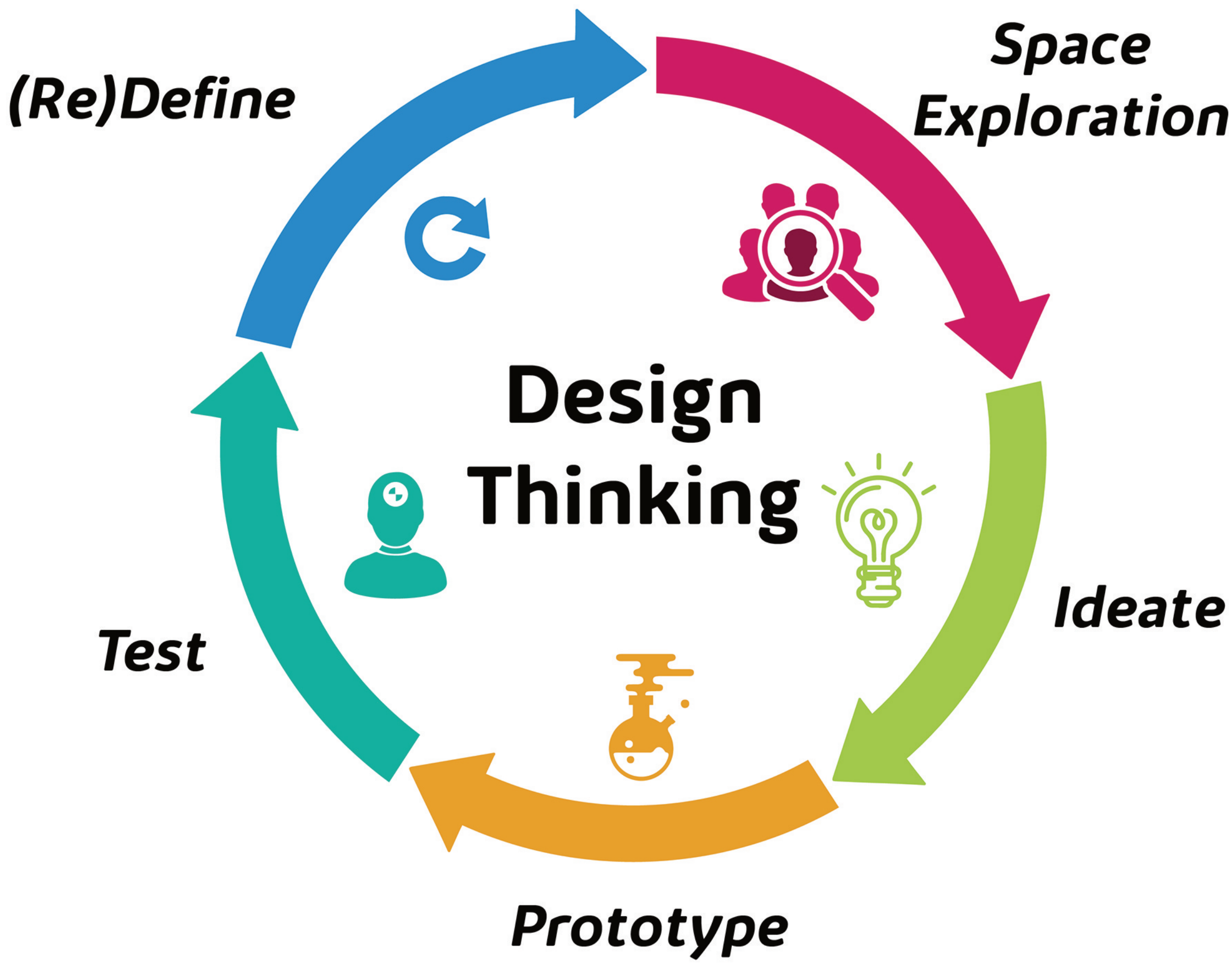

Image 2: Iterative design thinking process

on an iterative cycle of problem definition, space exploration, ideation, prototyping and testing that leads to new insights into the user's needs. It aims to simultaneously addresses technical feasibility, financial viability and the user's desire for the solution, but takes desirability and the user as the starting point. It is collaborative and interdisciplinary and aims at learning fast through rapid, simple and cheap prototyping and testing with real users. Our eight students were part of an interdisciplinary team and had backgrounds in product design, visual design, mechanical engineering, and strategy. It was an international team collaboration, with students from two different universities, so the students were culturally mixed with four Brazilians, one Finish, one Estonian and two Swedish students.

Playing the Game

To try to help the students get unstuck, we initially divided the design team of eight into sub-teams of two and set them up with a starter set of five dice of different kinds.

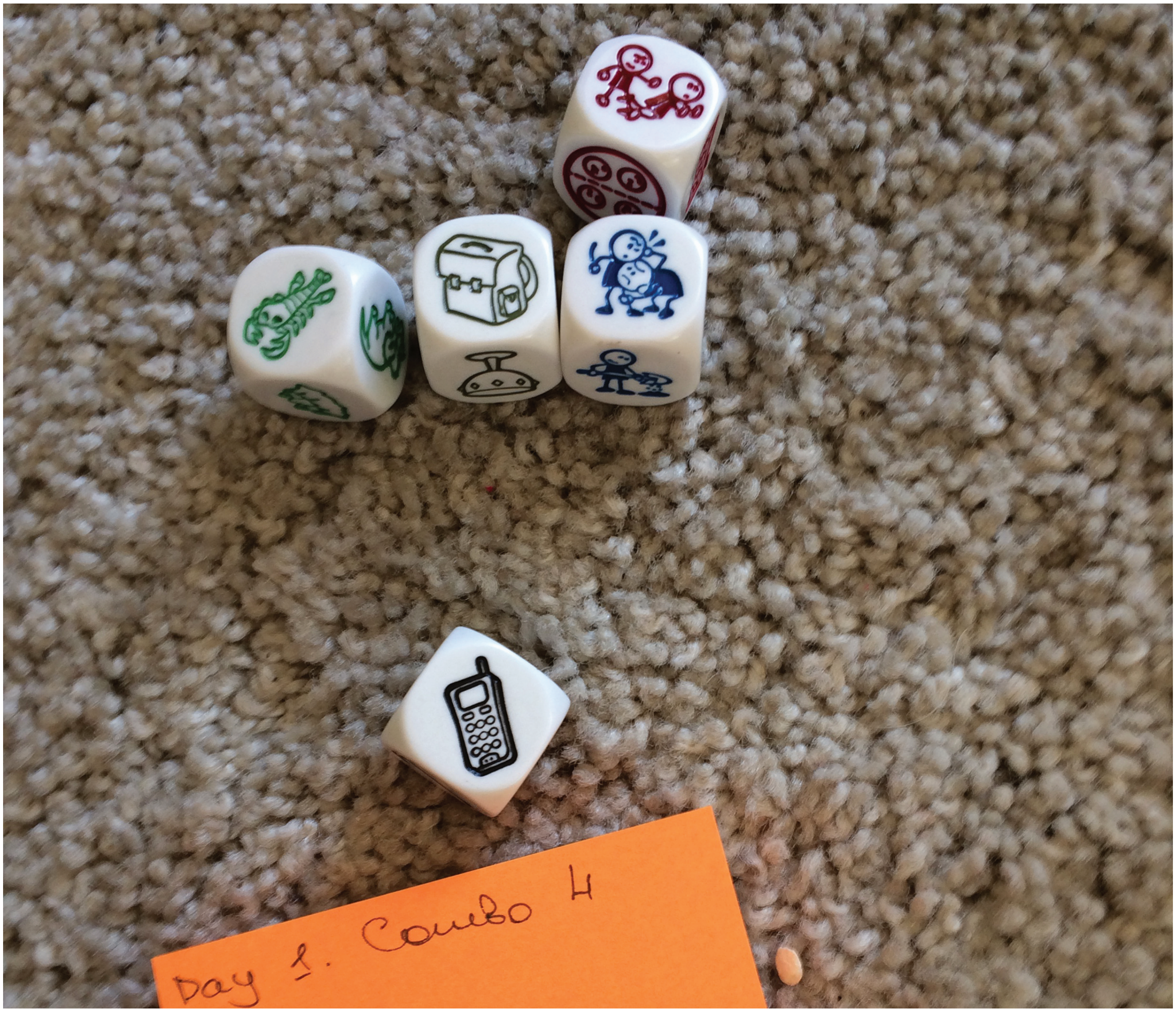

Image 3: Example of a roll used by students to generate stories

Telling Stories

The students' task was to spontaneously tell a story based on the dice they had rolled. In addition to the dice pictures, every story had to include a drone. They were handed post-its and asked to take a photo of the dice they had rolled and to write a short summary of each story they created. In the initial rounds, each participant was expected to tell their own story based on the dice to make sure that everyone felt expected to contribute and lost their inhibitions when it comes to telling silly stories. Once everyone was active and engaged, they could also create the story together with their partner.

From Stories to Scenarios

Once the teams of two had reached the goal of some twenty different stories they were asked to reflect on the stories they had created and see what drone uses they might indicate. The stories created varied from possible solutions to potential obstacles that can be found in the

Image 4: Example of stories generated by students during a session

challenge. One story for example featured a pirate, something that could be abstracted to the more general scenario of "Criminal", which led to discussions of how criminals might desire having illegal things drone-delivered over prison walls. Each new use scenario was noted without judgment of appropriateness or chance of success. Some stories were of course complete nonsense and would not lead to a second level abstraction. The sub-teams would then share the scenarios they had found with their other teammates. Once done, the teams would exchange partners, pick up a new mix of dice, and get going again. Our students initiated multiple game sessions spread out over the course of a week.

From Scenarios to Categories

After some 250 stories were created and scenarios abstracted, the team would synthesize and form connections between what had been produced. The participants sorted the scenarios and rearranged them seeking connections. The connections were based on criteria established by the team with the intention of finding paths that could be taken in the later design stages. Our students organized their scenarios into categories of drone use such as 'healthcare' (ranging from drone delivery of tools during surgery to nano-drones operating inside the body), 'rescue operations', and 'entertainment'.

This way interesting scenarios and categories were identified and used as starting points for further space exploration and need-finding.

Thoughts and Theories Behind the Game

Following March's (2010) separation of novelty as "deviation from established procedure or knowledge" and creativity as "novelty that is subsequently judged successful" the game was used in the initial steps of a design process where novel areas for problem search were identified. Among the scenarios and categories generated there were many novel ones, whereof only few were selected to be developed into potentially creative solutions. Our aim with the game was to provide the students with a tool to overcome some of the counterproductive effects of fixation and facilitate novelty generation.

The sources of fixation (why do we become fixated?)

Following research in the area, fixation is something that "blocks successful completion of various types of cognitive operations" and a result of "the inappropriate and counterproductive implicit use of knowledge" (Smith & Linsey, 2011, p. 85), meaning that people tacitly bring knowledge of solutions that have worked before into new problem areas and fails to see past it. There are numerous examples of experiments where students have been exposed to solutions, even flawed ones, and thereafter have incorporated them into their own solutions (see e.g. Jansson & Smith, 1991; Purcell & Gero, 1996). Fixation is not only bad though. More often than not, being able to see connections and effortlessly transfer knowledge between problem situations is a good thing, and part of what is considered skill and to be skillful (Polanyi, 1952). Experienced designers may that way however, also become attached to what they have already created and try to improve upon it instead of generating alternatives. Fixation has hence been referred to as "negative transfer of knowledge between problem situations" (Chryisikou & Weisberg, 2005 referred to in Cardoso and Badke-Schaub 2011).

Overcoming fixation

Much research has been devoted to how we may get around the negative effects of fixation. On top of very general suggestions, such as 'incubation' (letting the problem rest for a while) and exposing oneself to environments that are rich in cues and clues that may help trigger insight, Smith and Linsey (2011) sums up strategies in three main categories:

Forgetting fixation by putting it out of mind: This they suggest can be done by 'Inhibition' (identifying the fixating knowledge and intentionally putting it aside), 'Interference' (replacing a fixating response with another one), or 'Changing Context' (understanding the problem in a new context). The first two require that the fixating knowledge first can be identified, which may be difficult.

Redefining the problem: This can be done by thinking about the problem in an atypical work situation.

Using analogy: Finding other areas with an analogue relationship to the problem area. A waiter's hand carrying a tray can for example serve as an analogy to the construction of a highway overpass.

What the dice do

"As an instrument for selecting at random, I have found nothing superior to dice.

Galton (1890), p. 13

As mentioned in the introduction, novel solutions are re-combinations of known concepts and materials and rest on a somewhat unguided and random expansion of knowledge that is difficult to plan. Our students' main problem was to ignite this expansion and get beyond conventional use. One reason for this was inhibitions when it comes to exposing potentially stupid ideas and therefore over-thinking and judging before sharing. Another reason was the lack of outside stimuli. Dice have a long history of being used as tools for randomness. The randomness induced by Story Cubes is limited to the illustrations on each side of a die, but then as the pictures are open to multiple interpretations the number of possible outcomes increases. A combination of random elements from the dice and the problem domain-oriented knowledge that the students already had made the students stretch their imagination into areas they had not previously thought of, but still kept them grounded in their challenge.

Multiple interpretations.

The introduction of the Story Cube dice, which contained several different pictures, allowed our students to create several scenarios even if the same pictured appeared in multiple occasions. This was possible due to the multiple interpretations that each student gave to a particular image. One such example of different interpretations was one of a picture depicting a magnifying glass. For one student the picture was related to search while another interpreted as a detective, which allowed for two completely different outcomes.

Randomness.

Novelty cannot be conceived by only searching in the vicinity of what it's known to us, they require an element of random combination or chance that allows for new outcomes to appear. Introducing such element of randomness was the task attributed to the dice during the game. As previously proposed by Galton, the outcome of a roll of a number of dice cannot be predicted and by combining a number of dice with different faces, the number of possible combinations increased.

A change of context

The game itself forced our students out of their normal work environment but also transferred their challenge to a different context. Since the fixating knowledge was difficult to identify in our case, playing the game put their challenge in contexts that otherwise would not have been part of their creative dynamic by subjecting it to random scenarios.

The telling of stories provided opportunity to transfer and combine 'inside domain knowledge' with 'outside domain knowledge' on a first level of abstraction, capturing analogies. Reflecting on the stories and trying to find the higher-level categories was then similar to Linsey et al.'s (2008, referred to in Smith and Linsey 2011) use of word trees.

References

Campbell, D. T. (1960). Blind Variation and Selective retention in creative thought as in other knowledge processes. *Psychological Review*, vol. 67, p. 380-40

Cardoso, C. Badke-Schaub, P. (2011) Fixation or inspiration: Creative problem solving in design. *Journal of Creative Behavior.* vol. 45, p. 77-82

Chrysikou, E. G., Weisberg, R. W. (2005). Following the wrong footsteps: fixation effects of pictorial examples in a design problem-solving task. *Journal of Experimental Psychology, Learning, Memory and Cognition* Vol.31 (5), pp. 1134-1148.

Galton, F. (1890) Dice for statistical experiments. *Nature.* Vol. 42, 13–14

Jansson, D., and Smith, S. (1991). Design fixation. *Design Studies* Vol.12 (1), pp. 3-11.

Linsey, J., Wood, K., Markman, A. (2008). Increasing Innovation: Presentation and Evaluation of the Word Tree Design-by-Analogy Method. *ASME IDETC Design Theory and Methodology Conference*, New York, NY.

Mach, E. (1896) On the part played by accident in invention and discovery. *Monist*, 6, 161-175.

March, J. G. (2010) Generating Novelty. *The Ambiguities of Experience*. Ithaca and London: Cornell University Press 2010. 75-98. Print.

Polanyi, M. (1952) The Stability of Beliefs. *The British Journal for the Philosophy of Science,* Vol. 3, pp. 217-232

Purcell, A. T., Gero, J. S., (1996). Design and other types of fixation. *Design Studies* Vol.17 (4), pp. 363-383.

Smith, S. M. Linsey, J. (2011) A Three-Pronged Approach for Overcoming Design Fixation solving in design. *Journal of Creative Behavior*. vol. 45, p. 83-91

Schumpeter, J. A. (1934) The Theory of Economic Development. New Brunswick and London: Transaction Publishers 2004. Print

THE EXPERIENCE OF EMBODIMENT: VIDEO GAMES ARE BETTER WITH STORIES

Video Games Are Better with Stories

ALISHA KARABINUS AND BIANCA BATTI

The question of how it is games and narrative intersect is a particularly contentious one, especially within the field of game studies (Juul, 2001; Frasca, 2003; Pearce, 2005; Murray, 2005). This "divisive question" (Jenkins, 2004, p. 118) sits at the heart of the ludology/narratology debate that continues to recur among game studies scholars, a debate that seeks to define the specific relationship between video games and narrative—a debate that inspired Zimmerman (2004) to ask, "But what would it mean to take a closer look at games and stories?" (p. 154). Zimmerman's question highlights the ways game studies scholars interrogate the intersection of games and stories as well as how this intersection informs the study and development of games. From the early days of cybertext and the ergodic debates to Ian Bogost (2017) recently claiming narrative is unnecessary, the question of how games function with and around narrative continues to haunt the field of game studies and the industry itself.

In *Reading for the Plot: Design and Intention in Narrative* (1984), Brooks explored the significance of narrative, arguing that its significance lies in its ability to summarize and retransmit plot and story "even when its medium has been considerably changed" (p. 4). Brooks argued that narrative "is not a matter of typology or of fixed structures, but rather a structuring operation peculiar to those messages that are developed through temporal succession, the instrumental logic of a specific mode of human understanding" (p. 10). Thus, narrative can then be understood as a way of making meaning and is a form of "understanding and explanation" (p. 10). For Brooks, narrative is a form of *design*—a way of using the logic of storytelling structures to understand and represent the world.

Because narrative allows for such meaning-making, we argue in this paper that narrative is indeed a vital aspect of game design, and that the continued resurgence of the narrative debate underscores the need for feminist game studies. That is, we contend that narrative produces player investment, it creates stakes and connection, and is thus as important an aspect of game design as the rule systems that control every action and response to reaction. While not every game may have a "narrative" in the style of a film or novel, video games allow for narrative layers that invite players to learn and experience through embodiment and enactment, and that recognition of the importance of considering *bodies* as part of play is inherently feminist. To be sure, intersectional feminist research highlights the ways bodies, like narrative, make meaning (Hobson, 2012), and such feminist praxis thus also highlights the ways bodies and narrative are inexorably linked. We argue that this linkage—this embodied narrativity—is an important consideration for game design because both bodies and stories transmit messages, messages that players engage with as they play. We also argue that the messages games relay often reify hegemonic cultural codes, codes that need to be disrupted, interrogated, and challenged through feminist game studies praxis. As Shaw (2017) and others have proposed, the time is ripe for the inclusion of more intersectional feminist practices in game design and game scholarship, in order to better understand player positions in and around games. It is our position here that narrative is an essential part of that consideration.

Games enact narrative in a variety of ways, from the primarily linear experience of games like *Submerged* (2015) to open-world sandboxes ripe for exploration. But games, more than other media forms, particularly excel at emergent and procedural narratives, those stories that arise from player actions, decisions, and interactions in the game world. The *Civilization* series, which allows players to construct a history of the world from the perspective of a single growing nation, builds a narrative as the player progresses, expanding city by city to take over territory. The actuality of this progress represents one narrative (a growing nation), but some players may construct additional narrative overlays as well, envisioning their ruler as a benevolent emperor or a bloodthirsty warlord. In Undead Labs' *State of Decay 2* (2018), one narrative is baked into the game—players build a team of survivors in the zombie apocalypse, improving a defensible home base and completing quests—but players may construct additional narratives and interactions for their team of survivors, perhaps creating a merciful community that keeps weaker survivors (such as those with asthma or other stat-reducing conditions) around, or creating all-female teams. RPGs allow for similar flexibility; any player may build a Khajit archer in *The Elder Scrolls V: Skyrim* as a pragmatic choice, a path toward certain desired stats within the game's systems. These players may ignore or be unconcerned with the negative reception Khajit receive, as a generally ill-liked bestial racial minority within the game world, but for others, this becomes an important narrative element, part of perceiving the game world, perhaps even more important than stats. This an additional narrative overlay can offer a way to widen understanding of a game world, and the player's place within it.

In *Supersizing the Mind*, Clark (2008) related a study of *Tetris.* In the study, players moved blocks across the screen as well as rotating them as they fell, manipulating the pieces as much as possible before attempting to them in. Clark reported this manipulation was not in service of the goal-oriented pragmatic action of simply filling the space (or rather, not only for that reason), but rather as an act of learning/knowing—an epistemic act (p. 71-72). Moving the block—*experiencing* the block—gave players a wider understanding of the playing field, as it were. Through interactions with the block, and in visualizing it from different angles, players were able to see and experience the game more fully. Thinking of the *Tetris* study in terms of Brooks' notion of narrative-as-design then begs the question of empathy-based games. Does experiencing a moment of discovery, sadness, misery, joy, particularly in a character with whom the player relates in some way, translate to a similar widening of understanding? Are other game actions, particularly in narrative-heavy games, epistemic acts encouraged by game design? Consider *Depression Quest* (2013), a Twine-based game in which players navigate a character's struggle with depression. The key mechanic in *Depression Quest* revolves around text-based choices; players read a bit of story and are offered options. It's easy to determine the "best" option in any particular moment (the "winning" option), but until the character begins to go through treatment, these options are marked through as unavailable. As a person struggling with depression, the player character absolutely *cannot* make the "winning" choice. For a player, this may represent a moment of frustration; the best choice is right there! But in this way the game offers the opportunity to understand the physical inability to simply "fix" depression, and as such promotes empathy through a hands-on experience not otherwise available. Like rotating the block in *Tetris*, the act of hovering over choices that cannot be made is a way of broadening an understanding of the playing field (and what lies beyond). Or, to return to the example of the Khajit archer in *Skyrim*, the choice of a Khajit character may be an epistemic act, an act of placement within an embodied world that allows for greater understanding of both lore and personhood alike.

Games allow for this connection in ways that films and books do not, but forging such connections requires something for a player to hold onto, to connect *with*. That ephemeral something is built from story, character, and experience. To return to the example of *Depression Quest*, stripping the narrative from the game and offering instead a disembodied puzzle of options about "solving" depression, absent the context of story, is unlikely to produce the same experience in a player than the experience situated within the story of a young man struggling to hang onto his job, his relationship, and his quality of life. Bogost, writing for *The Atlantic*, derided narrative as an unnecessary aspect of games, on the grounds that other media are better equipped to tell stories, but one of his examples, *Gone Home* (2013), hinges on an experiential aspect that would not be the same rendered as simply text or film. From the beginning, *Gone Home* toys with player expectations; the game opens in a storm, on a lonely porch, and a feeling of foreboding falls across the scene. As a game presented in first-person perspective, the genre expectation (particularly with the kairotic context of *Gone Home's* release, as an early arrival among contemporary "walking simulators") is one of action or encounter, but all the player encounters in *Gone Home* is the past. Actions here center on sifting through memory, studying artifacts and piecing together what happened in the player-character's absence. Because there are so many hints of something bigger, the game's eventual reveal of a simple, all-too-human storyline is startling. There was no environmental disaster. Nothing is coming for the player character. All that's left to discover is experience, and perhaps understanding.

This understanding arises from the meshwork of system-software-player-more, of which the interplay of narrative-player is an essential part. A deep narrative is not required; when we play *Pong*, we are not just thinking of raw physics and math moving a dot across the screen but envisioning a match between players (Batti and Karabinus, 2017). But leaving narrative entirely (or nearly) up to emergent conditions (as with a *Pong*, as with a *Civilization* game, as with any number of shooting-based games, particularly multiplayer games) comes with its own set of problems. Cross (2009) referred to surprising, emergent moments as "a world where opaque, meaningless random occurrences between human-like entities, empty of content, can be called "narrative" because we're imagining a user who, like a kid playing with dolls, fills in all the semantic gaps." But for the player who finds themselves unrepresented in many games, filling in those semantic gaps—creating a personalized story from elements—may be one of the only ways they can enact a world that is welcoming rather than hostile, or a world that offers some understanding, even if thin, of what it is like to be something other than who they are in the "real" world. *Depression Quest* may offer some understanding of what it is like to struggle with depression. Playing as a Khajit in *Skyrim* may offer some understanding of what it is like to be a minority presence in a hostile world. If these games don't offer robust, full-bodied views of what it is like to be different, it isn't the fault of the concept: it just may mean we need stronger narratives.

Making space is vitally important in games if we want to continue to broaden the base of players and potential audiences, and making space requires consideration of the player's position when we consider games. Taylor (2009) referred to this situational context of player-in-game as part of her assemblage of play:

> Games, and their play, are constituted by the interrelations between (to name just a few) technological systems and software (including the imagined player embedded in them), the material world (including our bodies at the keyboard), the online space of a game (if any), game genre, and its histories, the social worlds that infuse the game and situate us outside of it, the emergent practices of communities, our interior lives, personal histories, and aesthetic experience, institutional structures that shape the game and our activity as players, legal structures, and indeed the broader culture around us with its conceptual frame and tropes (p. 332).

But there's even more at work with the interrelation of player and narrative than the application of assemblage theory. In *The Embodied Mind: Cognitive Science and Human Experience*, Varela, Thompson, and Rosch (2017) questioned the idea of an objective sense of the world from the level of the construction of human thought and experience across the broad spectrum of global experience. Can one interpretation of a machinic, rule-based system, as evoked by each incarnation of the ludology/narratology debate, allow for subjective understanding?

> When we tried to find the objective ground that we thought must still be present, we found a world enacted by our history of structural coupling. Finally, we saw that these various forms of groundlessness are really one: organism and environment enfold into each other and unfold from one another in the fundamental circularity of life itself (p. 217).

To extend this cognitive angle on embodied experience embodied experience to video games, then, instead of arguing that ludic and narrative elements are separate, we can envision these elements as circuits, with individual players completing loops, firing experience into being. For one player, the narrative elements may flicker and dim; for another, they shine bright, but the connections depend on the player and all the history, experience, and understanding they bring to the moment as connective tissue.

The particular system created by player-game connection can allow for the creation of experiences that push thought and understanding: play-within-narrative as an epistemic act, and one that deepens understanding of human experience. As part of an exploration of what games teach us, Koster (2013) outlined the way games teach and reinforce survival skills many humans may no longer particularly need (hunting, aiming, projecting power as a survival mechanism) in day-to-day life, and further categorizes these into types of games. Games use patterns to train skills, and rely on challenging patterns to stave off boredom, and as with any other skill, mastering these patterns requires practice. Games like *Gone Home* operate on a similar model, feeding story to players through the discovery of in-game artifacts and clues, but the skill trained here isn't survival in a physical sense. It's empathy and understanding—skills that should be practiced and honed like any other (Karabinus, 2016).

This practice of empathy underscores the importance of the ambient adventure, or the so-called "walking simulator," like *Gone Home*, or *What Remains of Edith Finch*, both games maligned as examples in Bogost's article on games' inability to grapple well with narrative. Bogost critiques the walking simulator by invoking the same question often employed by critics attacking exploratory or environmental games in particular: is it a game? Does it *need* to be a game instead of something else? Why not a movie? Why not a book?

But the question is reductive out of the gate and can be asked of any game. Does *Skyrim need* to be a game? The main storyline is a standard fantasy narrative journey: a prisoner becomes a hero and saves the world, with the added bonus of occasionally stopping to help people who need someone to recover an artifact or a person; if you'd like, you can also pick flowers or take up blacksmithing as a sideline. But *Skyrim* only offers one thing dozens of fantasy novels cannot: embodied experience. Players may not *need* this, any more than viewers *need* any superhero film (these stories already exist in comics). But it is a choice to allow a different form of experience, one that may have something different to offer than other, similar experiences. Obviously, a film offers a different experience than a comic book, and a fantasy game allows for different, broader experiences than a novel. With examples like *Gone Home*, a short story could have accomplished the same narrative end but could not capture the slowly unraveling hands-on *experience* offered by the act of moving through a house and reconstructing events that occurred while the player character was away. A player in *Gone Home* can zip through to the end, just as someone skimming a short story, or can linger over every object and clue, as with the slow and careful reader, but the reader can never walk through the halls of the family home in quite the same way as the player (Batti and Karabinus, 2017).

Many ambience-dependent games could be restructured as linear experiences in other modes. This doesn't mean they should; the game experience allows for an embodied feeling that is not possible with any other form. Certainly, *What Remains of Edith Finch* could be a comic book, a film, or a novel-in-stories, but the shift to another medium would introduce a narrative distance the creators hoped to collapse through their choice of medium. *Life Is Strange*, after all, could have been a *Choose Your Own Adventure*-style book; the game's central time mechanic invites the player to test options, just as a *CYOA* reader might flip to various endings. But in *Life Is Strange*, similar to *Depression Quest*, the "right" choices are not always optimal or attainable, and in *Life Is Strange* in particular, the "right" choice in one moment may lead to a very bad outcome much later. Life is messy, unpredictable, and hard, and just as *Gone Home* uses experiential narrative to toy with expectations of a first-person game, *Life Is Strange* uses its central rewind mechanic to teach a hard lesson about attempting to "game" the system and "win," lessons that would be difficult if not impossible to experience the same way in other media forms (Batti and Karabinus, 2017). In these games, narrative is intrinsically tied to the ludic experience; without the developing stories and characters, there is no experience. Rewinding events isn't useful or impressive if there are no stakes, and stakes are *built* from stories and context. Isbister (2015) cited this connection to player-character as the "core innovation" of games, a difference unique to this media form that allows for evocation of powerful emotion (p. 13), and as we argue here, narrative is part of that connection.

Because narrative is so intrinsic to ludic experience, the game/story divide is an artificial one. Of course, Murray highlights the artificiality of this divide in *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (1997); indeed, Murray argued, "The computer is not the enemy of the book. It is the child of print culture, a result of the five centuries of organized, collective inquiry and invention that the printing press made possible" (p. 8). Yet, while, for Murray "[g]ames are always stories" (2004, p. 2), she also believes that, we should work to understand how game-stories function *differently*—we should “stop trying to assimilate the new artifacts to the old categories of print- or cinema-based story and board- or player-based game. We should instead think of the characteristics of stories and games and how these separable characteristics are being recombined and reinvented within the astonishingly plastic world of cyberspace” (p. 10). This ability to recombine and reinvent, this plasticity, means that Murray’s dream of the Holodeck isn’t a complicated dream of the novel. It’s a dream of embodied experience. Murray knew that the magic of games wasn’t just in the idea that we could control the action, but in a combination (see Taylor’s assemblage) of things: control (agency), immersion, and transformation.

This assemblage of embodied experience is what makes the experience of play so meaningful. Indeed, in *Literary Gaming* (2014), Ensslin, like Murray, stressed the importance of this assemblage because the “ever morphing existence of digital texts requires new concepts of materiality and textuality that are far less bound to the hapticity of the artifact as tangible product (book and print) but inextricably connected to its medial contexts and connotations. Textuality becomes a pluralistic idea and the work of art an ‘assemblage’ of instantiations” (p. 32). Because games’ textuality allows for plasticity in experience, games then have the potential to make room not just for a multiplicity of texts but also, and just as significantly, for a multiplicity of bodies. This is all to say that games have the potential for embodied inclusivity *because of* the ways narrative can allow for inclusive meaning-making.

However, the disciplinary and epistemological deprivileging of narrative in games has made it so that this potential for embodied inclusivity has not been fully realized. Indeed, such deprivileging seems emblematic of the kind of gatekeeping and border-policing that occurs in game studies. The examination of how the narrative systems of video games broaden our understanding of the world is something that a formalistic, exclusively ludic approach cannot afford the field of game studies. This limitation is what causes Murray to argue for a shift in game studies:

> It is time to reframe the conversation…With students flooding our graduate and undergraduate programs around the world, they should no longer be confused by the appearance of an either/or choice between games and stories, or distracted by an unproductively sectarian discourse…No one group can define what is appropriate for the study of games. Game studies, like any organized pursuit of knowledge, is not a zero-sum team contest, but a multi-dimensional, open-ended puzzle that we all are engaged in cooperatively solving (Murray, 2005).

In short, game essentialism and formalism—an essentialism that disregards the impact of narrative—limit the field of game studies from fully interrogating all that video games are. But this essentialism is limiting not only because of its inability (or unwillingness) to examine the conversation between game and narrative; such formalism, in only caring about concerns like rule systems and procedurality (Bogost, 2007), is limiting in its inability (or unwillingness) to interrogate *bodies*—both the bodies that are represented in game worlds and the bodies of players themselves.

Aarseth (2004) discussed the body of Lara Croft in a way that demonstrates this lack of concern: “[T]he dimensions of Lara Croft’s body, already analyzed to death by film theorists, are irrelevant to me as a player, because a different-looking body would not make me play differently…When I play, I don’t even see her body, but see through it and past it” (p. 48). This brushing aside of Lara Croft’s body actively ignores the ways certain bodies are inscribed, the ways women’s bodies (like Croft’s) are often fetishized and objectified, and the ways other modes of analysis—especially feminist analysis—can allow for a more comprehensive consideration of the function and role of bodies in games. Thus, game formalism enacts not only an erasure of narrative analysis but an erasure of *feminist* analysis as well, and ludologists make use of this form of erasure—this effort to make other forms of study marginalized and peripheral—in an effort to legitimize their own form of study in academia. Such efforts also, consequently, enact the erasure of members of the gaming community whose bodies, narratives, and representations are not taken into account because such erasure implies that their stories do not matter. Such erasure implies that their stories do not, or should not, exist in the first place—an implication worth pushing against in the name of welcoming new players into game worlds, and making comfortable those who are already here.

A situated, embodied look at the essential intersections of narrative and play within games—and thus, designing for a varied audience, and allowing space for players in multiple subject positions—requires careful consideration, for it creates a much more complicated lens through which we view the game space. As Carr (2007) wrote,

> …when considered in combination, game structure (rules, programming, economy, components) and textual codes, connotation, narrative address and the variability of play modes all indicate that subject position in a game needs to be understood as a series of possible positions activated or dormant, taken up, dropped or ignored by a player from moment to moment. In other words, subject position is not a vacant seat established by the game that is offered to (or imposed on) the player-subject, who must then occupy this single position as a condition of participation. Resorting to the figure of the 'ideal player' might be one way to theories a consistent subject position, but I'm not sure how useful this would be.

That figure of the "ideal player" has too often been assumed as a figure of a (young/white/male) "gamer" that has proven inaccurate over the years; instead, better to privilege narrative, to carefully craft a world that supports it. For more open games, and game worlds, Alex Layne's 2015 theory of procedural ethics already provides an answer for scholars that can be adapted for designers as well. Layne, in addressing Sicart's critique of procedurality, wrote, "there have been limitations on how theories of procedurality have been implemented by focusing on only the most visible manifestations of procedurality." This too is the central problem with focusing only on formalism and ludic systems or in stating that games do not need or should not privilege narrative: there is deep meaning in the way players interface with games that should be understood by scholars and designers alike, and the primary way into those spaces for players is through worlds, characters, and narratives.

Just as Shaw (2017) calls for a demarginalization of intersectional work in game studies, so too should game scholars and designers both continue to actively demarginalize the question of narrative's essential role in the assemblage of play. When Bogost (2017) says games are best at "taking the tidy, ordinary world apart and putting it back together again in surprising, ghastly new ways," we—as scholars, as designers, as players—should recognize that narrative stakes are the way into those "ghastly new ways" for many players; that is the loop that connects player to embodied action. Games like *Gone Home* and *Life Is Strange* in fact offer precisely what Bogost asked for when he said narrative is unnecessary: a focus on taking things apart and reassembling them in surprising ways, but they do it through ambience, exploration, and narrative. *Gone Home* is not about the act of walking through a house; it's something else altogether, an enacted experience offering players the chance to experience a story in a way that is impossible in other media. The Holodeck, after all, isn't a passive trip into a story, like an afternoon spent with a good book. The Holodeck requires active engagement, movement and consideration. Players must be the ones to take things apart. It is up to designers to offer the necessary pieces that allow players to come in and get comfortable. To find a way to come alive within the game world (Batti and Karabinus, 2017).

This is why feminist game studies praxis is needed; that is, because ludic formalism continues on in game studies, feminist game studies scholarship is required in order to untangle the intersecting forms of erasure, silencing, and privileging that occurs in video game culture and the study of it. Because certain modes of study, certain modes of knowledge production, have been privileged in game studies, we argue for the need for feminist game studies—that is, the need for a mode of games criticism that can work to dismantle the hegemonic knowledge production of game studies formalism and that can create a more inclusive disciplinary space for additional voices in games. Intersectional feminist game studies praxis is needed because it allows us to seek change, and these efforts toward change, Murray said, are goals she learned from the feminist movement: "I learned from the feminist movement that some truths about the world are beyond the reach of a particular art form at a particular moment in time. Before the novel could tell the stories of women who did not wind up either happily married or dead, it would have to change in form as well as in content" (1997, p. 4). The games industry, with all its vast potential and ever-increasing reach, allows for exploration of stories and experiences previously undreamed—unless we lock games down, excluding those experiences that don't fit certain parameters or appeal to certain audiences.

As Shaw (2017) reminded us in her call for feminist game studies praxis, inclusion is difficult; it means examining and reexamining our ideas, our roles, our positions. Drawing on scholar-activist Bernice Johnson Reagon's 1981 remarks at the West Coast Women's Music Festival, Shaw reminds us that the goal of this kind of work is to give everyone the chance to feel a stake in the world. Players need to feel a stake in their game worlds, too, and that stake is so often enacted through an embodied narrative connection. Formalism too often seeks to exclude those connections. By excluding those connections, formalism seeks to assert a so-called universality to games—a universal way of studying games, a universal way of playing games, a universal way of designing games. Because all these actions of play, study, and design are tethered to bodies, formalism also, then, asserts a universal gaming body; that is, it works off the assumption that those who play, study, and design games are all after (or, at least, *should be* after) the same thing and are thus all the same. This sameness and essentialism privileges certain epistemologies and certain modes of embodiment—that is, the positionalities of cisgender, heteronormative white men. We contend that the essentialism of game formalism is limiting in that prevents games from being designed, studied, and played in more fluid, exploratory ways. It prevents games from exploring all the possibilities of being. It excludes those who do not fit into hegemonic, normative ludic boxes. We argue instead for the need to include, in order to allow games to continue to grow and change with a changing world.

References

Aarseth, Espen. (2004). Genre Trouble, Narrativism and the Art of Simulation in Wardrip-Fruin, Noah, and Harrigan, Pat Eds. *First Person: New Media as Story, Performance and Game*. Cambridge, MA: MIT Press. 45-55.

Batti, B. & Karabinus, A. (2017, May 1). A dream of embodied experience: On Ian Bogost, epistemological gatekeeping, and the Holodeck. *NYMG*. Retrieved from www.nymgamer.com.

Bogost, I. *Persuasive games: The expressive power of video games*. Massachusetts: MIT Press.

Bogost, I. (2017, April 25). Video games are better without stories. *The Atlantic*. Retrieved from www.theatlantic.com.

Brooks, P. (1984). *Reading for the plot: Design and intention in narrative*. Harvard University Press.

Carr, D. (2007). Un-Situated Play? Textual Analysis and Digital Games. DiGRA Hard Core Column, 18.

Civilization. (1991). Hunt Valley: MicroProse.

Clark, A. (2008). *Supersizing the mind: Embodiment, action, and cognitive extension*. New York: Oxford University Press.

Cross, T. (2009, July 15). Analysis: Story and the trouble with 'emergent' narratives. Gamasutra. Retrieved from www.gamasutra.com.

Depression Quest. (2013). The Quinnspiracy.

The Elder Scrolls V: Skyrim. (2011). Rockville: Bethesda Game Studios.

Ensslin, A. (2014). *Literary gaming*. Cambridge, MA: MIT Press.

Eskelinen, M. (2001). Towards computer game studies. *Digital Creativity*, 12(3), 175-183.

Frasca, G. (2003, November). Ludologists love stories, too: notes from a debate that never took place. In *DiGRA conference*.

Hobson, J. (2012). *Body as evidence: Mediating race, globalizing gender*. Albany, NY: SUNY Press.

Isbister, K. (2015). *How games move us: Emotion by design*. Cambridge, MA: MIT Press.

Jenkins, H. (2004). "Game design as narrative architecture" in Wardrip-Fruin, Noah, and Harrigan, Pat Eds. *First Person: New Media as Story, Performance and Game*. Cambridge, MA: MIT Press. 118-130.

Juul, J. (2001). Games telling stories. *Game Studies*, 1(1), 45.

Karabinus, A. (2016, January 20). Walking simulators and the theory of fun. *NYMG*. Retrieved from www.nymgamer.com.

Koster, R. (2013). *A theory of fun for game design* (2nd ed.). Sebastopol, CA: O'Reilly Media.

Layne, A. (2015, January 7). Procedural ethics: Expanding the scope of procedures in games. *First Person Scholar.* Retrieved from www.firstpersonscholar.com.

Life Is Strange. (2015). Paris: Dontnod Entertainment.

Murray, J. H. (2004). "From game-story to cyberdrama" in Wardrip-Fruin, Noah, and Harrigan, Pat Eds. *First Person: New Media as Story, Performance and Game*. Cambridge, MA: MIT Press. 2-11.

Murray, J. H. (1997). *Hamlet on the Holodeck: The future of narrative in cyberspace*. Cambridge, MA: MIT Press.

Murray, J. H. (2005, June). The last word on ludology v narratology in game studies. In *International DiGRA Conference*.

Pearce, C. (2005). Theory wars: An argument against arguments in the so-called ludology/narratology debate. In *International DiGRA Conference.*

Shaw, A. (2017, May). Are we there yet? The politics and practice of intersectional feminist games studies. Keynote at the 2nd Annual Critical Games Studies Symposium, Irvine, CA.

State of Decay 2. (2018). Seattle: Undead Labs.

Submerged. (2015). Canberra: Uppercut Games.

Taylor, T. L. (2009). The assemblage of play. *Games and Culture*, 4(4), 331-339.

Tetris. (1986). Atari.

Varela, F. J., Thompson, E., & Rosch, E. (2017). *The embodied mind: Cognitive science and human experience*. Cambridge, MA: MIT Press.

Zimmerman, E. (2004). Narrative, interactivity, play, and games: Four naughty concepts in need of discipline in Wardrip-Fruin, Noah, and Harrigan, Pat Eds. *First Person: New Media as Story, Performance and Game*. Cambridge, MA: MIT Press. 154-164.

AB ERRANTRY: A GAME TO BUILD AWARENESS OF THE ABERRANT AND ABHORRENT IN TEENS AND YOUNG ADULTS WITH AUTISM

A game to build awareness of the aberrant and abhorrent in teens and young adults with autism

PATRICIA F. ANDERSON AND BRUCE R. MAXIM

Abstract

Diagnoses of autism continue to climb, with incidence levels reported as 1 in 59 for 8-year-old children. Persons with autism prefer to socialize online where they risk encountering online predators. Online social environments can be used to the build skills needed to make them more risk aware. The team created a medieval-themed Unity game with a fantasy storyline. In this game, the player/knight needs to navigate past non-playing characters who misrepresent their identities/goals, and who try to manipulate choices and behaviors of the knight trying to complete traditional game challenges (e.g. battles and puzzles). The game mechanics were designed to show common behaviors and linguistic patterns used by online sexual predators: social grooming, inappropriate trust building, and social distancing from trusted communities. Play-testing was performed by middle-school and college students (some with disabilities). A strong majority of the play-testers provided positive feedback and expressed willingness to play the game again.

Context and Project Need

The core concepts driving the Ab Errantry project are the prevalence of the online environment and gaming in the lived experience of many with autism, the risks which accompany the benefits of the online environment, and our perception of the potential to use the same kind of environment to address the risks.

Autism and the Online Experience

Diagnoses of autism continue to climb, with the most recent incidence levels reported as 1 in 59 8-year-old children (Baio et al, 2018). Persons with autism sometimes prefer to socialize online, as this can minimize sensory overload and reduce the stress of social interactions (Davison & Orsini, 2013), as well as providing access to communities such as online forums, communities devoted to "autistic culture," and social media which focus on the often niche special interests which are an integral part of the autism experience (Jordan & Caldwell-Harris, 2012) (Davidson, 2008) (Brosnan & Gavin, 2015). This preference holds true across age groups and genders (Haney & Cullen, 2017), and is significantly higher in children with autism than those without (Mazurek & Wenstrup, 2013). The importance of the internet for those in the autism community has been described in such strong terms as "[t]he impacts of the Internet on autistics may one day be compared to the spread of sign language among the deaf" (Singer, 1999).

Autism and Online Games

It should be no surprise to find that the importance of online community for those with autism extends to online games and virtual environments, many of which have been tested and proven effective for many in this community. For younger children, modalities included games, "computer-delivered instruction (including games), iPad-type apps, virtual environments, and robots" (Gillespie-Lynch et al, 2016) (Abirached, 2011) (Ke, Moon, 2018) (Zakari, Ma, Simmons, 2014), while for older children, teens, and young adults, and adults examples include Minecraft, Second Life, social networks, MMORPGs, virtual reality (Gallup, 2016) (Kidney, 2015) (Ringland et al, 2016) (Smith et al, 2014) (Stendal & Baladin, 2015). In some tests, video games and online gaming has proven more successful in engaging teens and young adults with autism spectrum disorders (Bahiss, Cunningham, Smith, 2010) (Cole, Griffiths, 2007) (Mazurek, Engelhardt, Clark, 2015) (McEvoy, 2016), both socially and therapeutically (Wilkinson, Ang, Goh, 2008).

Autism and Risks of Online Environments

Persons with autism may be more at risk from online predators, experiencing bullying, insults, threats, being the targets of lies or rumors, and/or sexual cyber-solicitation (Normand & Sallafranque-St-Louis, 2016) (Sallafranque-St-Louis & Normand, 2017) (Sevlever, Roth, & Gillis, 2013). Part of this is due to the innate social skills and communication challenges associated with spectrum disorders (Lough & Flynn, 2015), in particular difficulties distinguishing lies and jokes (Leekam & Prior, 1994), as well as a general tendency to be more trusting or naive and susceptible to deceit (Yi et al, 2013) (Li et al, 2011). Another aspect of increased risk is due to children with disabilities being preferred targets for some online predators, and children with autism being specifically susceptible due to vulnerabilities derived from social isolation, loneliness, naivety, low self-esteem, insecurity, and related qualities (Whittle et al, 2015) (Wells & Mitchell, 2013) (Quayle, 2016). High levels of internet use have also been identified as a factor associated with increased vulnerability to online predators (Whittle et al, 2013).

The World Wide Web Consortium (W3C) Cognitive Accessibility Roadmap and Gap Analysis (COGA) has synopsized the specific qualities that enhance these risks in the following way.

> "People with cognitive disabilities may be more at risk of being a victim of a sexual crime. This is more likely if:
>
> - they tend to be unaware of someone using a fake identity or misleading information;
> - they are dependent on care givers and family who they are afraid of disappointing, which makes them susceptible to blackmail;
> - they tend to believe false information and find it harder to validate facts;
> - they are less likely to identify unreasonable requests."
>
> (Cooper & Bernard, 2017)

Because of the preference for online social environments, to address skills-building around these risks, the approach taken was to develop an online game. Online resources, virtual environments, and video games have previously been utilized for autism social skills education and soft skills training

(Gallup et al, 2017), while edutainment and online training have been used as tools for the prevention of sexual abuse (Gesser-Edelsburg et al, 2017) (Paranal et al, 2012).

Relevant Aspects of Online Predation

A key factor in social engagement in online environments is communication and community building, both areas in which persons with autism tend to struggle in both offline and online contexts. Cyber-predators twist standard modes of communication in subtle ways to elicit specific responses and behaviors in the vulnerable whom they target. Identifying these differences was critical for game planning and scripting, especially with respect to social and sexual grooming behaviors to be modeled in the game.

A number of studies have used text-mining and various forms of algorithmic analyses to extract these patterns from text chatlogs and other resources (Bogdanova et al, 2012) (Bogdanova et al, 2014) (Ebrahimi et al, 2016) (Egan et al, 2011) (Pendar, 2007) (McGhee et al, 2011) (Kontostathis et al, 2010) (Gupta et al, 2012) (Drouin et al, 2017). Perverted Justice (http://www.perverted-justice.com) is a site which compiles chatlogs from online conversations with sexual predators, and is a resource which can serve to inform and model patterns of language to be used in scripting dialog. Text patterns of primary importance to the project were language used for gaining access ("luring"), compliments, reframing, building trust in the predator, undermining trust in prior relationships and friendships, iterative desensitization, and isolation. Those purposes were achieved through patterns of fixations and repetition in conversation, shifts in language toward familiarity and colloquialisms, and similar linguistic strategies.

There are many models defining stages of sexual grooming, as well as work to extract themes and define typologies of offenders (Gupta et al, 2012) (O'Connell, 2003) . Specific concepts repeated across virtually all of these and which proved essential to designing the game experience were in many ways parallel to the language patterns — building a friendship; forming a special relationship; minimizing risk to the predator through secrets-keeping; creating isolation by undermining other relationships, building dependence, and exclusivity, with the various parts of relationship forming being central.

Project Process

Often game developers use a story line, game mechanics, or desired technology as their starting point. In our case we began with the goal of creating a game that would help older autistic adolescents and young adults recognize the strategies used by cyber-predators to groom and seduce their victims. We created a storyline focused on a knight completing a quest for the king. During this quest the player would need to choose to interact with several non-playing characters (NPCs) who may or may not be good individuals. In fact, some of them would lie with the intention of harming the player in the future, and the player's best choice might be to approach strangers with caution or avoid them altogether.

The team examined the relevant literature on games for educational purposes, gamification strategies, and the use of games with our target audience. The literature findings, along with our previous experiences in building serious games, influenced the design of our game and the player interactions. We did not want this game to be text heavy, so the team decided to create a single-player 2D side-scrolling platformer using artificially intelligent (AI) NPCs.

Super Mario (https://www.mariowiki.com/Super_Mario_(series)) was selected by the design team as a model for game play. Super Mario is a single player game with the goal of rescuing a lost family member. The game requires no test input. Obstacles are puzzle that add to the entertainment values of the game play. Combat is simple (jump on the NPC blocking the player's progress or jump over the NPC). A complete game has several levels before the final boss battle.

The reason we choose to create a 2D platform game with animated characters was to reduce the system requirements for players' mobile devices. Cartoon like characters were created to lighten the ambience of what could be a very dark and scary experience (the dangers posed by cyber predators). We wanted to emphasize player decision making and focus on the quality of the game AI instead of using high resolution graphics. Multi-player gaming was rejected to allow students opportunities to engage the game in private.

Scoring is being done unobtrusively based on the players' interaction with the NPCs. The NPC dialog is presented as a multiple-choice menu and only displayed if the player chooses to interact with the NPC. Assessment of the player's performance (e.g. how often did you give out too much information to the NPCs?) is done after the final boss battle. I In the final boss battle the where the player is asked to choose which of two character is the lost prince or princess and which of the boss characters is the pretender.

This game was implemented as using the Unity game engine. The reason for using Unity is the ease with which games can be exported to multiple platforms (the web, PC, Mac, and mobile – both IOS and Android). We decided to implement Lynx, Mac, and Win10 PC versions of the game and to deploy the game on the Steam platform. Our game scripting is being done using C#, making it easy to interface with external software libraries as needed. An XML editor was created to allow fine tuning of the scripts without rebuilding the game itself.

Story

The game was developed in Unity 3D as a 2d side scroller with a medieval-themed fantasy quest storyline. We created a storyline focused on a knight completing a quest for the king. The king's children, a son, and a daughter, have run away from the castle, and the king is offering a reward for their safe return. The king's children do not want to be found or returned, and are hiding their identities, while there are other characters who wish to get into the castle or to disrupt the rescue for their own reasons. The knight has to navigate past characters who misrepresent their identities and goals, along with more traditional game challenges such as battles and puzzles. The knight character includes minimal player customization for gender, and the player can also choose which of the king's children they wish to focus on rescuing.

The game contains several scenes (e.g. forest, cave, castle, etc.) to allow the introduction of several different types of cyber predators. We tried to use game characters whose appearance as fantasy beings or animals which personified specific types of predator grooming behaviors.

Mechanics and Development

The game mechanics were designed to address specific target common behaviors of online sexual predators, such as social grooming, inappropriate trust building, and social distancing from previously trusted communities. The dialog scripting was developed, in part, to model language extracted from linguistic patterns of actual predators (Olson et al, 2007), as well as to further the game storyline. The game concept and design were developed in collaboration with a person with autism. The scripting and game mechanics were developed in conjunction with a consultant in online sexual predators. The game was designed to be enjoyable for a broad audience, not just the original target audience, with the underlying purpose presented as subtext, with the specific lessons to remember brought out in a post-game 'debrief' that is made available to the player.

The player is given the initial quest (find the missing prince or princess) and it free to undertake the quest using either a male or female avatar. Avatar is controlled using the keyboard. Players are taught how to use special keys during the in-game tutorial level.

After completing the tutorial level, the player advances through each level by solving puzzles required to get past each obstacle. Puzzles are solved by deploying the right combination of player actions. NPCs and boss characters are present in each level. Game pickups (e.g. better armor) are scattered throughout the levels. Players must to decide to ask for help by talking to an NPC or to run away from the NPC. Each boss character exhibits a different grooming behavior or seduction strategy towards the player. In the final boss battle the player must decide which of the two characters is the prince or princess the player was trying to save.

In-game rewards provide powerful motivation for players to continue to play the game and replay levels. The rewards included in our game are a high score list and feedback on how well the player avoided risky choices.

Connecting Game Mechanics to Behavior and Purpose

For game design purposes, it was necessary to limit the number of online safety concepts to be explored in the game. For this early version of the game, the core concepts selected were appropriate information sharing; social grooming; social distancing and isolation; and appropriate and inappropriate trust building. Some of the ways in which these were integrated into the game mechanics included character development and situational tasks, beyond the previously mentioned design of bosses to match predator types or grooming behaviors.

Example One

Appropriate information sharing is addressed at one point through a scenario in which the knight had promised the King or the King's representative to keep his quest private. The knight then, early in the quest, encounters a village where other characters ask him for information about his visit. Depending on what information and how much information is shared by the knight, the villager(s) respond differently, ranging from being welcoming to an attack.

Example Two

Social grooming and trust building are negotiated in one version of the game through two characters which play "good cop" / "bad cop" roles. One character is the General, who represents the King's interests in the quest, and the character will be randomized to be either. The knight must decide whether or not to trust the General or the King, and both characters make requests of the knight which can model social grooming types of decision points. This means that the knight is asked to perform tasks or behaviors which either break conventions or promises already made by the character, and that the requests escalate over time.

Development

Students taking the Computer and Information Science (CIS) capstone design course at the University of Michigan-Dearborn provided the majority of the software engineering effort for this project. They were assisted by a group of professionals working without pay. The authors served as mentors for this team.

The CIS capstone design experience is organized as two, two credit-hour courses (CIS 4961 and CIS 4962) which students complete over two semesters. These courses are required of all computing majors. Most students taking these courses complete projects for off campus clients as part of their capstone design projects. Students enroll in the capstone design experience after they complete all required software engineering courses. For this project it was expected that they had completed the two course Game Design sequence as well.

The capstone experience projects generally require about 800+ hours of student effort to complete. The major activities in the capstone experience involve: requirements gathering, project planning, risk management, product design, product implementation, quality assurance, and testing. Serious game projects usually make use of an agile, rapid prototyping process, so a clear distinction between the analysis and design phases of a project may not exist.

Ideally students work in four-person teams. Students select their own teammates and determine their own plan for rotating team leadership. For game project students tend to work as agile teams, though often one team member takes charge of documentation and one team member takes charged of the asset creation (2D art, animation, and audio design).

Game Testing

The planned evaluation of the game consists of a technical assessment of the game's usability, as well as an assessment of the student learning resulting from game play. Both assessments were accomplished by having game play testers complete paper survey forms. As part of the usability assessment, several software engineering students reviewed the game and provided verbal feedback to the development team. The development team ran a large number of test cases to insure conformance with the user stories defined for the game by their client. Testing was done early and often. Regression testing was done after every biweekly build. We ended up with a total of 80 usable surveys, 10 of which were from autistic individuals and 5 from persons having physical challenges.

The game was tested with a diversity of communities representing the target audiences, including middle school children, college students, and persons with a wide variety of physical and cognitive disabilities. Middle school testing was performed more in large groups, with quantitative results, while the play-testing for college students and persons with disabilities was done in more of a focus group approach, with qualitative results. Gender balance of the play-testers tended slightly towards male but was close to being balanced for gender. Game play testing addressed both specifics (such as interface, satisfaction with specific game elements, willingness to play again), and less tangible elements (such as perceived lessons in the game, and ability to identify the underlying purpose of the game). A strong majority of the play-testers provided positive feedback and expressed willingness to play the game again.

The first play-testing session took place at a local middle school during the seventh month of the project. We had classes of sixth and seventh grade students test the game's first two levels; the plains and water levels. The goal of this play test was both mechanics and function: Is it fun? Is it too hard? Is it too long? We asked questions that gave us an idea of how the project was developing as a game, as opposed to just focusing on dialogue and social "status". We received almost 80 completed surveys that served as developer feedback, as well as identifying a large number of bugs and glitches. We noted the problems and created fixes for each of them.

The second play-testing session was held a three weeks later during the final month of the project. This time the play test took place in the University of Michigan Shapiro Design Lab. We had three university students with a range of cognitive and physical disabilities spend an hour each playing the game. This test focused on the game as a whole; functionality, dialogue, UI, design, animations, accessibility, etc. Using older testers and smaller sample size, this play test was much more personal in mature. We were able to take more detailed notes. We performed immediate hotfixes for small issues and rebuilt the game on the fly and let our play testers verify that we fixed the game problems they identified.

Future Directions & Next Steps

As the project progressed, we received feedback that the game was of interest for other audiences in addition to those with autism. We were encouraged to make the game available for testing with groups such as teens and young adults with cochlear implants, persons with mental illness and their therapists, seniors, and the elderly, and other vulnerable populations at risk of online predation. The game code and assets are being made available in GitHub in the hope that others may choose to modify the game for some of these other populations, or to expand upon the core which has been developed.

Future directions for the project include seeking partnerships with researchers working in the autism community or related populations to further validation and testing, and to work with researchers and clinicians working with persons with disabilities to improve the accessibility of the core game. It would also be desirable to build out the game to include additional tests, encounters, puzzles, or battles to reinforce the specific concepts from different perspectives, and to provide alternate scenarios to allow for replay variations or to facilitate randomization of roles assigned to characters.

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References

Abirached B., Zhang Y., Aggarwal J. K., Tamersoy B., Fernandes T., Miranda J. C., & Orvalho V. (2011). Improving communication skills of children with ASDs through interaction with virtual characters. In Serious Games and Applications for Health (SeGAH), 2011 IEEE 1st International Conference on (pp. 1-4). IEEE. 10.1109/SeGAH.2011.6165464

Bahiss K., Cunningham S. J., Smith T. (2010) Investigating the usability of social networking sites for teenagers with autism. CHINZ '10; Proceedings of the 11th International Conference of the NZ Chapter of the ACM Special Interest Group on Human-Computer Interaction. New York, NY: ACM, 2010, 5-8. Retrieved from: https://doi.org/10.1145/1832838.1832840

Baio J., Wiggins L., Christensen D. L., Maenner M. J., Daniels J., Warren Z., Kurzius-Spencer M., Zahorodny W., Rosenberg-Robinson C., White T., Durkin M. S., Imm P., Nikolaou L., Yeargin-Allsopp M., Lee L. C., Harrington R., Lopez M., Fitzgerald R. T., Hewitt A., Pettygrove S., Constantino J. N., Vehorn A., Shenouda J., Hall-Lande J., Van Naarden-Braun K., Dowling N. F. (2018) Prevalence of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2014. MMWR Surveillance Summaries 67(6), 1–23. Retrieved from: http://dx.doi.org/10.15585/mmwr.ss6706a1

Bogdanova D., Rosso P., Solorio T. (2012) Modelling fixated discourse in chats with cyberpedophiles. EACL 2012, Proceedings of the Workshop on Computational Approaches to Deception Detection, 86-90. Retrieved from: https://dl.acm.org/citation.cfm?id=2388629

Bogdanova D., Rosso P., Solorio T. (2014) Exploring high-level features for detecting cyberpedophilia. Computer Speech & Language 28(1), 108-120. Retrieved from: https://doi.org/10.1016/j.csl.2013.04.007

Brosnan M. & Gavin J. (2015) Are "Friends" Electric?: Why Those With an Autism Spectrum Disorder (ASD) Thrive in Online Cultures but Suffer in Offline Cultures. Chapter 14 of The Wiley Handbook of Psychology, Technology, and Society, ed. L. D. Rosen, N. Cheever, L. M. Carrier. NY: Wiley, 2015, pp. 250-270. Retrieved from: https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118771952.ch14

Cole H. & Griffiths M. D. (2007) Social Interactions in Massively Multiplayer Online Role-Playing Gamers. CyberPsychology & Behavior 10(4), 575-583. Retrieved from: https://doi.org/10.1089/cpb.2007.9988

Cooper M. N., Bernard R. (2017) Issue Paper: Online Safety. Cognitive Accessibility Roadmap and Gap Analysis, W3C Working Draft. Retrieved from: https://github.com/w3c/coga/blob/master/issue-papers/safety.html

Davison J. (2008) Autistic culture online: virtual communication and cultural expression on the spectrum. Social & Cultural Geography 9(7): 791-806. Retrieved from: https://doi.org/10.1080/14649360802382586

Davidson J. & Orsini M. (2013) The Shifting Horizons of Autism Online. In Davidson J. & Orsini M. (Eds.), Worlds of Autism: Across the Spectrum of Neurological Difference (pp. 285-304). Minneapolis;

London: University of Minnesota Press. Retrieved from: http://www.jstor.org/stable/10.5749/j.ctt4cggsn.16

Drouin, M., Boyd, R. L., Hancock, J. T., & James, A. (2017) Linguistic analysis of chat transcripts from child predator undercover sex stings, The Journal of Forensic Psychiatry & Psychology, 28:4, 437-457, DOI: 10.1080/14789949.2017.1291707 <https://www.tandfonline.com/doi/abs/10.1080/14789949.2017.1291707?casa_token=TxOq_iuQ9mgAAAAA:jBLxks5Fp9fJ-AKTH-yM6V-dSxYAHy2IqDAGsWEZnolr-ye2ZvPvAYh9GYAWUtZteJ5eamSbc91UQQ>

Ebrahimi M., Suen C. Y., Ormandjieva O. (2016) Detecting predatory conversations in social media by deep Convolutional Neural Networks. Digital Investigation 18, 33-49. Retrieved from: https://doi.org/10.1016/j.diin.2016.07.001

Egan V., Hoskinson J., & Shewan D. (2011) Perverted Justice: A Content Analysis of the Language Used by Offenders Detected Attempting to Solicit Children for Sex. Antisocial Behavior: Causes, Correlations and Treatments, ed. R. M. Clarke. Hauppauge, NY: Nova Science Publishers. Retrieved from: https://www.researchgate.net/profile/Vincent_Egan/publication/47867576_Perverted_Justice_A_Content_Analysis_of_the_Language_Used_by_Offenders_Detected_Attempting_to_Solicit_Children_for_Sex/links/53f1d63a0cf26b9b7dd101c7.pdf

Gallup J., Duff C., Serianni B., & Gallup A. (2016) An Exploration of Friendships and Socialization for Adolescents with Autism Engaged in Massively Multiplayer Online Role-Playing Games (MMORPG). Education and Training in Autism and Developmental Disabilities 51(3), 223–237. Retrieved from: http://www.daddcec.org/Portals/0/CEC/Autism_Disabilities/Research/Publications/Education_Training_Development_Disabilities/Full_Journals/Gallup.PDF

Gallup, J., Little, M. E., Serianni, B., & Kocaoz, O. (2017). The Potential of Virtual Environments to Support Soft-Skill Acquisition for Individuals with Autism. The Qualitative Report, 22(9), 2509-2532. Retrieved from https://nsuworks.nova.edu/tqr/vol22/iss9/16

Gesser-Edelsburg A., Fridman T., & Lev-Wiesel R. (2017) Edutainment as a Strategy for Parental Discussion With Israeli Children: The Potential of a Children's Play in Preventing Sexual Abuse. Journal of Child Sexual Abuse 26(5), 553-572. Retrieved from: https://doi.org/10.1080/10538712.2017.1319003

Gillespie-Lynch K., Brooks P. J., Shane-Simpson C., Gaggi N. L., Sturm D., Ploog B. O. (2016) Selecting Computer-Mediated Interventions to Support the Social and Emotional Development of Individuals with Autism Spectrum Disorder, Special and Gifted Education: Concepts, Methodologies, Tools, and Applications, ed by Information Resources Management Association. Hershey, PA : Information Science Reference / IGI-Global, pp. 32-58. Retrieved from: https://doi.org/10.4018/978-1-5225-0034-6.ch003 <https://www.igi-global.com/gateway/chapter/151199>

Gupta A., Kumaraguru P., Sureka A. (2012) Characterizing Pedophile Conversations on the Internet using Online Grooming. Retrieved from: https://arxiv.org/abs/1208.4324

Haney J. L., Cullen J. A. (2017) Learning About the Lived Experiences of Women with Autism from an Online Community. Journal of Social Work in Disability & Rehabilitation 16(1), 54-73. Retrieved from: https://doi.org/10.1080/1536710X.2017.1260518

Jordan C. J., Caldwell-Harris C. L. (2012) Understanding Differences in Neurotypical and Autism Spectrum Special Interests Through Internet Forums. Intellectual and Developmental Disabilities 50(5), 391-402. Retrieved from: https://doi.org/10.1352/1934-9556-50.5.391

Ke F., Moon J. (2018) Virtual collaborative gaming as social skills training for high-functioning autistic children. British Journal of Educational Technology (BJET) 49(4), 728-741. Retrieved from: https://doi.org/10.1111/bjet.12626

Kidney, C. A. (2015) "Rethinking Autism, Communication, and Community Involvement: Exploring Involvement in Online Communities, Communication Preference, Autistic Identity, and Self-Determination." Portland State University, Dissertations and Theses. Paper 2224. Retrieved from: https://doi.org/10.15760/etd.2221

Kontostathis A., Edwards L., Bayzick J., McGhee I., Leatherman A., & Moore K. (2009) Comparison of Rule-based to Human Analysis of Chat Logs. 1st International Workshop on Mining Social Media (MSM09). Seville, Spain. Nov 2009. Retrieved from: https://pdfs.semanticscholar.org/8c50/e2b9d0bc638f525b08b4ae67641108a9d956.pdf

Kontostathis A., Edwards L., Leatherman A. (2010) Text Mining and Cybercrime. Text Mining: Applications and Theory, ed. M. W. Berry & J. Kogan. NY: Wiley. Retrieved from: https://doi.org/10.1002/9780470689646.ch8

Leekham S. R., & Prior M. (1994). Can autistic children distinguish lies from jokes? A second look at second-order belief attribution. Child Psychology & Psychiatry & Allied Disciplines, 35(5), 901-915. Retrieved from: http://dx.doi.org/10.1111/j.1469-7610.1994.tb02301.x

Li A. S., Kelley E. A., Evans A. D., & Lee K. (2011) Exploring the Ability to Deceive in Children with Autism Spectrum Disorders. J Autism Dev Disord. 41(2), 185–195. Retrieved from: https://doi.org/10.1007/s10803-010-1045-4

Lough E., Flynn E. (2015) Mapping Real-World to Online Vulnerability in Young People with Developmental Disorders: Illustrations from Autism and Williams Syndrome. Review Journal of Autism and Developmental Disorders 2(1), pp 1–7. Retrieved from: https://doi.org/10.1007/s40489-014-0029-2

Mazurek M. O., Engelhardt C. R., Clark K. E. (2015) Video games from the perspective of adults with autism spectrum disorder. Computers in Human Behavior 51(A), 122-130. Retrieved from: https://doi.org/10.1016/j.chb.2015.04.062

Mazurek M. O., & Wenstrup C. (2013) Television, Video Game and Social Media Use Among Children with ASD and Typically Developing Siblings. Journal of Autism and Developmental Disorders 43(6), 1258-1271. Retrieved from: https://doi.org/10.1007/s10803-012-1659-9

McEvoy, Loran J. (2016) Understanding Socialization for Young Adults with High Functioning Autism Spectrum Disorder Utilizing Massively Multiplayer Online Role-Playing Games.

Northcentral University, ProQuest Dissertations Publishing. 10159195. <https://search.proquest.com/openview/d0e4ca8cecff64449e7095ba19da1fd9/1?pq-origsite=gscholar&cbl=18750&diss=y>

McGhee I., Bayzick J., Kontostathis A., Edwards L., McBride A., & Jakubowski E. (2011) Learning to Identify Internet Sexual Predation. International Journal of Electronic Commerce 15(3), 103-122. Retrieved from: https://doi.org/10.2753/JEC1086-441550305

Normand C. L. & Sallafranque-St-Louis F. (2016) Cybervictimization of Young People With an Intellectual or Developmental Disability: Risks Specific to Sexual Solicitation. Journal of Applied Research in Intellectual Disabilities 29(2), 99-110. Retrieved from: https://onlinelibrary.wiley.com/doi/full/10.1111/jar.12163

O'Connell R. (2003) A Typology of Child Cybersexploitation and Online Grooming Practices. Cyberspace Research Unit, University of Central Lancashire. Retrieved from: http://image.guardian.co.uk/sys-files/Society/documents/2003/07/17/Groomingreport.pdf

Olson L. N., Daggs J. L., Ellevold B. L., Rogers T. K. K. (2007) Entrapping the Innocent: Toward a Theory of Child Sexual Predators' Luring Communication. Communication Theory 17(3), 231-251. Retrieved from: https://doi.org/10.1111/j.1468-2885.2007.00294.x

Paranal R., Washington-Thomas K., & Derrick C. (2012) Utilizing Online Training for Child Sexual Abuse Prevention: Benefits and Limitations. Journal of Child Sexual Abuse 21(5), 507-520. Retrieved from: https://doi.org/10.1080/10538712.2012.697106

Pendar N. (2007) "Toward Spotting the Pedophile Telling victim from predator in text chats," International Conference on Semantic Computing (ICSC 2007), Irvine, CA, pp. 235-241. Retrieved from: https://doi.org/10.1109/ICSC.2007.32

Quayle E. (2016) Researching online child sexual exploitation and abuse: Are there links between online and offline vulnerabilities? (Method Guide 7) London: Global Kids Online. Available from: http://globalkidsonline.net/tools/guides/sexual-exploitation/ Retrieved from: http://eprints.lse.ac.uk/71260/1/Guide-7-Child-sexual-exploitation-and-abuse-Quayle.pdf

Ringland K. E., Wolf C. T., Faucett H., Dombrowski L., Hayes G. R. (2016) "Will I always be not social?": Re-Conceptualizing Sociality in the Context of a Minecraft Community for Autism. CHI '16; Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. New York, NY: ACM, 2016, 1256-1269. Retrieved from: https://doi.org/10.1145/2858036.2858038 | <https://dl.acm.org/citation.cfm?id=2858038>

Sallafranque-St-Louis F., & Normand C. L. (2017). From solitude to solicitation: How people with intellectual disability or autism spectrum disorder use the internet. Cyberpsychology: Journal of Psychosocial Research on Cyberspace 11(1), article 7. http://dx.doi.org/10.5817/CP2017-1-7

Sevlever, M., Roth, M.E. & Gillis, J.M. (2013) Sexual Abuse and Offending in Autism Spectrum Disorders. Sexuality and Disability 31(2), 189-200. Retrieved from: https://doi.org/10.1007/s11195-013-9286-8

Singer, J. (1999) "'Why can't you be normal for once in your life?' From a 'problem with no name' to the emergence of a new category of difference". In Disability Discourse, Ed. by: Corker, M. and French, S. Buckingham: Open University Press,1999: Chapter 7, 59–67.Smith M. J., Ginger E. J., Wright K., Wright M. A., Taylor J. L., Humm L. B., Fleming M. F. (2014). Virtual reality job interview training in adults with autism spectrum disorder. Journal of Autism and Developmental Disorders 44(10), 2450–2463. Retrieved from: https://doi.org/10.1007/s10803-014-2113-y

Stendal K., Balandin S. (2015) Virtual worlds for people with autism spectrum disorder: a case study in Second Life. Disabil Rehabil. 37(17):1591-8. Retrieved from: https://doi.org/10.3109/09638288.2015.1052577

Wells M., & Mitchell K. J. (2013). Patterns of internet use and risk for online victimization for youth with and without disabilities. Journal of Special Education 48(3), 204-213. https://doi.org/10.1177/0022466913479141

Whittle H. C., Hamilton-Giachritsis C., & Beech A. (2015). A comparison of victim and offender perspectives of grooming and sexual abuse. Deviant Behavior 36 (7), 539–64.

Whittle H., Hamilton-Giachritsis C., Beech A., Collings G. (2013) A review of young people's vulnerabilities to online grooming. Aggression and Violent Behavior 18(1), 135-146. Retrieved from: https://doi.org/10.1016/j.avb.2012.11.008

Wilkinson N., Ang R. P., Goh D. H. (2008) Online Video Game Therapy for Mental Health Concerns: A Review. International Journal of Social Psychiatry 54(4), 370-382. Retrieved from: https://journals.sagepub.com/doi/abs/10.1177/0020764008091659 \

Yi L., Pan J., Fan Y., Zou X., Wang X., Lee K. (2013) Children with autism spectrum disorder are more trusting than typically developing children. J Exp Child Psychol. 116(3):755-61. Retrieved from: https://doi.org/10.1016/j.jecp.2013.05.005

Zakari H. M., Ma M., Simmons D. (2014) A Review of Serious Games for Children with Autism Spectrum Disorders (ASD). SGDA 2014: International Conference on Serious Games Development and Applications, pp 93-106. Retrieved from: https://link.springer.com/chapter/10.1007/978-3-319-11623-5_9

THINKING OUTSIDE THE BOX: VIDEO GAME PLAY AS WARM UP FOR CREATIVE THINKING

Video game play as warm up for creative thinking

ELIZABETH VEINOTT AND KAITLYN ROOSE

In an experiment, we examined the effect of game play on improving participant's problem-solving ability, perspective shifting (using the Remote Association task), and change detection ability. These are common cognitive elements in video game play that relate to creative problem solving and have the potential to transfer to problems outside of video games (Gee, 2003; McDonigal, 2011; Veinott et al., 2013). Classic insight problems are difficult to solve. When one solves one of them, it is not likely that they will solve another (Gentner, 1980).

Sixty-two participants were randomly assigned to a Game or Control condition. Participants either played Atari's Roller Coaster Tycoon or were in the control condition (filler task for 30 min). In the game condition, players built and maintained a park. To be successful, this required the players to manage resources and look at the situation from multiple different levels. After this manipulation, participants completed 3 tasks: a pre/post insight problem task, a remote association task (10 trials), and a change detection task (100 trials). For all the tasks, including perspective taking and creativity, we used a standard remote association task in which participants must find a relationship among three words.

Participants in both conditions tried to solve one insight problem at time 1, then either filled out a series of questionnaires (Control condition) or played Roller Coaster Tycoon (Game Condition) for 30 minutes, then tried to solve a new similar insight problem at time 2 (Dunker, 1942). Problem order was counterbalanced across participants within conditions. Data were analyzed using a 2 (Game, Control) x 2 Problem Time (Pre/Post) analysis of variance. Two different problems were used and their order was counterbalanced. Our results indicate that while there was no difference in problem solving abilities at time 1 as expected, participants in the game condition increased their problem solving ability at time 2 by 27% compared to the control condition which improved by 3% on average.

Unlike problem solving, the results for the other two tasks were not statistically significant. A repeated measure ANOVAs was not statistical significant for the other two tasks. Participants in the game condition did not do better on a remote association task, $F(1, 528) = 1.257$, $p = .263$, or complete it faster, $F(1, 528) = 0.067$, $p = .796$, than those in the non-game condition. Participants in the game condition did not do better on change detection accuracy, $F(1, 532) = 1.70$, $p = .193$, or speed, $F(1, 532) = .207$, $p = .849$, than those in the non-game condition. These data indicate that game play did not warm-up participants for either of these tasks, but did for the problem solving task. The problem solving result provides initial support for the idea that video games that practice certain cognitive strategies can serve as a potential warm-up for problem solving activities outside of the game.

The problem solving result provides initial support for the idea that video games that practice for certain cognitive strategies can serve as a potential warm-up or transfer for problem solving activities outside of the game. If warm up was universal, we might have expected improvement on all three tasks, but we only found it on one. Future research will seek to replicate the problem solving result, and include measures that are more directly tied to the specific game play (e.g., in this case resource management in roller coaster tycoon). This will allow us to tease apart whether this is transfer of specific skills or warm up of more general skills (e.g., perspective taking). In general, transfer of cognitive learning is not found as often as one would hope. While we discuss the potential of games for transfer of learning, the measure of this type of transfer is rare. The idea that games could serve as a warm up we think in intriguing, but more research is needed.

HE AU HOU: (RE)CODING HAWAIIAN SURVIVANCE THROUGH GAMING

(Re)coding Hawaiian Survivance through Gaming

RIAN BARRERAS, MICHELLE LEE BROWN, AND DANIEL KAUWILA MAHI

Abstract

For three weeks in the Summer of 2017 a group of primarily Indigenous students from diverse backgrounds and levels of experience came together to create a video game based on Hawaiian mo'olelo or storytelling.The Skins 5.0 workshop resulted from the collaboration of multiple organizations including The Initiative for Indigenous Futures (IIF), Kanaeokana, and Aboriginal Territories in Cyberspace. These groups contributed funding, curriculum, educators and enthusiasm to provide the physical and mental space necessary for the creation of the design team name Nā 'Anae Mahiki.In time since the release of *He Au Hou*, the designers have had time to reflect on the final product, the impact it has on players and the impact it has had on the designers.

This paper is an exploration of the intersections of video game building, meaningful learning, and Hawaiian culture. It also takes up the challenges and rewards of organizing and running an inclusive trans-Indigenous workshops involving Indigenous and non-Indigenous participants and instructors from Turtle Island and Oceania. Further, this co-authored research investigates identity building, cultural development, programming and game creation from Hawaiian cultural and ontological perspectives, as well as the creation of connections to cultural heritage through developing a video game based in Hawaiian ways of knowing.

Each of the co-authors took on a different role during the workshop, this paper is a reflection of our pilina (connections, ties) to each other, this place, and the larger web of connections into which the game is woven. To reflect these different strands, each of the authors presents a section relating to their ʻikena (view, seeing, knowing/knowledge), each of which is briefly summarized below.

Kaona or multiple meanings are learned from intimate relationships with ʻōlelo Hawaiʻi (Hawaiian Language). Within *He Au Hou*, the design elements play with kaona and use methods of ulana (weaving; calm; prophecy of a foreteller) to connect the player with traditional stories from Hawaiʻi. Ulana is one of the most important game mechanics within the game and it is through ulana the player and the designers experiment with Hawaiian ontological practices. This begins to question what it means to be a pāʻani wikiō Hawaiʻi (Hawaiian Video Game). Taking elements and cues from the vast archive of Hawaiian Language materials, through chant, song, dance, and many other publications and records, the player and the designer both start to understand how deeply they know their language as the images and experiences of the game telegraph many meanings. Every step taken in the game

has a meaning, so every significant interaction whether player with their avatar or virtual interactions within Hawaiian reality creates a ripple effect in our environments.

This section performs a refusal – turning away from alien phenomenology, object-oriented ontologies, and new materialism currents. It turns towards an Indigenous multisensory method of (re)coding to trace how the students, instructors, designers, community members, and cultural experts came together to nurture a new emergence of Kanaka Maoli ways of playing and sharing stories with a diverse audience and engage kaona as security protocols. In conclusion and contrast, the complications of the materials and extraction involved with digital gaming in tension with the learning and (re)coding that occurs are noted.

To the player, games are a participatory experience that can result in valuable learning. Games can act as vessels to communicate cultural values by providing social context for cultural learning (Salen & Zimmerman, 2004). The designers of *He Au Hou* deliberately worked to create an experience that would immerse players and share cultural values. Players have the chance to empathically connect to the experience (Schell, 2008) by becoming the avatar of a voyager in the game and gathering cultural knowledge to add to the formation of their own identities. In this way, players are not only passive learners of a culture, but also become active creators.

Rather than close with connections to cultural heritage or individual experiences, this collective work returns to our pilina to frame the workshop and resulting game as ways of opening to, as one of the organizers noted, “getting us back to the right timescale” (Kuwada, 2015). Programming languages and software programs are embedded with and co-constitutive of settler-colonial structures and ‘discrete‘ ways of coding the world through Western cultural frameworks (Harrell, McPherson). This workshop – and the network of connections and (reconnections made that extend beyond it – challenge those technical-cultural systems by providing (re)generative paths towards inclusive Indigenous Futurities (Tuck, Gaztambide-Fernández) and planting seeds of ‘ōlelo Hawai‘i within the code itself to cultivate future emergences of intellectual sovereignty and what Noelani Goodyear-Ka‘ōpua terms Hawaiian survivance.

Sources

Goodyear-Ka‘ōpua, N. (2013). *The seeds we planted : Portraits of a native Hawaiian charter school.* Minneapolis, MN: University of Minnesota Press.

Harrell, D. F. (2013). *Phantasmal media: An approach to imagination, computation, and expression*. Cambridge, MA: MIT Press.

Kuwada, B. K. (2015). “We live in the future. Come join us.” *Hehiale*.https://hehiale.wordpress.com/2015/04/03/we-live-in-the-future-come-join-us/

McPherson, T. (2012). “Why are the digital humanities so white?: Thinking the histories of race and computation.” *Debates in the Digital Humanities*. Ed. M.K. Gold. Minneapolis, MN : University of Minnesota Press.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. Cambridge: The MIT Press. http://doi.org/10.1093/intimm/dxs150

Schell, J. (2008). *The art of game design: A book of lenses*. Burlington: Morgan Kaufmann Publishers. http://doi.org/10.1017/CBO9781107415324.004

Tuck, E. and R. A. Gaztambide-Fernández. (2013). "Curriculum, replacement, and settler futurity." *Journal of Curriculum Theorizing* 29:1, pp. 72-89.

I'VE GOT YOU IN MY SIGHTS: DEVELOPING A NOVEL METHODOLOGY COMBINING COGNITIVE TASK ANALYSIS AND EYE TRACKING

Developing a Novel Methodology Combining Cognitive Task Analysis and Eye Tracking

KAITLYN M. ROOSE AND ELIZABETH S. VEINOTT

Abstract

Video games cognitively challenge players to perform multiple cognitive activities at once. Game researchers and designers need to understand how players are interacting in the game environment, and new methods that provide actionable and focused feedback would provide the greatest benefit. This paper presents an efficient and novel approach (*The Tracer Method*) to address this issue, and describes its initial demonstration. *The Tracer Method* builds upon previous research (using only process tracing methods and static environments) to evaluate the combination of the two Human Factors methodologies, Cognitive Task Analysis (CTA) and Eye Tracking (ET), in a fast-paced first-person shooter: *Overwatch.* Both the CTA method and ET provided a level of validation between the data, however, this overlap was significantly lower than previous research. *The Tracer Method* findings do indicate that integration of the two methods provides new and useful information that either method alone would not be able to elicit.

Extended Abstract

In Human Factors Psychology, there are many methodologies to unpack cognitively complex decision making in dynamic and difficult environments. Cognitive Task Analysis (Crandall et al., 2006) and Eye Tracking (Duchowski, 2002; 2003) are two heavily used methods across many different domains (i.e. military and aviation). Cognitive Task Analysis (CTA) is a set of methodologies used to unpack experts' cognitive processes during complex tasks. Typically, the output of CTA encompasses designing guidelines to decrease errors while increasing performance, and improving training for novices. Very few studies have used CTA in games, and those that have explicitly used process tracing methods to: unpack learning in gameplay (Shute & Kim, 2011) and develop game design requirements (Boyle et al., 2012; Gallagher & Prestwich, 2013). Eye Tracking (ET) is a technique to record and measure eye movements as they interact with elements in an environment or task. Typically, ET measures fixations and saccades across Areas of Interest (AOIs), which have been mostly used to evaluate usability (Duchowski, 2002; Duchowski, 2003; Jacob & Karn, 2003; Poole & Ball, 2006). ET has been used more commonly than CTA in video games, focusing on using ET as input for game control (Leyba & Malcom, 2004) or to evaluate player strategies in game (Alkan & Cagiltay, 2007; Almedia, 2009; Almeida et al., 2011, El-Nasr & Yan, 2006; Renshaw et al., 2009). Some research has investigated the combination of the two, and none have investigated them in the context of a video game (Cooke & Cuddihy, 2005; Cooke, 2010; Elling et al., 2011; Elling et al., 2012; Rhenius

& Deffner, 1990). Previous research has focused on process tracing methods (e.g. concurrent verbal protocol) and static tasks (e.g. navigating a website). Cooke (1994) articulates that these previously used methodologies (e.g. process tracing) are unable to capture all of the knowledge associated with completing a task or making a decision. The information that they do capture may not even be actionable. To date, there has been no research investigating any other Cognitive Task Analysis method (i.e. Critical Decision Method) and Eye Tracking, thus, this would be the first study to do so.

The goal of this paper is to describe *The Tracer Method*, a novel methodology combining Cognitive Task Analysis and Eye Tracking that addresses previous limitations (Cooke, 1994; Elling et al., 2011; 2012) while expanding the focus to investigating new information, and exploring new application areas to: informing game design and eSports. To evaluate *The Tracer Method*, we evaluated the overlapping, different, and new information elicited from Overwatch. Overwatch was chosen as the first demonstration environment for several reasons: 1. The complexity mirrors real world, 2. There are interdependent teammates, 3. Cognitively difficult tasks with various pressures occur throughout the game, and 4. The game exhibits qualities of Naturalistic Decision Making (Zsambok & Klein, 2014).

Seventeen experienced Overwatch players with at least 50 hours of playtime participated in the study. The study involved two sessions. In the first session we interviewed participants about general Overwatch strategies using two CTA techniques: Task Diagram and Critical Decision Method. In the second session, participants played 1-2 games of Overwatch while having their eye movements tracked. After the games, participants were interviewed regarding one of the games they had just played, using Critical Decision Method (Hoffman et al., 1998; Klein et al., 1989). The CDM data (decisions, cues, and courses of action) were coded using both top down and bottom up techniques. The ET data involved overlaying AOIs based on the Overwatch UI, segmenting out each 20 second decision window (10 seconds before and 10 seconds after decision), and coding 1,766 fixations on the reticle. Finally, *The Tracer Method* involved coding cues for mappability (ET), if the cues were confirmed with ET, and any cues that were not reported in the CDM but were fixated on in the ET data.

Using this new method, we found an overlapping percentage of 35-59%, compared to previous research having between 77-98% overlapping information (Cooke, 2010, Rhenius & Deffner, 1990). We also found new information using this technique: 1. 96 potentially valid bottom up cues from ET (within decision window), 2. Common transitions between areas of interest that relate to task diagram output, 3. Reticle fixation cues distributed across decision types, and 4. AOI centrality that related to specific viewing patterns. The findings from each individual submethod (CDM and ET) found consistent results with past research from other domains (e.g. 39 critical decisions compared to 33 from Crandall & Getchell-Reiter, 1993). With eye tracking, it was not surprising that in *Overwatch*, a FPS, the majority of fixations occurred in the reticle area. However, *The Tracer Method* was able to tease apart the individual fixations and determine the type of information that was being elicited. The method was also able to demonstrate the range of decisions and cognitive activities that occur in a FPS game, which on the surface seems reactive. There has been no past research on gaze/visit patterns on Overwatch.

Overall, *The Tracer Method* combines two methodologies that provide important independent insight. CTA provides understanding of game sense or expertise knowledge/cues, while ET provides behavioral data based on a participant's interaction with the environment. Combined, these methods support each other: CTA providing context and focus and ET providing validation and scope. This study builds off of past research by investigating a highly dynamic and complex environment (past: website vs. current: video game), using a different CTA technique, and investigating both different and new information instead of focusing on overlapping information. For game design, this methodology could be very useful in several ways: evaluating user interfaces in less time (focusing on 40-80 seconds of gameplay vs. 30 minutes), providing useful information across different game versions (e.g. conceptual to alpha), and understand how players are using the game environment (via "cognitive playtest"). For eSport training, the output can help develop scenarios to allow players to train on specific valid cues or types of decisions. It can also help develop decision making measures to evaluate and recruit individual players (e.g. Wagner, 2006). Finally, it can help train "novices" or new teammates to understand and gauge the flow of the specific team.

The Tracer Method is the first documentation of a combined methodology using CDM, and exploring within the context of a video game. This method is efficient, flexible, and focused to the specific problem or goal. We are not the first to suggest the compatibility of these methods (Rhenius & Deffner, 1990), but we are the first to fully expand upon the added value. The alliance of these methods is fully supported, however, more research is needed to evaluate and further develop *The Tracer Method*. The world could always use more METHODS!

References

Alkan, S., & Cagiltay, K. (2007). Studying computer game learning experience through eye tracking. British Journal of Educational Technology, 38(3), 538-542.

Almeida, S. de J. (2009). Augmenting video game development with eye movement analysis. (Master's thesis, Universidade de Aveiro).

Almeida, S., Veloso, A., Roque, L., & Mealha, O. (2011). The eyes and games: A survey of visual attention and eye tracking input in video games. Proceedings of the SBGames, 1–10.

Boyle, E., Van Rosmalen, P., MacArthur, E., Connolly, T., Hainey, T., Johnston, B., Pennanen, T. (2012). Cognitive task analysis (CTA) in the continuing/higher education methods using games (CHERMUG) Project. In Proceedings of the 6th European Conference on Games Based Learning: ECGBL (p. 63). Academic Conferences Limited.

Calderwood, R., Crandall, B. W., & Klein, G. A. (1987). Expert and novice fire ground command decisions (No. KA-TR-858 (D)-87-03F). KLEIN ASSOCIATES INC YELLOW SPRINGS OH.

Cooke, L. (2010). Assessing concurrent think-aloud protocol as a usability test method: A technical communication approach. IEEE Transactions on Professional Communication, 53(3), 202-215.

Cooke, N. J. (1994). Varieties of knowledge elicitation techniques. International Journal of Human-Computer Studies, 41(6), 801–849.

Cooke, L., & Cuddihy, E. (2005, July). Using eye tracking to address limitations in think-aloud protocol. In Professional Communication Conference, 2005. IPCC 2005. Proceedings. International (pp. 653-658). IEEE.

Crandall, B., & Getchell-Reiter, K. (1993). Critical decision method: a technique for eliciting concrete assessment indicators from the intuition of NICU nurses. Advances in Nursing Science, 16(1), 42-51.

Crandall, B., Klein, G. A., & Hoffman, R. R. (2006). Working minds: A practitioner's guide to cognitive task analysis. Mit Press.

Duchowski, A. T. (2002). A breadth-first survey of eye-tracking applications. Behavior Research Methods, Instruments, & Computers, 34(4), 455–470.

Duchowski, A. T. (2003). Eye tracking methodology. Theory and Practice, 328.

Elling, S., Lentz, L., & De Jong, M. (2012). Combining concurrent think-aloud protocols and eye-tracking observations: An analysis of verbalizations and silences. IEEE Transactions on Professional Communication, 55(3), 206–220.

Elling, S., Lentz, L., & de Jong, M. (2011, May). Retrospective think-aloud method: Using eye movements as an extra cue for participants' verbalizations. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 1161-1170). ACM

El-Nasr, M. S., & Yan, S. (2006). Visual attention in 3D video games. In Proceedings of the 2006 ACM SIGCHI international conference on Advances in computer entertainment technology (p. 22). ACM.

Gallagher, P. S., & Prestwich, S. (2013). Cognitive Task Analysis: Analyzing the Cognition of Gameplay and Game Design. Paper presented at Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC). Orlando, FL.

Hoffman, R. R., Crandall, B., & Shadbolt, N. (1998). Use of the critical decision method to elicit expert knowledge: A case study in the methodology of cognitive task analysis. Human Factors, 40(2), 254–276.

Jacob, R. J., & Karn, K. S. (2003). Eye tracking in human-computer interaction and usability research: Ready to deliver the promises. Mind, 2(3), 4.

Klein, G. A., Calderwood, R., & Macgregor, D. (1989). Critical Decision Method for Eliciting Knowledge. Retrieved from http://services.lib.mtu.edu:2188/stamp/stamp.jsp?arnumber=31053

Leyba, J., & Malcolm, J. (2004). Eye tracking as an aiming device in a computer game. Course Work (CPSC 412/612 Eye Tracking Methodology and Applications by A. Duchowski), Clemson University, 14.

Overwatch. (2016) [Video Game]. Irvine, California: Blizzard Entertainment

Poole, A., & Ball, L. J. (2006). Eye tracking in HCI and usability research. In C. Ghaoui (Ed.), Encyclopedia of human-computer interaction.. (pp. 211-219). Pennsylvania: Idea Group Inc.

Renshaw, T., Stevens, R., & Denton, P. D. (2009). Towards understanding engagement in games: An eye-tracking study. On the Horizon, 17(4), 408–420.

Rhenius, D., & Deffner, G. (1990, October). Evaluation of concurrent thinking aloud using eye-tracking data. In Proceedings of the human factors society annual meeting(Vol. 34, No. 17, pp. 1265-1269). Sage CA: Los Angeles, CA: SAGE Publications.

Shute, V. J., & Kim, Y. J. (2011). Does playing the World of Goo facilitate learning. Design Research on Learning and Thinking in Educational Settings: Enhancing Intellectual Growth and Functioning, 359–387.

Wagner, M. G. (2006, June). On the Scientific Relevance of eSports. In *International Conference on Internet Computing* (pp. 437-442).

Zsambok, C. E., & Klein, G. (Eds.). (2014). Naturalistic decision making. Psychology Press.

FROM GAME DESIGN TO GOAL DELINEATION IN THE TANDEM TRANSFORMATIONAL GAME DESIGN FRAMEWORK

SAFINAH ALI, ALEXANDRA TO, ZHEN BAI, JARREK HOLMES, ELAINE FATH, JESSICA HAMMER, AND GEOFF KAUFMAN

Abstract

Transformational game design requires clear delineation of transformational goals, both to guide the game design process and to evaluate a game's intended impact. Tandem Transformational Game Design framework supports game designers and researchers in selecting relevant theories and translating those theories to design decisions using a goal delineation process, which occurs in tandem with the iterative development and playtesting of game artifacts in a game design process. An alignment stage between the goal delineation and game design processes helps multidisciplinary design teams come to common understanding and supports theory-driven prototyping and testing. Previous work has shown how theory development can directly inform the iterative game design process. In this paper, we demonstrate the importance of moving from the game design iteration loop back to the goal delineation loop, using playtest findings. We use our work on the game *Outbreak* to demonstrate how this alignment process might happen in practice.

Introduction

Transformational games are designed with the specific intention of changing players' behaviors, attitudes, or knowledge during and after play (Culyba, 2015). In transformational or educational game design, developing a clear, shared vision of how the player should change as a result of the game is a critical and ongoing process. Given the multidisciplinary interest and expertise involved in designing transformational games, design teams tend to be comprised of members from a broad range of disciplines, each bringing different perspectives, vocabularies, and areas of expertise to the table. Multidisciplinary teams, particularly those comprised of both expert and novice designers and researchers, may experience barriers to defining and sharing their vision due to disparate vocabularies and theoretical frameworks. This can make achieving such unification of vision quite challenging. Adding to a growing body of research that attempts to tackle this challenge, the Tandem Transformation Game Design framework proposes the two mutually informing "loops" of theory-driven goal delineation and goal-driven game design. Previous work from our team has outlined the overall framework, and demonstrated through a design case study how the goal delineation loop informs the game design loop. In this paper, we discuss how insights and observations from the game design loop can often necessitate a return to the goal delineation loop through an alignment process that can inspire the team to reconsider and refine the key theories informing the designation of a game's core transformational goals and the mechanisms for achieving them.

To understand this process, we first review the Tandem Transformational Game Design Process. Then we talk about how, in an attempt to design game-based interventions for fostering curiosity through play, we reviewed literatures of curiosity from psychology and came to an initial understanding of the theoretical space and selection of focal curiosity-related constructs to inform the designation of the game's specific transformational goals. We detail how this understanding of theory in turn informed our game iteration loop while designing the game *Outbreak*. We then outline what we learned through playtesting of early versions of the game, and how playtesting data informed not only the design of the game, but also inspired us to return to the literature to achieve a deeper understanding of the theoretical space and a more nuanced delineation of the game's intended goals. Specifically, based on our observations and measurements of players' emotional responses to *Outbreak*, we returned to the psychological literature on emotion both to help make sense of what the playtesting revealed and, moreover, to begin to apply those theories to iterative design decisions. In sum, in this paper, we focus on the importance of returning from the Goal-Driven Game Design loop back to the Game-Driven Goal Delineation loop, and explain how our team navigated the alignment between these two loops. This paper thus aims to provide, through an illustrative case study, a design framework resource for multidisciplinary transformational design teams to employ in their own practice.

Tandem Transformational Game Design Processes

Culyba (2015) defines transformational games as games designed for facilitating how the player is changed outside the game. While game designers are proficient at creating fun and engaging games, transformational games require designers to consider psychological and social factors that affect players' willingness and ability to change (Culyba, 2015), and to have a deep understanding of relevant content. Making a viable, entertaining, and effective transformational game means drawing on theories and methodologies from a range of fields in addition to game design, such as psychology, learning sciences, and human-computer interaction, and deciding how to integrate or translate those theories and methodologies to specific game design mechanisms and content (Seidman et al., 2015).

In order to draw from such diverse areas of theory while designing effective games, transformational game design teams often bring game designers together with experts in the design and research of psychological or educational interventions. Helping these interdisciplinary teams collaborate effectively is challenging but critical. One of the biggest predictors of a game's success is the team's level of clarity and alignment on the vision (Tozour, 2015). Moreover, given the potential for players' resistance to overly didactic or prescriptive game experiences, the overt insertion of existing intervention methods or strategies into game contexts can reduce how engaging and/or impactful a transformational game is likely to be (Kaufman & Flanagan, 2016). To this end, game design approaches that aim to more fully integrate or embed known theories or interventions in the design process tend to produce better results and, from players' perspective, better games. In order to accomplish this successful intermingling of disciplines, iterative, player-centric game design methods such as rapid prototyping must be combined with psychological insights (Seidman et al., 2015; Flanagan et al., 2013). To this end, psychologists (and other domain experts) must join forces with game designers, who, domain experts in their own right, often lack firmly established ways to bring non-game designer team members to the table, and vice versa. Non-designer content experts, meanwhile, may struggle with translating their knowledge of abstract concepts and principles from a given theoretical literature to concrete game design decisions. While transformational game design teams do, in practice, find ways to build on these multiple intellectual traditions, the integration is often challenging.

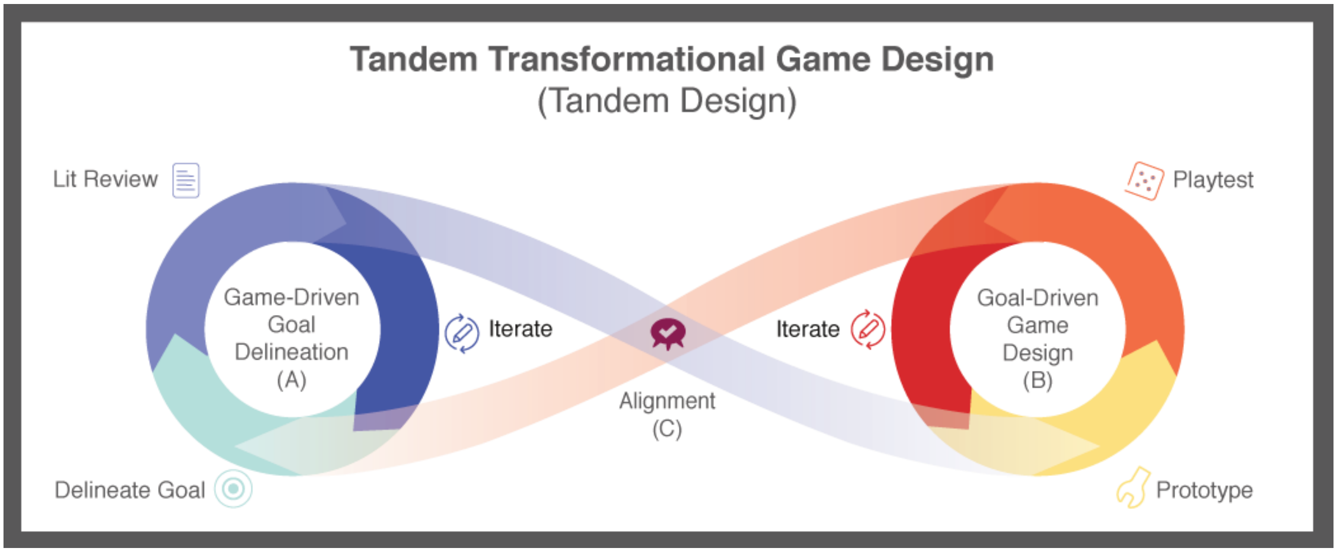


*Figure 1. The Tandem Design Process. Delineate Goal: articulation of goals for player transformation. Lit Review: collective reading of prior research to develop a shared vocabulary. Alignment: The juncture between the two phases. See descriptive paragraph below. Prototype: rapid game prototyping with one or more delineated goals as the initial point of inspiration. Playtest: frequent and extensive testing and evaluation of game (both within the team and with target audience). Iterate: the process of refinement when remaining inside one cycle. *Icons from (Harlow, n.d.; Luck, n.d.)*

The Tandem Transformational Game Design Framework (Figure 1) is one method that addresses this challenge. In the Tandem Design process, prototyping games and articulating goals are positioned as intrinsically intertwined cycles occurring in tandem with one another. In the *game-driven goal delineation* cycle (goal cycle, Figure 1.A), teams articulate their goals in conversation with the research literature and other data sources; in the *goal-driven game design* cycle (game cycle, Figure 1.B), teams prototype and playtest their games. Games and other research artifacts are used to iteratively align a team's prototyping process with their vision and goals (alignment, Figure 1.C). Prior work has shown how theory can guide the development of game prototypes and inform specific game design decisions (Figure 1.A). The current paper examines how prototypes and playtest findings can, through an alignment process, inform the iterative development of the theoretical foundations informing the team's game design goals (Figure 1.B, Figure 1.C).

In this case study, we focus on a game-based intervention for fostering curiosity through play, one aiming to increase young players' comfort and engagement with science, technology, engineering, and math (STEM) topics. During the design process, the team used the goal cycle of Tandem Design to develop a better shared understanding of the *problem space* – the conceptualization and operationalization of the construct of curiosity; the *intended audience* – underrepresented groups in STEM, including minority, women, and low socioeconomic status students; and the *transformational goals* – increasing curiosity through play (To et al., 2016). In prior work on the design process for this game, the team described researching *theories* of curiosity and developing *elements* of curiosity that could be instantiated or explored in a game (To et al., 2016). They developed *artifacts* to use during the alignment process, such as lists of game elements (Figure 3), and used those artifacts in the alignment process to decide whether they were ready to move to the prototyping stage or whether they needed to iterate through the goal delineation cycle (Figure 2) again.

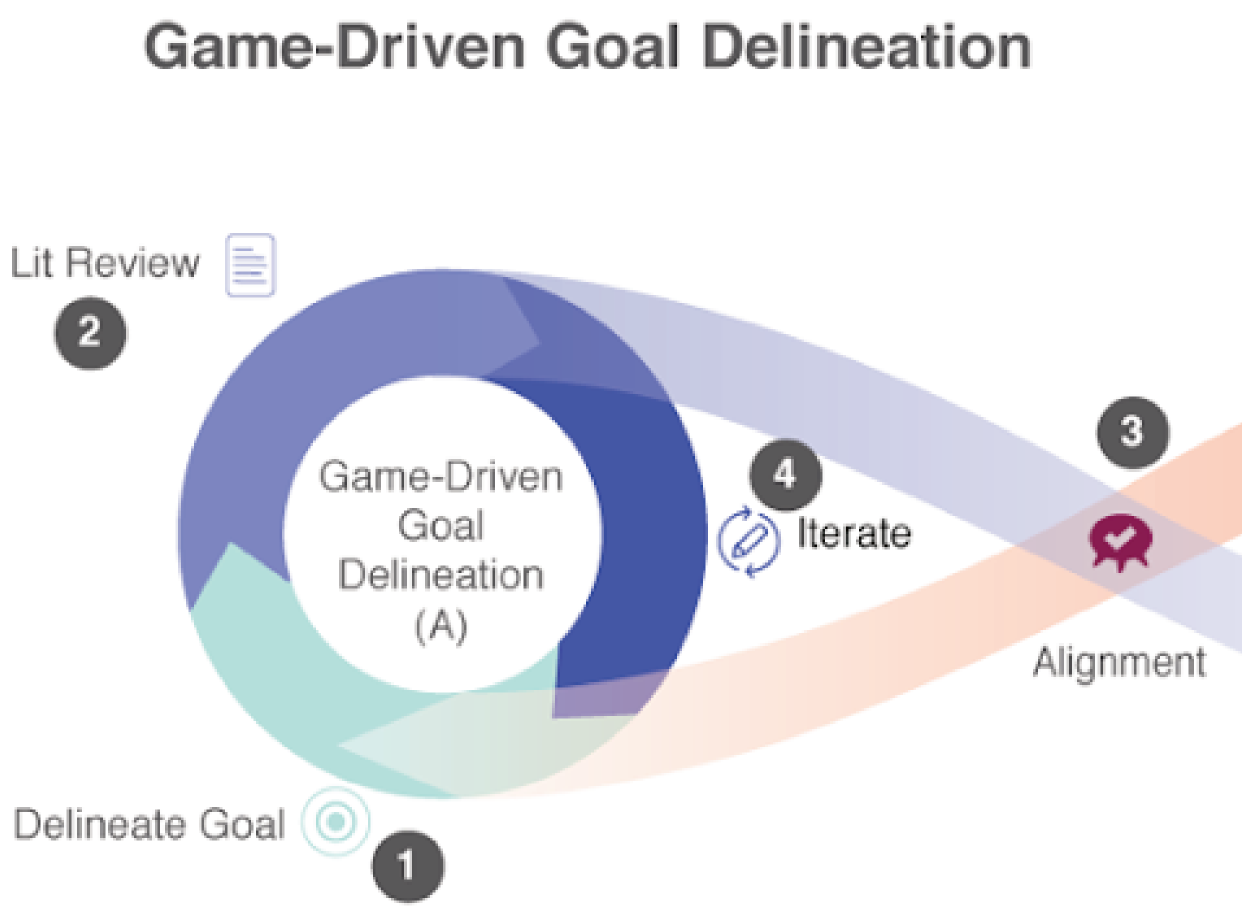
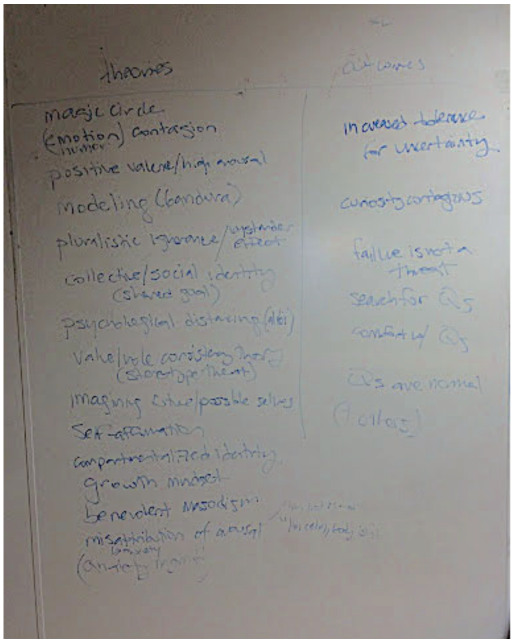


Figure 2. Our team's pathway through our first game-driven goal delineation cycle.



Theories	Outcomes
Magic circle Emotion Contagion Positive Valence / High Arousal Modeling Pluralistic Ignorance Collective/Social Identity Psychological Distancing Value / Role Consistency Imagining future and past selves Self-affirmation Compartmentalization of identity Growth mindset Benevolent Masochism Misattribution of Arousal	Increased tolerance for uncertainty Curiosity contagion Failure not a threat Search for unanswered questions Questions are Normal

Figure 3. Documentation photo (left); transcription (right). After reviewing the curiosity literature, the team extracted the elements (right, then labeled outcomes), brainstormed related moments in their own lives out loud, and extracted related theories from those stories and goals.

After a second pass through the goal cycle, the team moved to the goal driven game design loop (Figure 4). They documented their prototyping and game development process (To et al., 2016), building on existing design practices such as reflective practice, rapid prototyping, and iterative design (Zimmerman et al., 2014; Frens et al., 2013; Nielsen 1993;) and integrating them with current game design practices such as playtests. The team ideated a wide range of game ideas (using the theories and intended outcomes listed in Figure 3 as a foundation), created playable prototypes to use as internal reflective probes, iterated on the prototypes to create designs for the target audience, and playtested the games repeatedly. They implemented design practices such as parallel ideation and removal of individual ownership of game concepts in order to develop the widest range of interesting and successful ideas.

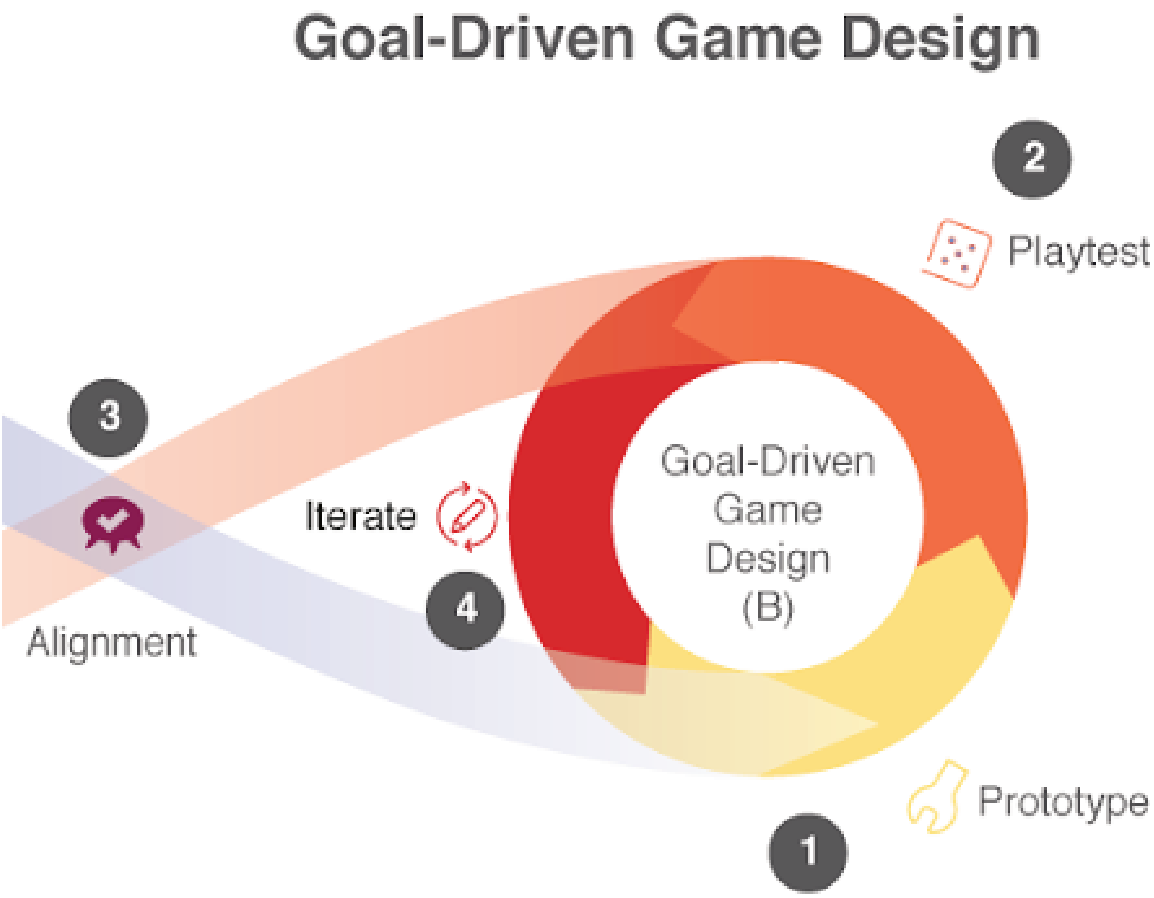


Figure 4. The Goal-Driven Game Design Cycle. Now with delineated goals, team members divergently prototype (1), playtest within the team (2), align with the team on what's working (3), then either move on to game iteration (4) or revisit the goal cycle.

In the end, *Outbreak* emerged as one design that the team brought to fruition, and elsewhere we have detailed the initial processes of goal delineation and game design that guided its development (To et al., 2016). However, the Tandem Design process does not stop when a game has been successfully created. The prototyping and playtesting process ends by returning to the alignment process (Figure 1.C) and is meant to inform the iterative development of further theory (Figure 1.A) and/or the redesign of a game in light of new theoretical insights and frameworks that emerge. It is this process that we explore in depth in the present work. Following a brief overview of the game's design, we discuss how the results of our game's playtesting (in particular, the emotional responses evoked by the game) inspired a return to the literature to help make sense of these results and to refine the transformational goals of the game. In the following section, we outline the design decisions of the game in question, *Outbreak*.

Outbreak

Outbreak is a cooperative tabletop game for two to five players, targeted toward ages 9-14, in which the group must save a town from a rogue scientist by searching their laboratory for antidotes to a disease, and asking questions to solve puzzles. Most players assume the role of scientific investigators, but one player takes the role of the investigators' robot assistant. Each time the investigators encounter a new room in the laboratory, they can send the robot in first to determine what potential dangers or obstacles await (e.g., locked cabinets, unfriendly creatures) and what character traits (e.g., speed or stealth) and resource cards (e.g., flashlight or lockpick) might be helpful in overcoming them. Investigators then enter the *question-asking phase*, where they can ask the robot questions to learn more about the challenge they will face in the room and prepare accordingly; however, the robot can only answer questions that are posed to it using special formats that the robot can understand (represented as "question tokens"). After the *question-asking phase* of the game, players enter the *discussion phase*, during which the players must collaboratively decide what resources to use in order to overcome the room's challenges and claim its antidotes. If the players are successful, they receive antidotes; if not, they lose the resources they used to make the attempt.

Learning from literature, we structured the design goals behind *Outbreak* to operationalize curiosity through two specific curiosity elements: (1) *comfort with uncertainty* which relates to players' perceptions of failure, their comfort and willingness to take risks, and their search for unanswered questions and (2) *comfort with questions*, which relates to players' perceived abilities to fill a knowledge gap and cope with uncertainty, their persistence towards understanding, and their assessment of their own knowledge states. *Outbreak* was designed as a multiplayer board game, which necessitates that players are co-present during gameplay, in order to help mitigate the affective experience of failure and the strategies available to manage it (Mohammed & Dumville 2001). Specifically, the question-asking phase was designed to encourage equal and frequent participation from players and to foster a sense of a shared experience of uncertainty (Mahdikhani et al. 2015). Second, the game supports risk-taking and failure by allowing players to experiment with different hypotheses and, together, to confront the results of incorrect assumptions or suboptimal decisions (Rocca 2010).

In the following sections, we discuss our methods and processes of playtesting *Outbreak* and what we learned from the playtest results.

Summary of Playtest Methods and Results

In order to examine the emotional impact of playing *Outbreak*, we conducted playtest sessions of the game in a lab setting, while we recorded and analyzed pre- and post-play self-report measures of emotion as well as gameplay behavior. We recruited 21 local Pittsburgh participants (9-14 y/o, 9 female) and ran hour-long playtest sessions with a total of 10 groups (each comprised of 3-4 participants).

We recruited participants by distributing advertisements via local public schools, parent mailing lists within the university's research participant pool, local parent groups on social media (e.g., Facebook, Craigslist), as well as local community centers. Participants and their parents/guardians were provided with a consent form explaining the study's purpose, procedures, participant requirements, potential risks and benefits, and confidentiality assurance, as well as a request for permission for audio and video recording, demonstration and online crowdsourcing and third party services for transcription. All participants' parents gave consent, and participants provided assent by signing the consent form on the day of study.

Participants were seated around a square table in a private lab space, with a researcher present at all times to facilitate game play and distribute study materials. First, participants were equipped with audio recording collar microphones and then performed a number of lightweight pre-playtest icebreaker activities – the results of which were not significant to the findings of this paper and will be reported in future work.

Next, participants played *Outbreak*. The researcher initiated game play by explaining the rules to the participants and then running a scripted practice round with the participants to demonstrate how to play. As a part of the script, the researcher directly encouraged players to provide their honest feedback about the game when appropriate and disclosed that they did not participate in the design of the game. During play, the researcher assumed the role of "robot," with participants playing the role of investigators. The game challenges were randomized for each play group, but the researcher was trained with guidelines for responding to players' questions to increase uniformity between groups. Game play then proceeded either for 40 minutes or until the participants reached the end of the game.

Measures

In our playtest we recorded and analyzed game play behavior data as well as pre- and post-play measures related to player curiosity and players' affective experiences. During game play, video and audio data were recorded. Additionally, a researcher seated in the room recorded structured field notes, specifically focusing on inter-player dynamics. Quantitative field note data included the number of questions asked, challenge successfully completed, conflicts, and agreements. Qualitative field note data included instances of emotional expressions (e.g., utterances such as "yay!", or "I don't think we can ever win" and occurrences of smiling or frowning) and specific actions (e.g., silence for an entire round, moderating discussion, grabbing other players' cards).

In addition, in order to examine how participants responded emotionally to different phases of game play, we asked participants to complete a self-report measure of emotional experience. This measure specifically gauged the levels of valence and arousal experienced by players during or after different events in the game and was administered individually on a laptop computer. Participants were provided with a four-quadrant map on the screen with different emotions at each edge and corner of the map corresponding to different combinations of positive/negative valence and low/high arousal. The interface displayed 15 prompts for stages of the game (e.g., `When you won a round', `When someone disagreed with you') , and the participants were asked to click the point on the map that best corresponded to how they felt during that stage of the game. Events were chosen in order to provide more fine-tuned insight for understanding when and how players experience different emotions during the game. This method of inferring valence and arousal of the participants provided us more detailed quantitative data compared to previous work, where we qualitatively coded these events along a variety of axes – most relevant to this work we include codes for whether or not the event is a "positive, neutral, negative, or unclear" event (where an event like winning a round is positive and an event like losing a resource is negative while discussion is neutral).

Coordinate (x, y) data, corresponding to the click location of the valence/arousal map on a -2.5 to 2.5 scale, were recorded for each participant. In our analysis for valence on the x-axis we defined the coordinate range from -2.5 to -.5 as 'negative' affect, -.5 to .5 as 'neutral' affect, and .5 to 2.5 as 'positive' affect.

In the analysis we aggregated the valence/arousal data across all study groups and examined the valence response (DV) by question-prompt (IV) or game phase (IV) as well as the relationship between valence (DV) and arousal (IV).

Two prompts were related to question-asking phase of the game :

- 'The first round of asking questions to the robot',
- 'The last round of asking questions to the robot.'

We use these two events in order to look for overall change in emotion towards question-asking across a game session.

One prompt related to the discussion phase of the game:

- 'Discussing which room to go into.'

Other prompts that were related to question-asking and discussion had clear emotional biases, and hence, were omitted. For example, 'When someone disagreed with me' is an event that might happen during discussion, but is more likely to be associated with negative emotions. We analyze the average response valence for these three prompts to indicate the emotions that participants felt during those two phases of the game.

In order to examine sentiment and emotion expressed in players' dialogue during the game, we used IBM Watson's sentiment analysis tool (High, 2012) on transcripts from the audio recording in order to examine what emotions players verbally expressed during play.

From Artifact to Theory

In this section of the paper we will detail the alignment process that occurred after several cycles of iterative game design as an illustrative case study for how a team might use playtest data to move from the game design and iteration loop of Tandem Design back to the goal delineation loop.

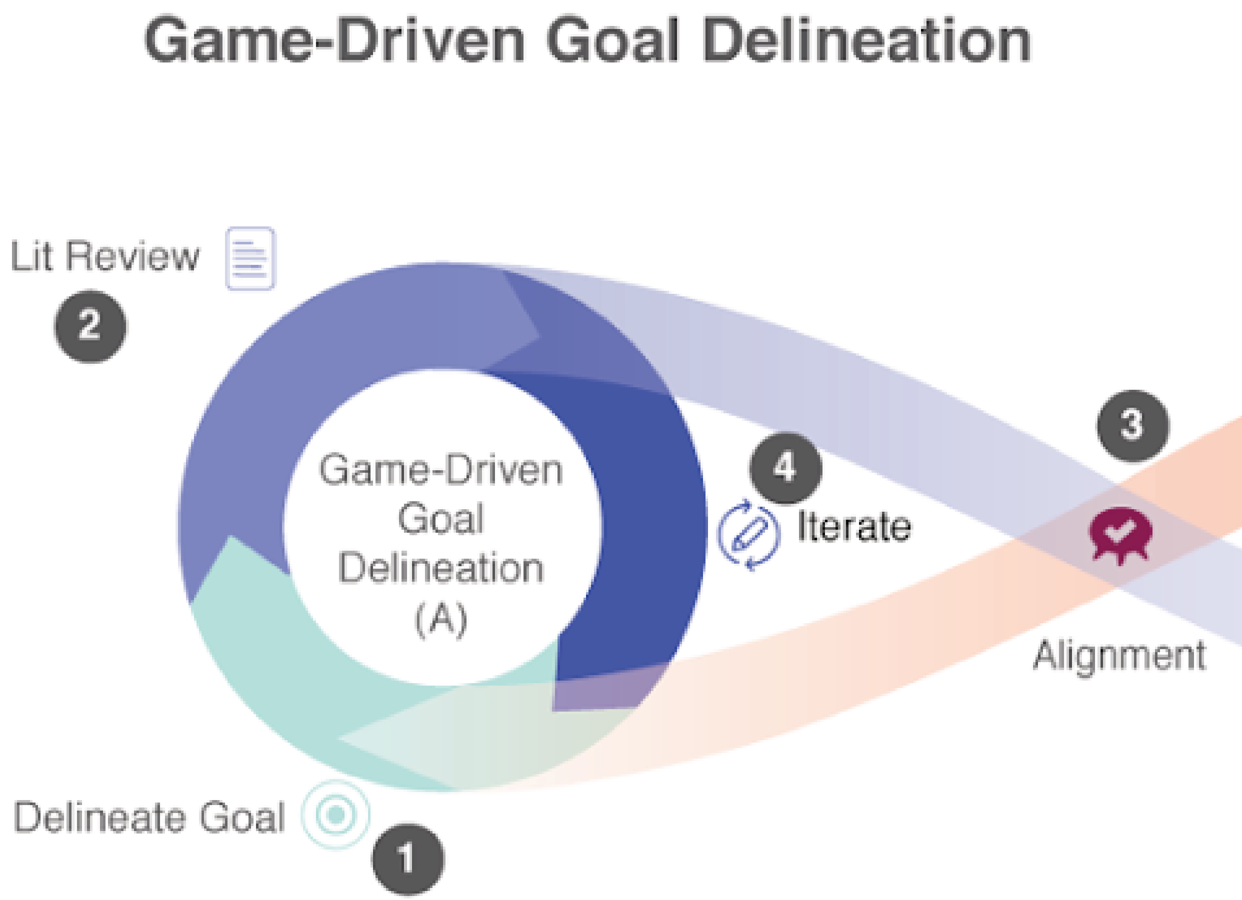


Figure 5. The Goal-Driven Game Design Cycle. Now with delineated goals, team members divergently prototype (1) alignment of the team around the players' experiences and responses, (2) Goal Delineation process, (3) Review emotion theory literature, and (4) Iterating on goal delineation to return to common alignment of the team.

As academic researchers, our alignment process at this stage was centered around organizing, analyzing, and interpreting the playtest data, both individually and during large and small group meetings, with the initial goal of publishing the insights we gleaned regarding players' experiences and responses to the game. We understand this process as alignment, as it involves the entire team coming to a central understanding of the project (Figure 5.1). At this stage, we analyzed the playtest results and came to a common understanding of the players' emotional responses in the game. This transitioned into the goal delineation loop that was based on a new theoretical framework that ties in the theories of emotion that we reviewed to explain our playtest results (Figure 5.3). We outline this process in greater detail below.

In order to examine sentiment and emotion expressed in players' dialogue during the game, we used IBM Watson's sentiment analysis tool (High, 2012) on transcripts from the audio recording in order to examine what emotions players verbally expressed during play. The tool takes in transcripts as text files and returns a numerical result for the fear, disgust, joy, sadness, anger, and overall sentiment expressed in that text data using deep natural language processing (i.e., gathering and applying as much relevant context from the text as possible). We segmented game transcripts and extracted text related to the two main phases of game play: 1) question-asking and 2) discussion. Researchers who were not involved in running the study transcribed the audio and denoted the beginning and ending of the question-asking and discussion phases using verbal cues from the robot player (e.g., "you can ask questions now", "ok time's up on question-asking"). We then performed IBM Watson analysis on transcript data from each category separately. Taking the results from the IBM Watson analysis, we compare the aggregate question-asking phase analysis to that of the aggregate discussion phase analysis.

From this sentiment analysis we used confidence intervals to examine the difference between these phases of game play and found that players expressed significantly more negative overall sentiment, more disgust, and more fear during question-asking than during the discussion phase of game play. There was no significant difference in expressed joy, anger, or sadness. This differed from self-report data in which we saw that participants reported positive and neutral affect during both question-asking and discussion.

This divergence between the detected and self-reported emotions experienced by players during these key game rounds was unexpected – and, as we discuss below, inspired us to return to the psychological literature on emotion in order to try to make sense of these findings. In our final round of alignment, we thus looked closely at this gap between expressed and self-reported emotion and called upon various theories of emotion to offer potential clarification. We considered several possible explanations for the difference in participants' self-reported and observed emotional experiences during play. To better understand why the players reported their emotion differently, we ventured into the domain of affect and emotion, and expression of emotion, and explored several theories that help us make sense of our results. We found three strong contenders for what might explain this phenomenon: misattribution of arousal, benign masochism, and social facilitation theory. This new literature review, which we outline in the next section, transformed the team's understanding of the theoretical space.

Theories of emotional relevance to situation

As a psychological, behavioral and affective state, curiosity is associated with a variety of arousal states, combining the aversive feeling of knowledge deprivation, the pleasure of knowledge acquisition, and the positive anticipation of new information (Litman, 2010, Jirout and Klahr, 2012). Much research suggests that curiosity and anxiety are co-activated in response to approach or avoidance of uncertainty, and there is an optimal threshold between curiosity and anxiety (Kashdan and Roberts, 2006). One explanation of the negative correlation between curiosity and anxiety is that the latter increases a preference for low-risk options, which prevents people from approaching uncertain scenario (Lerner et al., 2015).

The design of *Outbreak* aimed to incorporate opportunities for players to manage negative emotions around question-asking through play. This paper's key finding, that players expressed negative sentiments during game play but reported positive emotional reactions when looking back on their experiences in the game, suggests that players are indeed successfully managing or shifting their negative emotions. This specific pattern of results is consistent with a range of psychological constructs and theories pertaining to the relationship between arousal and emotion, including misattribution of arousal, benign masochism, and social facilitation theory. We consider the role each of these explanations plays in helping to account for the difference between participants' observed and self-reported emotional experiences of play.

Misattribution of Arousal

Cognitive reappraisal is a main emotion regulation approach that helps shift negative emotional states to more positive ones through reinterpreting the meaning of anxiety-inducing situation (Gross and John, 2003). Common reappraisal approaches involves eliminating negative arousal by helping people recognize that there is minimal threat or negative consequences (Hofmann, 2009), or enhancing positive arousal by emphasizing the pleasurable outcomes involved in the situation (Fredrickson, 2001). Previous research has demonstrated promising emotion regulation effects in fostering curiosity for young children by using intelligent learning companions to reduce anxiety for potential failure (e.g. "I love getting it wrong sometimes. This is how you learn new things") and elicit positive emotion relating to knowledge acquisition (e.g. "I love to learn") (Gordon, 2015). Cognitive reappraisal involves a relatively high cognitive demand, as it requires a two-step process: the subject has to first attribute causations of one's own emotional arousal, and then actively modify the meaning of the associated consequences. An alternative approach to cognitive reappraisal is to influence at the first step by changing the interpretation of the attribution. For example, research shows that by shifting the attribution of high arousal from anxiety to excitement based on their arousal congruency, people perform better in anxiety-inducing activities such as public speaking and math tasks (Brooks, 2014). Research also shows that by misattributing the source of arousal, unwanted effects of emotion on decision making can be reduced. There is an explicit link between behaviors and reported emotional states. In studies describing this phenomenon there is an observed difference between subjective reported experience of emotion and an objective measure of emotion. For example people may report: less situational anger when they can attribute negative feelings to drug-induced arousal, higher confidence in their ability to achieve tasks when they can attribute anxiety and nervousness to subliminal noise, and less error-related negative emotions when completing error-prone tasks when they could attribute aversive feelings towards a placebo pill.

As predicted by prior work, the challenges of question-asking (e.g., its perception as a socially risky, anxiety-inducing activity) may have produced heightened levels of arousal for players during the question-asking phase of the game. However, the game itself was designed to offer a number of arousal-inducing elements that could serve as plausible explanations for that heightened arousal. Our prior work showed, for example, that players are immediately well-attuned to the scary aspects of the game's theme and narrative. In fact, in early iterations of the game we found that if the arousal and/or anxiety induced by game elements (e.g., the use of scary music) was too high, it interfered with the success of the game's other mechanics to create a safe space to ask questions. For this reason, we believe that these competing explanations with high arousal congruency offered an opportunity for players to interpret their arousal in ways that were less threatening to their self-image and more conducive to their continued immersion in and enjoyment of the game experience. Indeed, prior work has demonstrated that when serious or learning activities are framed as a game, participants tend to view the activity more favorably (Lieberoth, 2015) – after all, games are "supposed to be" fun. Thus, after play, participants, as a result of misattributing the source of their arousal to the game's aesthetics, reflected on their experience of question-asking in a more positive light.

Benign Masochism

Relatedly, benign masochism describes the phenomenon where pleasure is derived from the realization that the brain has falsely interpreted an initially negative experience as threatening (Rozin et al., 2013). Examples of this phenomenon include eating spicy foods, riding roller coasters, and engaging with horror or suspense narratives. Benign masochism provides a framing for how and why players would enjoy or describe enjoying playing games with a haunted house theme. According to this viewpoint, players' heightened anxiety during the question-asking phase could have signaled to the brain that a threat was imminent, but, upon reflection, the safety of emerging from the experience produced pleasure. This pattern of "hedonic reversal" has been demonstrated in a number of related domains, including the enjoyment of horror films and haunted houses, in which the relief of escape and the recognition of safety can produce intense pleasure. Similar intensification of joyous emotion has been found due to leftover of excitation from previously experienced aversion feelings according to the excitation-transfer theory (Bryant, 2003). This interpretation of the findings assumes that the shift from negative to positive affect occurred at the end of the game, when players' "safety" was fully realized. This is arguably borne out by the finding that there was not a significant difference in sensed (negative) sentiment levels between the first and last rounds of question-asking.

Social Facilitation Theory

Finally, social facilitation theory posits that the mere presence of others heightens physiological arousal, which in turn increases the likelihood of individuals exhibiting their dominant response (i.e., the response that is the most automatic, well-learned, or likely to be the default for that context) (Zajonc, 1965). For example, in the presence of an audience expert pool players were shown to perform better (i.e., more accurate, better shots) while novices performed worse (i.e., less accurate, fewer shots). This theory suggests that players would experience a heightened level of arousal when playing a multi-player cooperative game (as compared to a solo game). This phenomenon may contribute to overall heightened levels of arousal that players might experience, thus supporting players in responding to the other built-in arousal-heightening elements and mechanisms of *Outbreak*. Social facilitation might also then help predispose participants towards emotional re-framing, misdirection, and reinterpretation. However, social facilitation theory predicts that players should experience similar levels of arousal during the question-asking and discussion phases of the game, since both involve players working in a group. This pattern was not observed in our data.

Discussion

Outbreak and theories of arousal

The design of *Outbreak* aimed to incorporate opportunities for players to manage negative emotions around question-asking through play. Through iterative play testing, we observed that players expressed negative sentiments during game play but reported positive emotional reactions when looking back on their experiences in the game, suggesting that players are indeed successfully managing or shifting their negative emotions. This specific pattern of results is consistent with a range of psychological constructs and theories pertaining to the relationship between arousal and emotion, including benign masochism, social facilitation theory, and misattribution of arousal. Interpreted through the lens of benign masochism theory, the discrepancy between the participants' observed and self-reported emotional experiences observed during game play and those reported by players post-game could reflect the affective shift that occurs when an initially negative experience, but, upon reflection, the safety of emerging from the experience produced pleasure. Findings could also be explained by referring to the social facilitation theory, that suggests that players would experience overall heightened levels of arousal when playing a multi-player cooperative game, which may in turn contribute to supporting players in responding to the other built-in arousal-heightening elements of *Outbreak*. Findings could also be explained by the phenomenon of misattribution of arousal. As predicted by prior work, both the challenges of question-asking (e.g., its perception as a socially risky, anxiety-inducing activity), and the design elements of the game could serve as plausible explanations for that heightened arousal. Thus, after play, participants, as a result of misattributing the source of their arousal to the game's aesthetics, reflected on their experience of question-asking in a more positive light.

Of course, without direct evidence of players' cognitive appraisals of their emotions, it becomes difficult to disentangle these theoretical explanations. While both benign masochism and misattribution of arousal involve key processes involved in interpreting the meaning of their feelings, they diverge in how the reconciliation between negative and positive emotions occurs. Benign masochism predicts a shift from negative to positive emotional experiences as the transition from perceived danger to safety occurs. In contrast, misattribution of arousal suggests that the shift happens not at the emotional level but at the level of interpretation preceding the experience of emotion (that is, the appraisal of the meaning and valence of one's felt arousal). In other words, benign masochism entails ambivalence (in the co-occurrence or shift between negative and positive emotions), whereas misattribution of arousal entails ambiguity (with the valence of experienced emotions dependent on how the brain interprets the cause of arousal).

The difficulty of differentiating between these two mechanisms as explanations of player emotion, and the potential discrepancy of real-time rating of "experiencing self" and retrospective report of "remembering self" due to bias of peak and end feelings (Kahneman, 2003), point to the need for additional measures, such as players' cognitive appraisals and real-time reports of affective experience, in future work. What we hope to have demonstrated is that games can indeed by designed to facilitate the manipulation or re-direction of player emotion, especially in ways that shift perceptions of content or behaviors that may elicit negative emotions when encountered outside the context of the game.

Finally, we observe that for positively coded events, the higher the arousal the more positive the valence and for negatively coded events, the higher the arousal the more negative the valence. This may indicate that participants are "correctly" attributing their arousal based on the valence of the game event. That is, this is in line with appraisal theories of emotion that suggest we use the context to interpret the meaning of our arousal, which leads to emotional experience in line with the valence of the contextual cue (Scherer, 2001). This may also align with our hypothesis that players are misattributing their arousal during play, although in this case they may be using contextual cues rather than game elements to make emotional attributions.

Process insights

In our prior work on Tandem Design we stressed the dual importance of defining transformational goals and producing game artifacts, presented a method for cycling between those two phases of game design, and shared a case study focused on game goals (To et al., 2016). The present work emphasizes how working with artifacts and playtest data can generate not just research insights, but new design goals. We accomplish this through the process of alignment, as shown in the case study above.

During our alignment process, we identified strategies that helped our interdisciplinary team accomplish critical tasks: 1) make sense of complex data, 2) retain the connection between artifact design and player data, and 3) translate research hypotheses into transformational design goals. We consider each of these challenges in turn.

Making sense of complex data. Post-playtesting, we had a range of data sources, including observational field notes, transcripts, audio and video, and quantitative measures. In our interdisciplinary design team, members had different levels of expertise in analyzing or interpreting data. Aligning the team members' understanding of the playtest data was therefore a challenge. To address this challenge, we assigned some team members to produce interpretable artifacts for each data source, such as data visualizations of the valence arousal data points. However, because the point of the process was *alignment among team members*, and utilize their range of expertise, we did not want to have the quantitative data, the qualitative data, the design team, etc. operate in a vacuum. We therefore connected the interpretable artifacts to one another. For example, the valence-arousal visualizations were discussed in the context of selected quotes and gameplay moments drawn from the qualitative data. One of the challenges faced while trying to intertwine multiple data artifacts was that different segments of data analysis progressed at different speeds. For instance, quantitative analysts were able to bring in new visualizations every week, while our qualitative coding process was slower. In future iterations of this process, we plan to allot proportional resources and time to keep the analyses concurrent.

Connecting artifact design and player data. In order to understand how to iterate the game, we needed to understand how our design decisions were driving the playtest findings we observed. However, in an iterative playtest process, it is not always possible to formally test every design decision. We needed to rely on game design analysis techniques, such as identifying and coding game events, to build hypotheses about what design decisions might be driving player reactions. While we were able to build on existing game design knowledge in the original design process for *Outbreak*, by connecting theories of curiosity to uncertainty in game design, the second phase of the process did not immediately suggest an existing body of game analysis literature to draw from (To et al., 2016). We addressed this issue by developing custom measures for our own game, such as game event prompts for self report. These events were chosen as significant game moments, and coded as positive, neutral, negative, or unclear, to provide fine-tuned insight about what event has an emotional effect on the player, and by what amount. However, this opens the possibility of disproportionately weighing some events and omitting others. One method to analyze emotion data that could have been used is to look at all significant deviations in valence and arousal in the sentiment analysis data points, and include all the game events corresponding to those deviations in the self report, in addition to what team members identified as significant events.

From research hypotheses to design goals. The purpose of this process is not just to develop research insights, but to identify ways to iterate *Outbreak* so that the game better aligns with its transformational goals. As part of the case study presented here, we identified three theories related to emotion that could explain our playtest findings. While there is value in disambiguating between the three theories, we asked to what extent these three theories implied different *design goals* or different *game design decisions*. For instance, while benign masochism predicts a positive emotional shift due to reduced perceived danger, misattribution of arousal suggests that the shift happens at the level of interpretation preceding the emotional experience, as opposed to the actual emotional experience. This helped us acknowledge that the extent to which reduction of perceived danger in the game design has an effect on the participants' emotional shift, is not certain. As part of this process, we also recognized that we could work toward increasing the emotional impact of *Outbreak* even before we disambiguated between the competing explanations for our findings. Our findings were not consistent with a pure social facilitation hypothesis, but they were consistent with both misattribution of arousal and benign masochism. In turn, both those theories suggest that adjusting the frightening elements of the game would affect player behavior. Hence, we are now exploring a redesign of *Outbreak* in which we amplify the scary or stressful game aesthetics to help players cope with emotionally or socially difficult learning tasks. Our model currently assumes that teams are *either* in a goal delineation *or* in a game design phase, and outlines the process our team followed in adjusting the goal, or iterating the game. We have found that sometimes the appropriate outcome for an alignment process is for the team *both* to adjust their goals (e.g. by performing research studies to disambiguate competing hypotheses) *and* to continue designing and iterating games.

Limitations and Future Work

We acknowledge that there may be multiple interacting psychological phenomenon that contribute to the gap between reported and observed affect during play. For example, although we strongly believe that players may be misattributing the source of their arousal, it is difficult to isolate this phenomenon with our current data. In order to understand the role of game theme and content in inducing or appearing to induce physiological arousal, further inquiry is required. For example, we could examine *Outbreak* players' emotional responses not only to game events but to game content. Additionally, in our sentiment analysis, we only examine the question-asking and discussion phases of the game. To explore whether or not participants are experiencing benign masochism we may want to examine post-round and post-game conversation to see how participants react to both the results of their discussion and decision making as well as the results of the game as a whole. This future research would allow us to isolate the psychological mechanism at play, discover ways to amplify it, and more reliably reproduce it in the future.

Nonetheless, there are still immediate implications for game designers who want to help players cope with anxiety-inducing or otherwise emotionally challenging tasks. Rather than avoiding additional potential stressors, designers can leverage scary or stressful game aesthetics to help players cope with emotionally or socially difficult learning tasks. The different psychological theories we consider in this paper imply that the mechanism for this coping behavior might manifest in different ways, but for many designs the two can be treated equivalently.

We recognize limitations in our iterative playtesting and data analysis cycle. Teams can intertwine multiple data artifacts collected during gameplay to better analyze contextual data. Proportional resource allotment to qualitative and quantitative data interpretations can also help collectively analyze large amounts of data better. In identifying significant game events based on designers' discretion, we come across the possibility of being biased, and disproportionately viewing all events. We also assume that teams are either in a game design or a goal deliation stage, but do not consider that the appropriate outcome for an alignment process for a team can be to adjust their goals and to continue designing and iterating games simultaneously.

There are also implications for the iterative design process and playtesting. In light of our findings, how do we interpret players' negative sentiments expressed during gameplay? When do negative sentiments mean the players are having a bad experience, and when does it mean that these alternate psychological mechanisms are being triggered? How does that interact with the ethics of working with children? If players are having a bad experience in the moment, even if they remember it fondly later and it contributes to long-term ability, should the play session continue? One way to approach answering these ethical questions is to develop new methods for analyzing players' emotional reactions. Here the distinction between mechanisms may become more meaningful (e.g., how can we register benign masochism before the player realizes the experience is benign?).

Related to this, in the immediate future we also plan to explore other avenues of research. We will continue to make design changes to *Outbreak*, introducing new sources of arousal through game content, theming, as well as a virtual peer player who can reflect, amplify, encourage, etc. the emotions the players express. We will explore this game design space and seek to identify potential differences in sources of arousal and their effect on misdirecting the source of anxiety as well as question-asking behavior. For instance, one redesign project initiated by the team after reaching this new theoretical understanding, is designing a scary and non-scary version of *Outbreak* and observing the differences in expressed and self-reported emotions, to understand the role of misattribution of arousal.

While misattribution of arousal and benign masochism are both theories about the individual, *Outbreak* is still a group game. It is therefore critical to understand how these mechanisms function at a group level as well as the contributing role of group phenomenon such as social facilitation. Future analysis will focus on both individual and group emotions. One way to explore this question is to develop a virtual peer player who can systematically affect the group-level behavior through interventions such as reflect, amplifying, encouraging, etc. the emotions that players express. We can use the virtual human player to identify the impact of group-level factors and inter-player interactions on players' emotional experiences both during and after play.

Finally, in considering these explanations, we must also rule out possible sources of bias in our measures. When collecting self-report data, there is always the possibility of response bias, and in particular the possibility of reporting more positive emotions in order to please the researchers (e.g., social desirability bias (Paulhus, 1991). In our data collection, we addressed this bias by making it clear that the researchers present were not involved in game design, and sought honest feedback from participants to improve the game. We observed that indeed, participants reported a range of positive and negative emotional experiences across game events, demonstrating that participants are willing to report negative feelings.

Conclusion

This paper describes the team's alignment process after playtesting *Outbreak* to make sense of findings around players' affective states during and after a transformational game that is designed to facilitate negative emotions such as anxiety aroused by inquisitive learning behaviors, in this case question-asking. We compare players' sentiment analysis of playtesters' in-game verbal responses during game phases with their post-game self-reported emotional data, to draw conclusions about playtesters' direct emotional responses to in-game mechanics against what they interpreted those emotional responses to be attributed to. In particular, we found an intriguing disparity between observed and self-reported sentiment, where players expressed negative sentiments during game play but reported positive emotional reactions on reflection of their in-game experience. These findings are consistent with explanations of misattribution of arousal or benign masochism, both of which deal with players' interpretations of their own feelings based on experiences in the game, but not with social facilitation theory, which is purely an effect of group play. We discuss how, as a team, we came to a common understanding of the playtest results, and how it lead us to explore several theories of emotion and affect. This exploration of emotional theories led us to develop a new shared understanding of the theoretical space, which in our future work, will influence the game design of *Outbreak*.

Additional research is needed to disambiguate benign masochism and misattribution of arousal as the mechanism, and to better understand group-level effects. This paper helps design teams in designing games with elements that promote positive learning by redirecting negative emotions around anxiety-inducing learning activities in group play, as well as make use additional theories to make sense of playtest data and bring a diverse team to a common understanding of the data.

Our playtest findings suggest that playtesters self-report no significant difference in their emotional states in high- and low-uncertainty game phases, while their verbal responses suggest otherwise. This leads us to the interpretation that intelligently-designed game mechanics successfully redirected playtesters' negative emotional response to high-uncertainty game phases to thematic and narrative game elements. Post alignment of the team on playtest findings, we present the goal delineation loop where the team reaches a new understanding of the theoretical space, which in turn influences defining new transformed goals for *Outbreak*.

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References

Brooks, A. W. (2014). Get excited: Reappraising pre-performance anxiety as excitement. Journal of Experimental Psychology: General, 143(3), 1144.

Bryant, J., & Miron, D. (2003). Excitation-transfer theory. In J. Bryant, D. Roskos-Ewoldsen, & J. Cantor (Eds.), Communication and emotion: Essays in honor of Dolf Zillmann (pp. 31-59). Mahwah, NJ: Erlbaum.

Culyba, S. (2015). Transformational Games: A Field Guide for Design Leaders. Unpublished manuscript

Flanagan, M., Punjasthikul, S., Seidman, M., Kaufman, G. (2013). Citizen Archivists at Play: Game Design for Gathering Metadata for Cultural Heritage Institutions. *Proceedings of DiGRA 2013, Atlanta, Georgia, August 2013.*

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. American psychologist, 56(3), 218.

Frens, J.W. & Hengeveld, B.J. (2013). To make is to grasp. 5th International Congress of International Association of Societies of Design Research (IASDR), 2630 August 2013, Tokyo Tokyo, Japan: Technische Universiteit Eindhoven.

Gordon, G., Breazeal, C., & Engel, S. (2015, March). Can children catch curiosity from a social robot?. In Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction (pp. 91-98). ACM.

Gross, J. J., and John, O. P. (2003).Individual differences in two emotion regulation. Processes: implications for affect, relationships and well-being. J. Pers.Soc. Psychol. 85, 348–362.

High, R. (2012). The era of cognitive systems: An inside look at IBM Watson and how it works. *IBM Corporation, Redbooks*.

Hofmann, S. G., Heering, S., Sawyer, A. T., & Asnaani, A. (2009). How to handle anxiety: The effects of reappraisal, acceptance, and suppression strategies on anxious arousal. Behaviour research and therapy, 47(5), 389-394.

Jirout, J., & Klahr, D. (2012). Children's scientific curiosity: In search of an operational definition of an elusive concept. *Developmental Review*, *32*(2), 125-160.

Kahneman, D., Kahneman, D., & Tversky, A. (2003). Experienced utility and objective happiness: A moment-based approach. The psychology of economic decisions, 1, 187-208.

Kashdan, T. B., & Roberts, J. E. (2006). Affective outcomes in superficial and intimate interactions: Roles of social anxiety and curiosity. *Journal of Research in Personality*, *40*(2), 140-167.

Kaufman, G., & Flanagan, M. (2015). A psychologically "embedded" approach to designing games for prosocial causes. Cyberpsychology: The Journal for Psychosocial Research on Cyberspace, article 5. doi: 10.5817/CP201535.

Kaufman, G., Flanagan, M., & Seidman, M. (2015). Creating stealth game interventions for attitude and behavior change: An "Embedded Design" model. In Proceedings of the Digital Games Research Association (DiGRA) Conference.

Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. *Annual Review of Psychology*, *66.*

Lieberoth, A. (2015). Shallow gamification: Testing psychological effects of framing an activity as a game. *Games and Culture*, *10*(3), 229-248.

Litman, J. A. (2010). Relationships between measures of I-and D-type curiosity, ambiguity tolerance, and need for closure: An initial test of the wanting-liking model of information-seeking. *Personality and Individual Differences*, *48*(4), 397-402.

Mahdikhani, M., Soheilahamzehloo., Maryamshayestefard., and Mahdikhani, N. (2008). "Student participation in classroom discourse." vol.5, no. 6, pp. 1422–1431.

Mohammed, S., and Dumville, B. C. (2001). "Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries" in *Journal of Organizational Behavior* 22, no. 2, pp. 89-106.

Nielsen, J. (1993). Iterative userinterface design. Computer, 26(11), 3241.

Paulhus, D. L. (1991). Measurement and control of response bias.

Rocca, C.H., Krishnan, S., Barrett, G. and Wilson, M. (2010). "Measuring pregnancy planning: An assessment of the London Measure of Unplanned Pregnancy among urban, south Indian women." Demographic research, vol. 23, p.293.

Rozin, P., Guillot, L., Fincher, K., Rozin, A., & Tsukayama, E. (2013). Glad to be sad, and other examples of benign masochism. *Judgment and Decision Making, 8*(4), 439.

Seidman, M., Flanagan, M., & Kaufman, G. (2015). Failed games: Lessons learned from promising but problematic game prototypes in designing for diversity. In *Proceedings of the Digital Games Research Association (DiGRA) Conference*.

Scherer, K. R., Schorr, A., & Johnstone, T. (Eds.). (2001). *Appraisal processes in emotion: Theory, methods, research*. Oxford University Press.

To, A., Ali, S., Kaufman, G., Hammer, J. (2016). Integrating Curiosity and Uncertainty in Game Design. In Proc. DiGRA/FDG 2016.

To, A., Holmes, J., Fath, E., Zhang, E., Kaufman, G., & Hammer, J. (2017). Modeling and Designing for Key Elements of Curiosity: Risking Failure, Valuing Questions. Proceedings of DiGRA 2017.

To, A., Fath, E., Zhang, E., Ali, S., Kildunne, C., Fan, A., … & Kaufman, G. (2016). Tandem Transformational Game Design: A Game Design Process Case Study. In Proceedings of the International Academic Conference on Meaningful Play. Awards: Best Student Non-Digital Game, *Outbreak*, People's Choice Award, *Outbreak*.

Tozour, P. (2015, January 13). The game outcomes project, part 3: Game development factors. Retrieved from http://www.gamasutra.com/blogs/PaulTozour/20150113/233922/The_Game_Outcomes_Project_Part_3_Game_Development_Factors.php#DesignRiskManagement

Zajonc, R. B. (1965). Social facilitation. *Science, 149*(3681), 269-274.

Zimmerman, J., & Forlizzi, J. (2014). Research through design in HCI. In Ways of Knowing in HCI (pp. 167189). Springer New York

AN AUGMENTED REALITY ENVIRONMENT FOR ENHANCING CLINICAL TRAINING EXPERIENCE: STROKE ASSESSMENT SIMULATION

Stroke Assessment Simulation

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Abstract

The development of virtual, augmented, and mixed reality in recent years is opening doors for using VR, AR and MR devices in education. The purpose of this study was to test the use of augmented reality in teaching healthcare practitioners. To conduct our research, a simulation application was developed for the HoloLens that projects a face displaying facial drooping (a symptom of stroke) onto a training mannequin. Students at the nursing school were then placed in a clinical simulation wherein they wore the Microsoft HoloLens and performed an assessment of their mannequin patient. The students participated in a survey following their simulations and provided feedback on the devices and the quality of their experience. The results of the study show that most students enjoyed the simulation and felt that VR and AR would be a very useful educational tool in the near future. Further development of the program and device is underway, and future tests will be conducted. The results from this study will be helpful in further progressing the development of mixed reality, and the use of these devices in healthcare training.

Stroke is one of the major causes of death and long-term disability in the United States. On average every 40 seconds, someone in the country suffers from stroke (American Heart Association, 2017). Several studies show that the stroke treatment provided in an acute stroke unit is able to improve the patient's functional ability and decrease the length of stay (Aebersold, Kocan, Tschannen, & Michaels, 2011; Chang, Llinas, Chen, Llinas, & Marsh, 2018; Roquer et al., 2008; Saposnik et al., 2009; Terént et al., 2009). Early detection and intervention is the best way to minimize the permanent damage to the patient who is experiencing a stroke (Cavallini, Micieli, Marcheselli, & Quaglini, 2003; Jauch et al., 2013).

While much work has been done to increase awareness in the community and training for first responders and emergency room staff to recognize and respond to patients with stroke, there is still work that needs to be done to train nursing staff on the inpatient units in our hospitals. Strokes can and do occur when patients are hospitalized for other conditions such as hip fractures, heart conditions or respiratory illnesses. Nurses need to be prepared to quickly recognize and respond to a patient having a stroke. Bunch, Nunziato and Labovitz (2012) found that patients who were already in the hospital being treated for something else and experienced a stroke were not always able to get tPA, a medication that can lessen the impact of an ischemic stroke. In their single site study, they found only 10/24 patients who could have received tPA were able to receive it. The largest modifiable reason they did not receive it was because their symptoms were not recognized within the required three-hour window. This could be addressed by training staff (most likely nurses) to recognize and quickly and correctly respond to stroke symptoms.

Mixed Reality for education

Mixed reality (MR) is one of the methods which can enhance the learning experience, due to its ability to provide an immersive learning experience as well as an interactive learning experience for students (Freitas & Neumann, 2009; Pan, Cheok, Yang, Zhu, & Shi, 2006). Mixed reality provides natural interactions with the real world and virtual objects (Azuma, 1997; Mann, Furness, Yuan, Iorio, & Wang, 2018), which extends and enhances the Virtual Reality (Hung, Liu, Liang, & Kang, 2016; Talmaki & Kamat, 2014) and Augmented Reality (Akula et al., 2013; Behzadan, Iqbal, & Kamat, 2011; Behzadan & Kamat, 2006, 2009, 2011; Kamat & Behzadan, 2006). Much experience-based knowledge, such as hospital patient room design (Dunston, Arns, Mcglothlin, Lasker, & Kushner, 2011) or evidence-based practice guidelines in healthcare (Aebersold, 2011), are more accessible to deliver through the application of MR. The virtual environment, e.g., Second Life® (Linden Lab, 2018)—a three-dimensional, online, multiplayer, interactive virtual environment, has been broadly used in nursing education (Aebersold, Tschannen, Stephens, Anderson, & Lei, 2012; Aebersold et al., 2015; Caylor, Aebersold, Lapham, & Carlson, 2015). On the other hand, the experience of the team collaboration or multi-professional learning can also be practiced in the MR environment (Caylor et al., 2015; Dong, Behzadan, Feng, & Kamat, 2013; Wu et al., 2017).

The recent growth of the augmented reality (AR) and virtual reality (VR) headset commercialization and the demand expedites the application of MR in healthcare (Kobayashi, Zhang, Collins, Karim, & Merck, 2018; Shirer, Mainelli, & Ubrani, 2018). The use of the headset such as the HTC Vive, Oculus Rift, Samsung Gear, or Microsoft HoloLens to provide education to healthcare education and medical personnel has become widespread (Zhu, Hadadgar, Masiello, & Zary, 2014). One of the primary advantages of MR simulation is to imitate the real world medical situation without putting actual patients at risk (Aebersold et al., 2011).

This pilot introduces new technology, using the HoloLens (Microsoft) to project an animated face onto a computerized mannequin (SimMan3G-Laerdal) in order to help nursing students recognize early stroke warning signs in patients who are not admitted for a stroke but who suddenly development one. The research questions in this pilot are:

1. Is the HoloLens an acceptable technology for the nursing students to use in simulation?
2. Were the nursing students able to complete the care of their patient including recognizing the stroke and completing a stroke screen (FAST)?

Methods

In this research, the AR simulation is applied to project the stroke animation on the head and face of the mannequin patient. When nursing students wear the AR device, they will see the animated face/head model on the mannequin patient. The stroke animation will be triggered after a predefined time for students to assess. The student's action can be evaluated by the instructor, as the simulation unfolds.

Device and Application

Microsoft HoloLens was utilized as the AR device in our simulation. The HoloLens is capable of projecting a 3D model into an open space or onto the desired location. The users can look or walk around, and the model will still be mounted at the same location. The HoloLens also includes some predefined gestures and voice control allowing users to interact with the model, as shown in Figure 1. To assign the projecting location, the AprilTag (Olson, 2011) was used as the AR sticker for the HoloLens to track the location. The AprilTag was placed on the head of the mannequin patient, as shown in Figure 2, and the HoloLens projected the 3D animated model based on the location of the AprilTag. An AR refining algorithm, KEG algorithm (Feng & Kamat, 2013), was applied to stabilize the model. After the model was placed at the correct location, it can be secured by the gesture control.

Figure 1: HoloLens using gesture control by a nursing student

Figure 2: The AR sticker (AprilTag) was attached to the mannequin patient

Stroke Simulation

The stroke simulation was designed for nursing students to evaluate their ability to recognize the patient was having stroke-like signs and to then perform the FAST stroke assessment (American Heart Association, 2018; Harbison et al., 2003). One scenario was developed for the simulation. After obtaining institutional review board (IRB) approval groups of 2–3 students participated in the simulation. At the beginning of the scenario, the patient said they felt uncomfortable, then stated, "something wasn't right' and their speech was garbled. The student nurse needed to identify symptoms, conduct the FAST assessment (check for the facial drooping, arm weakness, speech difficulties, and recognize time was important to verify that the patient is having a stroke) and proceed with the correct procedure (contact the stroke team or rapid response team).

The whole scenario took about 5–10 minutes and would end once the student finished all the required assessments and reacted accordingly or after 15 minutes. The facial drooping animation was triggered one minute after starting the simulation scenario when the student began her/his basic assessment stopped 30 seconds later. The animation could also be triggered by gesture control. Therefore, the instructor could decide when to trigger the change based on the student's action.

Evaluation

An evaluation survey of the stroke simulation was conducted following each simulation. A total of 33 questions were listed in the survey. The students rated their experience on devices and the quality of the simulation using a five-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree). The students were also asked to provide their familiarity with VR, AR, and MR.

Results

The simulations were conducted between November 2017 and March 2018 in the simulation center. Eighty-five nursing students participated in the stroke simulation. Table 1 illustrated the detailed perceptions of the AR stroke simulation. Among the experience with VR/AR, 88.2% (n=75) of the students had heard of the two before, but 76.5% (n=65) of them could not explain the difference between the two. Only 3 out of 85 students had used VR/AR in their healthcare training prior to the stroke simulation. For the opinion on using the HoloLens in learning, 82.4% (n=70) of them agreed that the 3D animated facial model could help them assess the patient and recognized stroke symptoms, and 91.8% (n=78) of them were able to find the stroke symptoms themselves. In addition, 68.2% (n=58) of them felt they could assess a real patient following the stroke simulation. The most common responses for what people liked best about the HoloLens were that it was a new and exciting way to learn and that it made the simulation more realistic. On the other hand, the most common responses for what people liked least about the HoloLens were that it was heavy or uncomfortable, especially for the glasses wearers. They also suggested including the whole-body 3D model, instead of the head-only model.

For the perception of the HoloLens, 54.1% (n=46) of the students thought the HoloLens was comfortable to wear, but 27.1% of them disagreed, and 24.7% (n=21) of them felt impaired. Only 6 out of 85 students felt dizzy when wearing the HoloLens. Regarding the technical part, 61.2% (n=52) of the students found the facial model to be stable, and 80% of them found the model to be clear.

	Strongly agree	Agree	Neither	Disagree	Strongly disagree
Prior experience with VR/AR					
Heard of VR/AR before	88.2%				11.8%
Could explain the difference	4.7%	18.8%	14.1%	47.0%	15.4%
Played VR game before	24.7%				75.3%
Used VR device before	23.5%				76.5%
Played AR game before	35.7%				64.3%
Used AR device before	4.7%				95.3%
Participated in training simulation before	89.4%				10.6%
Perception of HoloLens					
Felt itchy	1.2%	4.7%	11.8%	50.6%	31.7%
Felt pain	1.2%	14.1%	9.4%	47.1%	28.2%
Felt dizzy	1.2%	5.9%	8.2%	51.8%	32.9%
Felt heavy	8.2%	44.7%	10.6%	22.4%	14.1%
Saw clearly	7.1%	60.0%	16.5%	15.3%	1.1%
Felt impaired	2.4%	22.4%	21.2%	49.4%	4.6%
Facial model stable	7.1%	54.1%	11.8%	21.2%	5.8%
Facial model clear	12.9%	67.1%	9.4%	8.2%	2.4%
Facial drooping clear	37.6%	56.5%	1.2%	4.7%	0%
Found the stroke symptoms	35.3%	56.5%	4.7%	3.5%	0%
Opinion on using the HoloLens in learning					
Novel features for learning	7.0%	69.4%	18.8%	3.5%	1.3%
Help them assess patient	11.7%	67.1%	11.8%	9.4%	0%
Recognize stroke symptoms	11.8%	70.6%	10.6%	7.0%	0%
Could assess a real patient	14.1%	54.1%	20.0%	9.4%	2.4%
Closer to a real person	20.0%	56.5%	10.6%	12.9%	0%
Help them learn about stroke	15.3%	62.4%	9.4%	12.9%	0%
A useful simulation tool	17.7%	56.5%	15.3%	8.2%	2.3%

Table 1: Overall perception of the AR stroke simulation (n=85)

Conclusion

In a clinic simulation learning environment, it is difficult to portray stroke symptoms using a computerized mannequin because there is no way to alter the facial features to show facial droop or asymmetry. Using the mix of augmented reality and simulation mannequins allows educators to provide more realism in their simulation experiences. The feedback from the students demonstrating their agreement that this was an exciting way to learn and adds to the realism. The future works of this research are first to continue to perfect the animation model, that is, making it more stable as well as different types of facial expression. Second, the method of eliminating the need for placing the fiducial marker on the forehead of the mannequin will be explored, for example, object recognition algorithm (Liang, Kamat, & Menassa, 2018) or pose estimation method (Liang, Lundeen, et al., 2018).

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References

Aebersold, M. (2011). Using simulation to improve the use of evidence-based practice guidelines. *Western Journal of Nursing Research*, *33*(3), 296–305. https://doi.org/10.1177/0193945910379791

Aebersold, M., Kocan, M. J., Tschannen, D., & Michaels, J. (2011). Use of simulation in stroke unit education. *Journal of Neuroscience Nursing, 43*(6), 349–353. https://doi.org/10.1097/JNN.0b013e318234e9ca

Aebersold, M., Tschannen, D., Stephens, M., Anderson, P., & Lei, X. (2012). Second Life®: a new strategy in educating nursing students. *Clinical Simulation in Nursing*, *8*(9), e469–e475. https://doi.org/10.1016/j.ecns.2011.05.002

Aebersold, M., Villarruel, A., Tschannen, D., Valladares, A., Yaksich, J., Yeagley, E., & Hawes, A. (2015). Using a virtual environment to deliver evidence-based interventions: the facilitator's experience. *JMIR Serious Games*, *3*(2), e5. https://doi.org/10.2196/games.4293

Akula, M., Lipman, R. R., Franaszek, M., Saidi, K. S., Cheok, G. S., & Kamat, V. R. (2013). Real-time drill monitoring and control using building information models augmented with 3D imaging data. *Automation in Construction*, *36*, 1–15. https://doi.org/10.1016/j.autcon.2013.08.010

American Heart Association. (2017). Heart disease and stroke statistics—2017 update. *Circulation*, *135*. https://doi.org/10.1161/CIR.0000000000000485

American Heart Association. (2018). Stroke warning signs and symptoms. Retrieved June 19, 2018, from http://www.strokeassociation.org/STROKEORG/WarningSigns/Stroke-Warning-Signs-and-Symptoms_UCM_308528_SubHomePage.jsp

Azuma, R. T. (1997). A survey of augmented reality. *Presence: Teleoperators and Virtual Environments*, *6*(4), 355–385. https://doi.org/10.1162/pres.1997.6.4.355

Behzadan, A. H., Iqbal, A., & Kamat, V. R. (2011). A collaborative augmented reality based modeling environment for construction engineering and management education. *Proceedings of the Winter Simulation Conference (WSC)*, 3568–3576. https://doi.org/10.1109/WSC.2011.6148051

Behzadan, A. H., & Kamat, V. R. (2006). Animation of construction activities in outdoor augmented reality. *Proceedings of the Joint International Conference on Computing and Decision Making in Civil and Building Engineering (ICCCBE)*, 1135–1143. Montréal, Canada.

Behzadan, A. H., & Kamat, V. R. (2009). Interactive augmented reality visualization for improved damage prevention and maintenance of underground infrastructure. *Proceedings of the Construction Research Congress (CRC)*, 1214–1222. https://doi.org/10.1061/41020(339)123

Behzadan, A. H., & Kamat, V. R. (2011). Integrated information modeling and visual simulation of engineering operations using dynamic augmented reality scene graphs. *Journal of Information Technology in Construction (ITcon), 16*(17), 259–278. Retrieved from http://www.itcon.org/paper/2011/17

Bunch, M. E., Nunziato, E. C., & Labovitz, D. L. (2012). Barriers to the use of intravenous tissue plasminogen activator for in-hospital strokes. *Journal of Stroke and Cerebrovascular Diseases, 21*(8), 808–811. https://doi.org/10.1016/j.jstrokecerebrovasdis.2011.04.012

Cavallini, A., Micieli, G., Marcheselli, S., & Quaglini, S. (2003). Role of monitoring in management of acute ischemic stroke patients. *Stroke, 34*(11), 2599–2603. https://doi.org/10.1161/01.STR.0000094423.34841.BB

Caylor, S., Aebersold, M., Lapham, J., & Carlson, E. (2015). The use of virtual simulation and a modified TeamSTEPPSTM training for multiprofessional education. *Clinical Simulation in Nursing, 11*(3), 163–171. https://doi.org/10.1016/j.ecns.2014.12.003

Chang, A., Llinas, E. J., Chen, K., Llinas, R. H., & Marsh, E. B. (2018). Shorter intensive care unit stays? The majority of post-intravenous tPA (tissue-type plasminogen activator) symptomatic hemorrhages occur within 12 hours of treatment. *Stroke, 49*(6), 1521–1524. https://doi.org/10.1161/STROKEAHA.118.021398

Dong, S., Behzadan, A. H., Feng, C., & Kamat, V. R. (2013). Collaborative visualization of engineering processes using tabletop augmented reality. *Advances in Engineering Software, 55*, 45–55. https://doi.org/10.1016/j.advengsoft.2012.09.001

Dunston, P. S., Arns, L. L., Mcglothlin, J. D., Lasker, G. C., & Kushner, A. G. (2011). An immersive virtual reality mock-up for design review of hospital patient rooms. In X. Wang & J. J.-H. Tsai (Eds.), *Collaborative Design in Virtual Environments* (pp. 167–176). https://doi.org/10.1007/978-94-007-0605-7_15

Feng, C., & Kamat, V. R. (2013). Plane registration leveraged by global constraints for context-aware AEC applications. *Computer-Aided Civil and Infrastructure Engineering, 28*(5), 325–343. https://doi.org/10.1111/j.1467-8667.2012.00795.x

Freitas, S. de, & Neumann, T. (2009). The use of 'exploratory learning' for supporting immersive learning in virtual environments. *Computers & Education, 52*(2), 343–352. https://doi.org/10.1016/j.compedu.2008.09.010

Harbison, J., Hossain, O., Jenkinson, D., Davis, J., Louw, S. J., & Ford, G. A. (2003). Diagnostic accuracy of stroke referrals from primary care, emergency room physicians, and ambulance staff using the face arm speech test. *Stroke, 34*(1), 71–76. https://doi.org/10.1161/01.STR.0000044170.46643.5E

Hung, W.-H., Liu, C.-W., Liang, C.-J., & Kang, S.-C. (2016). Strategies to accelerate the computation of erection paths for construction cranes. *Automation in Construction*, *62*, 1–13. https://doi.org/10.1016/j.autcon.2015.10.008

Jauch, E. C., Saver, J. L., Adams, H. P., Bruno, A., Connors, J. J. (Buddy), Demaerschalk, B. M., … Yonas, H. (2013). Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the american heart association/american stroke association. *Stroke*, *44*(3), 870–947. https://doi.org/10.1161/STR.0b013e318284056a

Kamat, V. R., & Behzadan, A. H. (2006). GPS and 3DOF tracking for georeferenced registration of construction graphics in outdoor augmented reality. *Proceedings of the EG-ICE International Workshop on Intelligent Computing in Engineering and Architecture*, 368–375. Ascona, Switzerland: Springer, Berlin, Heidelberg.

Kobayashi, L., Zhang, X. C., Collins, S. A., Karim, N., & Merck, D. L. (2018). Exploratory application of augmented reality/mixed reality devices for acute care procedure training. *Western Journal of Emergency Medicine*, *19*(1), 158–164. https://doi.org/10.5811/westjem.2017.10.35026

Liang, C.-J., Kamat, V. R., & Menassa, C. C. (2018). Real-time construction site layout and equipment monitoring. *Proceedings of the Construction Research Congress*, 64–74. https://doi.org/10.1061/9780784481264.007

Liang, C.-J., Lundeen, K. M., McGee, W., Menassa, C. C., Lee, S., & Kamat, V. R. (2018). Stacked hourglass networks for markerless pose estimation of articulated construction robots. *Proceedings of the International Symposium on Automation and Robotics in Construction (ISARC)*, 859–865. Berlin, Germany: IAARC.

Linden Lab. (2018). Second Life – virtual worlds, virtual reality, VR, avatars, free 3D chat. Retrieved June 15, 2018, from https://secondlife.com/

Mann, S., Furness, T., Yuan, Y., Iorio, J., & Wang, Z. (2018). All reality: virtual, augmented, mixed (x), mediated (x,y), and multimediated reality. *ArXiv:1804.08386 [Cs]*. Retrieved from http://arxiv.org/abs/1804.08386

Olson, E. (2011). AprilTag: a robust and flexible visual fiducial system. *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, 3400–3407. https://doi.org/10.1109/ICRA.2011.5979561

Pan, Z., Cheok, A. D., Yang, H., Zhu, J., & Shi, J. (2006). Virtual reality and mixed reality for virtual learning environments. *Computers & Graphics*, *30*(1), 20–28. https://doi.org/10.1016/j.cag.2005.10.004

Roquer, J., Rodríguez-Campello, A., Gomis, M., Jiménez-Conde, J., Cuadrado-Godia, E., Vivanco, R., … Ois, A. (2008). Acute stroke unit care and early neurological deterioration in ischemic stroke. *Journal of Neurology*, *255*(7), 1012–1017. https://doi.org/10.1007/s00415-008-0820-z

Saposnik, G., Kapral, M. K., Coutts, S. B., Fang, J., Demchuk, A. M., & Hill, M. D. (2009). Do all age groups benefit from organized inpatient stroke care? *Stroke*, *40*(10), 3321–3327. https://doi.org/10.1161/STROKEAHA.109.554907

Shirer, M., Mainelli, T., & Ubrani, J. (2018, March 19). Demand for augmented reality/virtual reality headsets expected to rebound in 2018, says IDC. Retrieved June 17, 2018, from IDC: the premier global market intelligence company website: https://www.idc.com/getdoc.jsp?containerId=prUS43639318

Talmaki, S., & Kamat, V. R. (2014). Real-time hybrid virtuality for prevention of excavation related utility strikes. *Journal of Computing in Civil Engineering*, *28*(3), 04014001. https://doi.org/10.1061/(ASCE)CP.1943-5487.0000269

Terént, A., Asplund, K., Farahmand, B., Henriksson, K. M., Norrving, B., Stegmayr, B., … Åsberg, S. (2009). Stroke unit care revisited: who benefits the most? A cohort study of 105 043 patients in Riks-Stroke, the Swedish Stroke Register. *Journal of Neurology, Neurosurgery and Psychiatry*, *80*(8), 881–887. https://doi.org/10.1136/jnnp.2008.169102

Wu, T.-H., Wu, F., Liang, C.-J., Li, Y.-F., Tseng, C.-M., & Kang, S.-C. (2017). A virtual reality tool for training in global engineering collaboration. *Universal Access in the Information Society*, 1–13. https://doi.org/10.1007/s10209-017-0594-0

Zhu, E., Hadadgar, A., Masiello, I., & Zary, N. (2014). Augmented reality in healthcare education: an integrative review. *PeerJ*, *2*, e469. https://doi.org/10.7717/peerj.469

PLAYING FOR THE FUTURE: A PICTURE BOOK APP FOR CULTURAL RECLAMATION AND RECONCILIATION

A Picture Book App for Cultural Reclamation and Reconciliation

MAVIS REIMER

Abstract

This presentation emerges from a collaborative research project that is developing a series of picture book apps to support the grassroots cultural resurgence of the Rocky Cree people of northern Manitoba, Canada. Drawing on Anishinaabe digital game scholar Elizabeth LaPensée's claim that Indigenous games can serve as acts of survivance, "merging survival with endurance in a way that recognizes Indigenous peoples as thriving rather than merely surviving" (2017), the team seeks to decolonize technological tools and tropes and to explore the ways in which the gamification of education can support the goals of decolonization and reconciliation. The presentation recounts the challenges of developing game elements that honour the specificity of Rocky Cree worldviews and utilize what La Pensée calls culturally appropriate mechanics, including "slowing down, listening, making choices, revisiting paths, and interpreting the journey," focusing specifically on two games: Packing the Canoes and Gathering a Bundle.

This paper discusses a collaborative research project being undertaken by Indigenous and non-Indigenous researchers to develop a series of picture book apps to support the grassroots cultural resurgence of the Asiniskow Ithiniwak (Rocky Cree) of northern Manitoba, Canada. Drawing on Anishinaabe digital game scholar Elizabeth LaPensée's claim that Indigenous digital games can serve as acts of survivance, "merging survival with endurance in a way that recognizes Indigenous peoples as thriving rather than merely surviving" (2017), collaborators seek to decolonize technological tools and tropes and to explore the ways in which the gamification of education can support the goals of decolonization and reconciliation.

In 1993, two men from South Indian Lake in northern Manitoba found the eroding burial site of a woman who was named Kayasochi Kikawenow, or Our Mother From Long Ago, by elders of the O-Pipon-Na-Piwin Cree Nation (OPCN). Archaeologists from The Manitoba Museum in Winnipeg determined that the young woman had lived some 350 years ago and was buried about 1660 CE. This is the protocontact period in Manitoba history: Kikawenow would have heard about but never encountered non-Aboriginal people appearing in the land. OPCN elders understood the revelation of the burial site as a gift from the ancestors to support the reclamation of their culture, one that was "to be used by our youth to learn about the old ways and gain respect for the past" (Brownlee & Syms, 1999). When young people know and respect their past, they said, they can imagine and create a successful future. The research results were published by the Museum, but the accessibility of the teachings to young people remained a concern for community member, educator, storyteller, and knowledge keeper William Dumas. In 2008, at his invitation, a research team based at the Centre for Research in Young People's Texts and Cultures (CRYTC) at the University of Winnipeg, worked with him to develop a historical picture book for young people that sought to re-animate the life and times of Our Mother From Long Ago. Entitled *Pīsim Finds Her Miskanow*, the book tells the story of thirteen-year-old Pīsim, the fictional name Dumas chose for Kikawenow, as her family prepares for and then undertakes the journey to the Spring Gathering of her extended kinship group. At the edges of the story are blocks of supplementary information in the form of regional maps, Cree vocabulary, descriptions of material objects, transcriptions of songs and stories, and accounts of cultural traditions. In 2014, the Canadian Archaeological Association honoured Dumas and illustrator Leonard Paul with a Public Communications Award "in recognition of their outstanding contributions to Canadian archaeology."

The team is now working to transmediate the picture book into an app. (Over the seven years of the project, there will be a total of six picture books and six picture book apps developed.) The app will retain the aesthetic look and feel of the story and illustrations of the narrative strand of the picture book, while the supplementary informational texts (known to the project team as "story notes") will become pop-up modals. At several points in the app, readers/players will be invited to explore aspects of Rocky Cree language and culture through games. The paper presented at Meaningful Play 2018 discusses the project team's challenges and processes in developing game elements for the *Pīsim* app that honour the specificity of Rocky Cree worldviews and utilize what La Pensée calls culturally appropriate mechanics, including "slowing down, listening, making choices, revisiting paths, and interpreting the journey" (2017). The paper focuses specifically on two games: Packing the Canoes and Gathering a Bundle.

The Packing the Canoes game is a simple drag-and-drop game, where players are asked to decide which of a variety of items from their home camp should be taken with the family group on the five-day paddle to the site of the Spring Gathering. This game is inserted at a moment in the story that is focused on the plot event of setting out, and is a way of slowing down readers as they consider the journey ahead and make choices with regard to that journey. There is very little attention paid either in the text or illustration of the picture book to the details of the camp furnishings. An initial challenge, then, was to figure out these details. This involved a visit to one of our partner communities in northern Manitoba for a sharing circle—a widely used Rocky Cree research method (Sitchon, 2013)—with a group of land-based knowledge keepers, in this case, men who continue to travel across the lakes of their region to hunt and fish. What we learned was that the question of what is left behind is at least as important as the question of what is taken. In pursuing explanations for some of the choices that seemed obvious to the land users, we recognized that the game was much more meaningful than merely teaching facts about Rocky Cree adaptation to their places. Rather, these practices were an expression of a fundamentally different set of values from those that inform contemporary consumer culture.

The Gathering a Bundle game is a collections/item inventory game, but one that removes the elements of competition and accumulation (such as players scoring different levels of achievement or winning badges), and allows players rather to assemble story notes that are particularly meaningful or interesting to them and to save this collection of knowledge to their own bundles. In Cree culture, the bundle is a collection of objects that hold the memories and knowledges of an individual or group; in the app, the bundle will serve as a way for players to revisit their paths through the story and to interpret their journeys. This game was developed as an alternative to a proposal by our app development company to build a Find Your Miskanow (or Life Path) game that would reference the main theme of the book as expressed in its title. When we took the Find Your Miskanow game to our community partners, the knowledge keepers were first perplexed and then alarmed at the wrongheadedness of the assumptions embedded in the proposed game. By mediating between the app developers, who are accustomed to working within Western game tropes, and Indigenous knowledge keepers, who are grounded in the Rocky Cree worldview, we are striving to resist a reinforcement of dominant cultural behaviours while ensuring that the games retain clarity and usability for the user experience and interface.

Natalia Kucirkova (2016) has postulated that effective collaborative research, practice, and design for apps require that "a clear epistemology" be shared by all stakeholders. This is not the circumstance in which the Six Seasons collaboration is operating. The project was formulated in the aftermath of the final report of the Truth and Reconciliation Commission of Canada (TRC) (2015) and is funded by a national granting council in Canada that is committed to sponsoring projects that will advance reconciliation between Indigenous and non-Indigenous Canadians. Such reconciliation, the final report of the TRC concludes, must be "based on mutual recognition, mutual respect, and shared responsibility for maintaining those relationships into the future." The research team understands these to be our overarching objectives. It is increasingly clear to us, however, that "recognition" and "respect" are iterative processes within the long journey toward reconciliation rather than preconditions to be achieved before setting out.

References

Brownlee, K., & Syms, E. L. (1999). *Kayasochi Kikawenow: Our Mother From Long Ago*. Winnipeg, MB: Manitoba Museum of Man and Nature.

Dumas, W., & Paul, L. (2013). *Pīsim Finds Her Miskanow*. Winnipeg, MB: HighWater.

Kurcirkova, N. (2016). iRPD – A Framework for Guiding Design-Based Research for iPad Apps. *British Journal of Educational Technology, 48* (2), 598-610. doi: 10.1111/bjet.12389.

LaPensée, E. (2017). Transformations and Remembrances in the Digital Game *We Sing for Healing*. *Transmotion, 3*(1), 89-108. Retrieved from https://journals.kent.ac.uk/index.php/transmotion/article/view/243/1002

Sitchon, M. (2013). Renewing Relationships at the Centre: Generating a Postcolonial Understanding of Asiniskow Ithiniwak (Rocky Cree) Heritage. Retrieved from University of Manitoba Electronic Theses and Dissertations. URI: http://hdl.handle.net/1993/22081.

Truth and Reconciliation Commission of Canada. (2015). *Honouring the Truth, Reconciling for the Future: Summary of the Final Report of the Truth and Reconciliation Commission of Canada*. Retrieved from http://www.trc.ca/websites/trcinstitution/File/2015/Findings/Exec_Summary_2015_05_31_web_o.pdf

"ONCE UPLOADED, THIS CANNOT BE UNDONE": OSMOTIC STUDIOS' ORWELL AS DYSTOPIAN SIMULATION OF PARTICIPATORY SURVEILLANCE.

"Once uploaded, this cannot be undone"

JUSTIN WIGARD

Taking place over the course of five days in an alternate version of the United States from April 12, 2017 – April 16, 2017, *Orwell* (Osmotic Studios, 2016) places the player in the role of a state operative monitoring suspects related to an antigovernmental terrorist plot through ORWELL: a digital security system that archives items of interest ("datachunks") related to ongoing investigations. At first glance, the game draws on George Orwell's *Nineteen Eighty-Four* in two ways: directly referencing the author's name, and creating a similar narrative concerning dystopia and surveillance. As play progresses, players move from reading public information to listening in on private conversations to invading personal computers, cell phones and other private devices. With this information, the player must make significant narrative decisions concerning which datachunks to upload to the authorities, how invasive is too invasive and ultimately, who to implicate in the originating terrorist plot, warranting critical investigation into the relationship between the game's surveillant play, the mode of surveillance in *Nineteen Eighty-Four*, and contemporary surveillance practices.

This essay will explore generic connections between George Orwell's *Nineteen Eighty-Four* and a recent video game spiritual successor, Osmotic Studio's aptly-named *Orwell*, as a means of understanding the player-character-role dynamic in the simulation genre. I argue that by participating in an ongoing confrontation with societal surveillance as grounded in *Nineteen Eighty-Four*, *Orwell* (Osmotic Studios, 2016) operates as a critical dystopia warning of the sociopolitical stakes in the governance of social media through the participatory concept of play. Here, play is invoked as a mode of participation in *Orwell* (Osmotic Studios, 2016), wherein the player's actions and choices concerning truth, privacy and reporting have narrative consequences. Because the player inhabits the role of a governmental security agent monitoring information sharing on the internet, the player enacts power through a surveillant assemblage, regulating the populace through digital infiltration. This power is enacted critically through play, forcing the player to confront the tension between digital privacy and digital security by reflecting on the pervasive and prevalent nature of social media in the digital age. Ultimately, it will be shown that the ludic and narrative elements of *Orwell* (Osmotic Studios, 2016) work in tandem to empower the player through participatory surveillance, encouraging an awareness of contemporary surveillant practices.

A working foundation of the dystopia is necessary to understand the generic connections between *Nineteen Eighty-Four* and *Orwell* (Osmotic Studios, 2016). Erika Gottlieb (2001) defines dystopia by its relational status to its originating counterpart: utopia. She finds that utopia is "a well-run model of an ideal state of justice, [with] its nightmarish reversal as a systematic miscarriage of justice" being the dystopia (Gottlieb, 2001, p. 13). She argues that a key defining trait of the dystopia is to serve as a warning "of terror and trial in a world that *is* but should not be" (Gottlieb, 2001, p. i). This offers valuable insight into dystopic traits of literature (specifically George Orwell's *Nineteen Eighty-Four*), yet Gottlieb's conception of dystopia does not extend beyond literary novels to video game spaces, warranting further extrapolation. Building upon Gottlieb's foundation, Marcus Schulzke (2014) argues that dystopias reveal problematic aspects of society, highlighting "consequences of bad policies, flawed organizing philosophies, and unsustainable ways of life" manifest in fictional societies (p. 323). However, Schulzke (2014) highlights the unique power that stems from virtual dystopias, which "rely on a combination of engaging narrative elements and gameplay mechanics which come together to create dynamic worlds in which players are active participants" (p. 315). Because of this combination of play and narrative, dystopic video games allow for a uniquely critical mode of participation, which engenders players to critically reflect on the virtual world they're playing in.

Surveillance theory finds its roots in the image of the panopticon, a striking concept in its original construction. Jeremy Bentham (1995) conceived of a circular security building containing an indefinite number of open prison cells with "a spot from which, without any change of situation, a man may survey, in the same perfection, the whole number, and without so much as a change of posture, the half of the number, at the same time" (p. 43). For Bentham (1995), then, "the persons to be inspected should always feel themselves as if under inspection, at least as standing a great chance of being so, yet it is not by any means the *only* one," with the Panopticon deriving its strength from the apparent omnipresent surveillant gaze of the singular inspector within the structure (p. 43-44). Michel Foucault (1979) looks to the Panopticon as a theoretical underpinning to disciplinary societies, in which surveillance acts as a mode of discipline, and therefore, as a mode of power. Under his theory of panopticism, Foucault (1979) argues that the state maintains control over the populace through surveillance, holding the threat of disciplinary power over the governed subjects even if such power is not publicly used or directly asserted (p. 215). From the Foucauldian perspective, then, surveillance imbues the observer with a latent power over the observed.

To understand the role that surveillance takes in *Orwell* (Osmotic Studios, 2016), one must trace its prevalence in the game's antecedent, George Orwell's *Nineteen Eighty-Four*. Telescreens are ubiquitous in Oceania, appearing in citizens' homes, on the streets and in the workplace. These telescreens embody the Foucauldian notion of panopticism: because the telescreen "received and transmitted simultaneously…there was of course no way of knowing whether you were being watched at any given moment" (Orwell, 1949, p. 3). Further, members of the Party are encouraged to surveil one another, with children spying on adults and shopkeepers reporting any anti-Big Brother news to the Party. Here, the watcher of the Panopticon is not a single person, but an entire state. Surveillance is integral to the Party's control over its people, coming to a head when Winston is captured and made aware of the depths of the Party's surveillance. Often noted for being emblematic of Foucault's panopticism,[i] *Nineteen Eighty-Four* also serves as a foundational dystopian novel, as Gottlieb (2001) notes that the totalitarian Party only came to power due to the people's compliance, acceptance, even justification of said ruling power (p. 79). She emphasizes the strategy of warning endemic to the dystopia novel, pointing to Oceania as a signpost of warning "so that we realize what the flaws of our own society may lead to for the next generations unless we try to eradicate these flaws today" (Gottlieb, 2001, p. 4). These similarities in dystopian warning derived from *Nineteen Eighty-Four* influence *Orwell*'s (Osmotic Studios, 2016) narrative, particularly through the prominence of surveillance within the novel.

These themes of surveillance found in *Nineteen Eighty-Four* become the mode of play in *Orwell* (Osmotic Studios, 2016), with players taking an active role in assisting a similarly-named "Party" in monitoring potential threats to the nation-state through the computer system, ORWELL. According to Johan Huizinga (1949), play is an essential function of culture, particularly as the primary mode of interaction within video games, as he articulates the idea that "all play means something" through analyses of play in war, poetry, philosophy and law (p. 1). Because play is such a pervasive and nebulous concept, Eric Zimmerman (2004) suggests that "Play is the free space of movement within a more rigid structure. Play exists both because of and also despite the more rigid structures of a system" (p. 159). Therefore, one key facet to note about the power of play as a ludic construct is the specific form it takes and the structure that it housed within; in the case of *Orwell* (Osmotic Studios, 2016), play manifests through in two ways: *simulation* and *role-playing*. Sherry Turkle (1995) envisions the simulation as a "sophisticated social criticism…its goal the development of simulations that actually help players challenge the model's built-in assumptions…as a means of consciousness raising" (p. 71). In other words, simulations act as spaces for players to reflect on ideological assumptions. Multiple levels of simulation emerge in *Orwell* (Osmotic Studios, 2016), from "Timelines" (the stand-in for Facebook) to the text-messaging conversations between in-game suspects, not counting the ORWELL system itself as a system simulating governmental security monitoring.

As mentioned earlier, this form of simulation works in conjunction with another key component of the game: role-playing. When the player takes on the role of a security monitor, the player has to create a name and choose a profile picture, but is never shown what they truly look like. *Orwell*'s (Osmotic Studios, 2016) feature of the unseen protagonist marks it as a first-person video game where the player sees only that which the character sees, corresponding to an increase in the level of immersion. This is compounded by the governing mode of play: simulation. Because the player's mouse movements correspond directly to the character's mouse movements, "Interactive and narrative elements merge in the actual experience and realization of the interactive event inside the game world" of *Orwell* (Nitsche, 2008, p. 65). In typical first-person video games, the player is able to move through the game world in a physical manner, jumping over objects or visibly aiming down a gun's sightlines at an enemy. *Orwell* (Osmotic Studios, 2016) instead allows movement digitally through the space of the internet. Instead of physically retracing one's steps to old areas, the player digitally returns to old spaces of the internet to uncover new information, revisiting the Party's website on the Safety Bill or Cassaundra Watergate's 'Timelines' page for new updates, all without physically moving their character avatar who is presumably seated at a computer, much like the player. Majid Yar's (2014) concept of the internet as a space embodied by its virtual utopias and dystopias bears analysis here. Drawing upon the concept of the social imaginary of Cornelius Castoriadis and Charles Taylor, Yar (2014) finds that a society's modes of governance and existence manifest in its cultural production, and extending this further, looks to the internet as a space of this cultural imaginary (p. 2). To understand a society's views or fears in the 21st century, then is to examine its views of the internet as cultural imaginary, which is distilled in simulated form through *Orwell* (Osmotic Studios, 2016). He finds the virtual utopia not as a restoration of the past, but the product of human logic and technological development, an "outcome of human contrivance" and social engineering (Yar, 2014, p. 8). This conception of the virtual dystopia is narrower than Schulzke's, emphasizing "the loss of privacy and autonomy," individual alienation, and the perils of online terrorists or thieves (Yar, 2014, p. 58). In this regard, the player role-plays as a security monitor simultaneously taking part in a utopic technological development and a dystopic invasion of privacy through this simulated exploration of the internet.

Orwell (Osmotic Studios, 2016) enters into a tradition of dystopian video games, with precursors like 2K Games' *Bioshock* (2007) and Naughty Dog's *The Last of Us* (2013), alongside the upcoming *We Happy Few* (2017) from Compulsion Games. *Bioshock* (2K Games, 2007) has recently garnered much critical attention as a dystopic video game, due in no small part to its immersive first-person ludic elements and its narrative of an underwater utopia gone awry with the advent of individualistic power and a lack of ruling laws. William Gibbons (2011) cites the popular music in *BioShock* (2K Games, 2007) as reflective of the game's atmospheric environment, commenting on the dystopian narrative through ironic lyrics and affective melodies, whereas Rowan Tulloch (2009) finds *BioShock*'s (2K Games, 2007) manipulation of play (in which it is revealed that the player's choices, movements and actions are not wholly their own) that renders the game a "uniquely postmodern dystopia" in its ludic machinations (n.p.). However, the dystopia takes on new significance in *The Last of Us* (Naughty Dog, 2013), Gerald Farca and Charlotte Ladevéze (2016) argue, due to its affective aesthetic "which might result in a call to action in the real world," an actionable aesthetic that marks *The Last of Us* (Naughty Dog, 2013)as a critical dystopia (p. 1). Farca and Ladevéze (2016) distance the critical dystopia from the classical dystopia (*Nineteen Eighty-Four*, Yevgeny Zamyatin's *We*, or Aldous Huxley's *Brave New World*) "in that it leaves its diegetic characters room for contestation and revolt against the dystopian regime," particularly finding interesting purchase within critical dystopian video games that leave hope within the agency of the player (p. 3). Thus, critical dystopia is marked by a final opportunity for revolt, and an air of utopian hopefulness amidst the narrative element, generic traits that are embedded in *Orwell* (Osmotic Studios, 2016). To further understand whether players are presented with such an opportunity, and what the significance of an opportunity might be, one must examine the primary dystopic trait within *Orwell* (Osmotic Studios, 2016): the theme of surveillance.

Surveillance has evolved and transformed due to significant advancements in technology since Foucault's initial foray into surveillant power, warranting new interventions in surveillance theory. With the shift of data moving from the textual to the digital, a new mode of surveillance emerges not explicitly hingent upon discipline (Foucault) or prison structures (Bentham), but instead driven by data. Roger Clarke (1988) terms this mode "Dataveillance," highlighting the "systematic use of personal data systems in the investigation or monitoring of the actions or communications of one or more persons," built around the visible and invisible data trails people leave through commercial activities, biometrics and all things internet-related (p. 499). ORWELL is built on a foundation of dataveillance, monitoring not just suspects' activities but building a portfolio-like database concerning every major and minor interaction or piece of information connected to the suspect.

Within *Orwell* (Osmotic Studios, 2016), players must make careful decisions about which piece of information to upload by following characters' data trails through dataveillance. ORWELL was created under direction from the Safety Bill, "a collection of safety-centered laws and statutes created with the ultimate goal to protect the freedom of The Nation's citizens" in a "simplified, sped-up process of taking investigative measures against criminal suspects and their prosecution." In other words, the Safety Bill allowed for, and authorized creation of, ORWELL. The Reader tool allows the player to pore through, mostly, public pieces of information, tracing the paths that characters and suspects leave as they traverse digital spaces. Early in the game, the player's advisor on ORWELL the system gives verbal affirmation for factually correct information (birthdates or addresses), and chides the player when inaccurate or false information is uploaded (say, that a character's address is in "Rainbows and Clouds"). These intermingled and connected databases of information (social media sites, blog posts, public websites and private communication channels) embody David Lyon's (2001) concept of *leaky containers*, databases that are porous enough to allow the free movement of data. Anders Albrechstlund (2008) extends this leaky container concept to illustrate the pervasive nature of surveillance networks, as private organizations (law enforcement) examine the movement of leaky data in public spheres (social networking). Each choice the player makes in *Orwell* (Osmotic Studios, 2016) involves interacting with these leaky containers through database selection and monitoring, particularly through the Reader tool. This method of watching others' online activity, uploading datachunks and researching is the most benign form of participatory surveillance the player engages in as it involves taking advantage of freely available information databases and placing them into one's own secure container of the ORWELL system. Before uploading a datachunk to ORWELL, the player is warned that "Once uploaded, this cannot be undone," suggesting a tighter security measure than those of the public's leaky containers.

Yet, this same permanence to the uploading process raises the ethical stakes of both the system and the game. Rather than placing the protagonist in the role of the observed, as in the case of *Nineteen Eighty-Four*'s Winston, *Orwell* (Osmotic Studios, 2016) provides the player with panoptic power. Stakes are raised from simple data collection to ethical dilemma when the player is asked to determine a character's involvement with a terrorist bombing attack, and if so, to what degree. Symes reminds the player that "What's in ORWELL is [always] in ORWELL, and acting upon it is mandatory," no matter the ramifications. Foucault's notion of panopticism comes to fruition as the player takes on the role of warden through this participatory surveillance, though not to the degree that Foucault discusses. As this bombing takes place in a fictional city called Bonton, a small leap in letters might remind players of a similar historical bombing: the Boston Marathon bombing on April 15, 2013. *Orwell* (Osmotic Studios, 2016) calls attention to the societal connections between the city-wide manhunt in the aftermath of the Boston Marathon bombings and the Bonton bombing at Freedom Plaza, particularly through the similarity in location naming and in dates (the fictional bombing takes place on April 12th, 2017, eerily similar to the very real bombing date of April 15th, 2013). The simulation aspect of play becomes evermore critical given the player's role as both monitor and judge.

Albrechtslund (2008) challenges the prevalent thought that surveillance always disempowers, instead emphasizing that certain models of surveillance are imbued with potential for empowerment. Because social networking finds its roots in sharing and making information public, it affords social networking users the opportunity to participate in their own surveillance, a trait which Albrechtland (2008) finds can be empowering (n.p.). This argument finds purchase in *Orwell*, as it becomes apparent that one member of the rebellious organization, Juliet, uses her social network to expose problematic aspects of ORWELL the program, rather than succumbing to the surveillant state she finds herself in. Juliet purposefully posts incorrect or faulty information in Episode 2 to her social media profile in order to call attention to morally circumspect practices of surveillance. Juliet's actions begin to question the ethics of ORWELL: just because one has access to leaky containers, should one take advantage of said freely available information? further on surveillance tools within video games, T.L. Taylor (2006) finds that participatory surveillance allows players to work more collaboratively in massively-multiplayer online role-playing games (MMORPGS), such as *World of Warcraft* (Blizzard, 2004 – present). With certain modifications (mods), players can monitor the status of other members in the given party, affording them more information than the game's limited user interface normally offers through additional powers of surveillance. In this fashion, modes of self-monitoring and co/surveillance "intersect with playfulness [but] within the context of games and play, being watched (or watching)" constitutes entertainment for games, articulating ideals found in the play mechanics of *Orwell* (Osmotic Studios, 2016) (Taylor, 2006, p. 329).

In contrast to the Reader function, the Listener tool allows the player to listen in on synchronous conversations between at least one suspect and another person via text messaging, phone calls, or email, enacting this play through the feeling of observing (or in this case, listening) to others.. Each of these modes of communication are intended to be used within the private sphere, meaning that in order to "Listen" in on these conversations, the player must breach the privacy of the individuals involved. These intrusions have been clandestine in nature, as one such suspect learns of the invasion during an interrogation procedure, loudly exclaiming "Have you been spying on me, you dirty little Government Fucker?!" However, the player's immediate advisor, Symes, notes that all information gathered through ORWELL is "acting based on the Safety Bill. It's all legal and official." Returning to the surveillant concept of leaky containers, the Party shows that they must view most data containers as leaky enough to observe, track and investigate. It is also impressed on the player that all datachunk uploads are at their discretion, such that the authorities act on whatever information is uploaded, factual or otherwise. This comes to fruition later in Episode 3, during an observed conversation between a hacker and the primary suspect of the Bonton bombings: the hacker mentions that they are going to hack the government's website, and by the end of the conversation, have actually done so. If the player uploads the datachunk after the fact, they are chided for uploading information "when it's no longer useful" and for sitting on time-sensitive information. Returning to Juliet's manipulation of digital information, this exposes a problematic aspect of ORWELL: there is no discretion of truth, as all information is considered 'factual' until it is proven incorrect. Deduction comes to the forefront of the play experience in Episode 2, as players must decide where the next terrorism attack will take place: a government building or a local university campus. If they upload the correct information, the bomb is defused and the authorities are one step closer to catching the rebellious group, Thought; the other option leads the authorities further away from the group at the expense of human lives.

Lastly, in Episode 3 of *Orwell* (Osmotic Studios, 2016), players gain access to the Insider tool which allows them to remotely hack personal computers and mobile devices if they have the "UID" of a device, or its unique identification code. The aforementioned Safety Bill requires that all electronic devices created in the Nation have a UID, and to access one, the "device must be running and have an online connection." Players must use this new tool to investigate suspects' private devices to obtain information not shared on the internet; in other words, players must ultimately open the once-leaky containers of secure data, violating any sense of digital privacy in the process. With this UID, players gain access to any files on the suspect's desktop or device, including saved emails, photographs, browser history and personal documents. However, at certain points in the narrative, the player learns that suspects often have security applications and programs that notify and even defend against outside intrusion. Clarke (2005) notes that even if no action is taken by agencies, "the mere suspicion by the public that 'they' are watching reduces people's freedom to think, discuss, argue, and act" (p.10). In the same vein, if one of the suspects, Nina, learns that she is being surveilled, she begins panicking about her lack of options as the Party's agents begin pursuing her, leading to a violent shootout where Nina is killed.

Much like Winston in *Nineteen Eighty-Four*, the protagonist/player of *Orwell* (Osmotic Studios, 2016) is given the illusion of freedom and choice within a dynamic social system, only to have that illusion shattered towards the end of the narrative. For Winston, this freedom is carefully crafted by Big Brother and the government, "that for seven years the Thought Police had watched him…no physical act, no word spoken aloud, that they had not noticed, no train of thought that they had not been able to infer" (Orwell, 1949, p. 175). Within the video game, Juliet reveals that all of her machinations and manipulations have been for one purpose: to expose the flaws of ORWELL, specifically to the player. In *Nineteen Eighty-Four*, there is no potential for rebellion as Winston's mind is broken down and converted; conversely, Juliet's revelatory act not only places the potential for rebellion in the unnamed protagonist but with the player in *Orwell* (Osmotic Studios, 2016). This integral juncture between narrative and ludic play entrenches *Orwell* (Osmotic Studios, 2016) in the realm of the critical dystopia, as the player is left with power over the narrative. Schulzke's (2014) conception of the critical dystopia factors in here, as *Orwell* (Osmotic Studios, 2016) offers players the opportunity for rebellion through narrative choices reflected in the games multiple endings.

At the end of *Orwell* (Osmotic Studios, 2016), depending on what narrative choices players have made throughout the game, they can earn as many as four different endings, particularly based on the three fundamental actions offered to players concerning ORWELL: a) incriminate the rebellious party, Thought; b) incriminate the Secretary of Security and Advisor of ORWELL; or c) incriminate themselves. Each of these options corresponds to a different ending to the game, similarly resulting in unique personal and organizational ramifications.

Upon further analysis, these endings also correspond to varying degrees of utopia and dystopia, in equal measure. Perhaps the worst ending, if there is a metric, is titled "A Half-Hearted Attempt," in which players attempt to incriminate the senior official, Delacroix, but fail to gain access to her phone; this results in the unintended consequence of turning in all members of Thought as terrorists, with ORWELL being announced publicly, and with the player being promoted to the role of ORWELL advisor. Similar to the ending of *Nineteen Eighty-Four*, the player is left without hope for rebellion, as the power of surveillance remains with the Party and ORWELL is publicly revealed as successful due to the capture of Thought, and the protagonist is ultimately compliant with the Party's institutional brainwashing. The most utopic ending, however, involves incriminating oneself by manually uploading datachunks of the player's own involvement with ORWELL, particularly once the player confirms that the Party was monitoring their own record. This triggers ORWELL's mandatory follow-up investigation; in doing so, the system of ORWELL is shut down by the government. The Party suffers a tremendous blow to their power while Thought becomes a major political party, challenging the totalitarian leadership of The Party. Regardless of the player's chosen ending, the game's final opportunity for rebellion is the same: the player is confronted with their personal record and must choose which one piece of information to upload to an ORWELL-like system. This implies two points of significance: that systematic surveillance may never truly perish, but that the player has individualistic power through controlling what information they upload to the internet.

Orwell's (Osmotic Studios, 2016) narrative, while following the fictional account of a contracted security agent, mirrors the narrative of Edward Snowden in 2013. A former National Security Agency (NSA) contractor, Snowden disclosed vital information concerning the NSA's mass surveillance procedures, including programs such as the BOUNDLESSINFORMANT program and PRISM collection software (Electronic Frontier Foundation, 2013, n.p.). In an interview, Snowden revealed the driving motivation behind his public release of information was that he couldn't "in good conscience allow the US government to destroy privacy, internet freedom and basic liberties for people around the world with this massive surveillance machine they're secretly building" (Greenwald, 2013, n.p.). Much like the characters within *Orwell* (2016), Snowden had an online moniker, "The True HOOHA" that he used in his digital communications, and like the narratives of Cassandra, Juliet and Abraham, Luke Harding (2014) reports that "in 2009, the entries fizzle away. In February 2010, TheTrueHOOHA mentions a thing that troubles him: pervasive government surveillance" (n.p.). Returning to Yar's (2014) concept of the cultural imaginary, it can be surmised that *Orwell* (Osmotic Studios, 2016) allows players to consider the ethical ramifications of government surveillance in contemporary society, and that contemporary society may fear such pervasive hierarchical surveillance, much like in *Nineteen Eighty-Four*. Further, Snowden exposed the section of the Patriot Act, that the NSA relied on the "'business records' provision of the Patriot Act, 50 USC section 1861" in order to carry out its record-gathering and domestic surveillance of cell phone information and associated metadata (Harding, 2014, n.p.). This vague facet of the Patriot Act resonates most strongly with the exploitation of the Safety Bill in *Orwell* (Osmotic Studios, 2016), drawing more parallels between the breach of ethics by the NSA and the digital invasion of the ORWELL system.

With the prevalence of social media users, digital modes of communication and infrastructure of invisible data trails left all throughout the internet, the play of *Orwell* (Osmotic Studios, 2016) affords users the opportunity to simulate choices and ramifications of dystopic surveillance: they're able to place themselves in the virtual position of a whistleblower like Snowden, and decide what they might do. In this fashion, *Orwell* (Osmotic Studios, 2016) is elevated from a simulation of data invasion and digital privacy into a simulation of national surveillance and the ethics of whistleblowing, a simulacrum of Snowden's dilemma in 2013. Returning to Gottlieb's (2001) definition of dystopia, *Orwell* (Osmotic Studios, 2016) serves as a reminder and a warning of recent trends in governmental surveillance and the invisible, insidious nature of surveillant power.

However, what may be more indicative of the societal fears that *Orwell* (Osmotic Studios, 2016) taps into are independent companies like Dataveillance (not explicated connected to Clarke's theory of dataveillance, but a corporation that puts the theory into practice nonetheless). Dataveillance's position towards net neutrality and open source intelligence is that "Social media and mobile applications are unexploited sources of data" for law enforcement agencies to "proactively patrol and investigate crime." Given the existence of outside contractors like these that work with law enforcement agencies as well as the reality of online hackers that target databases of corporations and banks, danah boyd (2007) notes that fears of digital information are governed by four characteristics: persistency of data stored online; easy searchability of this stored data by anyone; that data can be replicated anywhere in any context; and that the audience of the internet is invisible, potentially including anyone with internet access (p. 2-3). *Orwell* (Osmotic Studios, 2016) confronts these fears through the simulation of a contracted security corporation, one in which the player actually plays through each of these four characteristics. The player mines suspects' social data, even old and archived blog posts that were thought to be deleted; searches stored data using three different modes of monitoring; replicates that data by uploading it to the ORWELL system; and is primarily invisible and untrackable due to the clandestine nature of ORWELL's tools.

Ultimately, *Orwell* (Osmotic Studios, 2016) exposes players to the fragility of their perceived digital privacy and security through simulation, suggesting that dystopian times certainly on their way, if not already happening. Like other critical and virtual dystopias, the video game offers a means of empowerment to the player through this critical awareness. Though the player doesn't control of a government-affiliated digital security system, players have access to similar levels of technology in the very device they're using to access the game: the computer. By calling attention to the surveillant forces at work within the very real spaces of the internet through simulated play, *Orwell* (Osmotic Studios, 2016) suggests rebellion through awareness: being mindful of one's internet practices, of what one puts online and of the precarious balance between digital privacy and digital invasion. Just as George Orwell's *Nineteen Eighty-Four* has been noted for since its publication in 1949, *Orwell*'s (Osmotic Studios, 2016) critiques systemic surveillant power and governmental control, calling for individuals to take control of their digital practices and rights, before the internet becomes a true digital panopticon.

References

2K Games. (2007). *Bioshock*. [Xbox 360], Boston, USA: 2K Games.

Albrechtslund, A. (2008). Online social networking as participatory surveillance. *First monday*, 13, 3, n. pag. Retrieved May 6, 2017

Bentham, J., & Bozovic M. (Ed.). (1995). *The panopticon writings*. New York, NY: Verso Books.

Boyd, D. (2007). Social network sites: Public, private, or what? *Knowledge tree* 13, pp. 1-7. Retrieved May 30, 2017.

Clarke, R. (1988). Information technology and dataveillance. *Communications of the ACM*, 31, 5, pp. 498-512. Retrieved May 30, 2017.

Clarke, R. (2005, 06). Have we learnt to love big brother? *Issues*, 71, pp. 9-13. Retrieved May 30, 2017.

Compulsion Games. (2017). *We happy few*. [Xbox One].

Electronic Frontier Foundation. (2013, June 8). *BOUNDLESSINFORMANT: Describing mission capabilities from metadata records.* Accessed May 6, 2017.

Farca, G. & Ladavéze, C. (2016). The journey to nature: *The last of us* as critical dystopia. *Proceedings of the 1st International Joint Conference of DiGRA and FDG*. Dundee, Scotland. Retrieved May 30, 2017.

Foucault, M. (1995). *Discipline and punish*: The birth of the prison. (A. Sheridan, Trans.) New York, NY: Vintage Books. (Original work published 1975).

Gibbons, W. (2011). Wrap your troubles in dreams: Popular music, narrative, and dystopia in Bioshock. *Game studies* 11, 3, n.p. Accessed May 30, 2017.

Gottlieb, E. (2001). *Dystopian fiction east and west: Universe of terror and trial*. Kingston, Ontario: McGill-Queen's University Press.

Greenwald, G. (2013, June 6). NSA collecting phone records of millions of Verizon customers daily. *The Guardian*. Accessed 6 May 2017.

Harding, L. (2014, Feb 1). How Edward Snowden went from loyal NSA contractor to whistleblower. *The Guardian*. Accessed 6 May 2017.

Huizinga, J. (1949) *Homo Ludens: A study of the play-element in culture*. London: Routledge.

Lyon, D. (2001). *Surveillance society: Monitoring everyday life*. New York, NY: McGraw-Hill Education.

Naughty Dog. (2013) *The last of us*. [Playstation 3], San Mateo, CA: Sony Computer Entertainment.

Nitsche, M. (2008). *Video game spaces: Image, play, and structure in 3D game worlds*. Cambridge, MA: The MIT Press.

Orwell, G. (1949). *Nineteen eighty-four*. New York, NY: Houghton Mifflin Harcourt.

Osmotic Studios. (2016). *Orwell*. [PC], South Melbourne, Victoria, Australia: Surprise Attack.

Schulzke, M. (2014). The critical power of virtual dystopias. *Games and culture*, 9, 5, 315-334.

Taylor, T. L. (2006). Does *Wow* change everything? How a pvp server, multinational player base, and surveillance mod scene caused me pause. *Games and culture*, 1, 4, 318-337.

Tulloch, R. (2009). Ludic dystopias: Power, politics and play. *Proceedings of the Sixth Australasian Conference on Interactive Entertainment*. New York, NY: ACM Publications.

Turkle, S. (1995). *Life on the screen: Identity in the age of the internet*. New York, NY: Simon and Schuster.

Yar, M. (2014). *The cultural imaginary of the internet: Virtual utopias and dystopias*. New York, NY: Springer Publishing.

Zimmerman, E. (2004). Narrative, interactivity, play, and games. In N. Wardrip-Fruin & P. Harrigan (Eds.), *FirstPerson: New media as story, performance, and game* (pp. 158-166). Cambridge, MA: The MIT Press.
[i] See also: Strub, Tyner, Yeo

HEMONAUTS: INITIAL IMPLEMENTATION OF DIGITAL GAMES TO INCREASE STEM LEARNING AMONG CHRONICALLY ILL CHILDREN

Initial Implementation of Digital Games to Increase STEM Learning Among Chronically Ill Children

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Abstract

This study reports on findings from the first phase of the *Hemonauts* project, a suite of interactive digital games, designed in collaboration with software developers at Thrust Interactive, which were intended to increase Science, Technology, Engineering and Mathematics (STEM) content knowledge and promote healthy lifestyle choices in chronically ill children. Chronically ill children are at risk of falling behind in school due to frequent absences and disease implications, potentially resulting in additional psychological complications and long-term setbacks. *Hemonauts* seeks to leverages childhood diseases as an entry point to exploit the target population's innate interest in anatomy and physiology. We created and tested a suite of three game prototypes to engage children in challenges related to Sickle Cell Anemia. Participants were middle school students and pediatric patients with Sickle Cell Anemia. They expressed that the game was captivating and highly needed and patients with Sickle Cell Anemia demonstrated high levels of interest-driven engagement with content relevant to their diagnosis. However, at this stage, they did not demonstrate increases in STEM content knowledge and more generally, we found that patients expressed an alarmingly low level of disease literacy.

Introduction

This study reports on findings from the first phase of the *Hemonauts* project, a suite of interactive digital games to serve chronically ill, frequently hospitalized, students in grades five through eight and their support networks. The aims are to increase STEM content knowledge through gameplay; increase knowledge of and intent to persist in STEM careers; and increase disease literacy to improve patient self-advocacy, treatment compliance, and to promote healthy lifestyle choices.

While there are health-based apps on the market that promote disease management, there are few games offered to children with chronic diseases such as Sickle Cell Disease (SCA), Asthma, and Diabetes. *Hemonauts* leverages these childhood diseases as an entry point to exploit the target population's innate interest in anatomy and physiology, leading to not only a greater understanding of patients' diseases but also an increase in STEM knowledge through newly designed, adaptive math and science challenges and virtual interactions with STEM professionals.

Chronically ill children and their families are a new, and promising, audience for targeted STEM education efforts. Health-related issues can cause frequent school absences, cognitive disabilities, and social and act as emotional stressors for chronically ill children. Yet, due to their disease, these children, their family members, and caretakers are eager for information about how the body, and more specifically, their disease, works. There are many challenges in health literacy (Wolf et al. 2009) and these challenges are more complex with regards to children's health (DeWalt & Hink, 2009) where parents are intermediaries and children's literacy rates are typically lower than adults.

This pilot study was building upon previous work conducting STEM education with children who have Sickle Cell Anemia (SCA). We sought to understand if we could leverage the interest of children in their own experiences, helping them establish their disease and their body as and interest area to encourages them to seek out more learning experiences. The goals were to improve health literacy and STEM learning. The innovation in this approach was to better understand whether chronic illness, which is generally considered a deficit learning challenge, could be leveraged into a learning asset, as a motivation to learn.

In this initial implementation we sought to (1) undertake the process of design, going from a low to high fidelity prototype while gathering formative feedback to improve the games; (2) to evaluate aspects ranging from usability, to social sharing, game experience and learning. Because we were using a thematic game about disease, rather than children's interest, humor, or "fun" topics we hoped to answer a more general question about engagement with informal learning: *Can something personally negative serve as the catalyst for learning the same way that positive and playful experiences do?*

Our interdisciplinary team, comprised of software developers from Thrust Interactive (thrustinteractive.com) and academic researchers from Georgia Institute of Technology and Emory University's College of Medicine, created and tested a suite of mini-games to engage children in challenges related to SCA. Chronically ill student players expressed that the game was captivating and highly needed and demonstrated an interest in using the game to learn and to teach others; however, they did not demonstrate increases in STEM content knowledge and in general expressed an alarmingly low level of disease literacy.

Background

It is estimated that up to 20% of the school-age population have a chronic medical illness or disabling condition (Kilewar, 1997). Chronic illness has been defined as, "a disorder with a protracted course that can be fatal or associated with a relatively normal life span despite impaired physical or mental functioning. Such an illness frequently shows a period of acute exacerbations requiring intensive medical attention" (Mattsson, 1972). Chronic illness is treatable, yet not curable, and requires management for long periods of time. We contend that chronically ill children are an *underserved*, *under-represented* and *educationally disadvantaged* population with regards to education. In addition to the child's medical illness, they are also at risk for psychological problems (Kilewar, 1997). One of the most common psychological problem areas is educational difficulties or academic and learning problems due to regular school absences for medical reasons. Also, complications from disease can result in learning disabilities or educational delays. We see an opportunity to leverage this disadvantage, a chronic and debilitating illness, into a learning opportunity, providing motivation to learn in a personally meaningful content area about the systematic and scientific processes of ones disease, which may spark an overall interest in math and science. Additionally, because of chronic illness, hospitalized children are a captive audience for informal learning using the math and science behind their disease.

Chronically Ill Children's' Education

Pediatricians and pediatric health care providers place a large emphasis on patient education when caring for chronically ill children. Multiple studies have established that effective patient education leads to significant improvements in clinical outcomes among chronically ill children (Brink, Miller & Moltz, 2002; Kahana, Drotar & Frazier, 2008). A key aspect of patient education involves teaching patients about their disease pathophysiology, in which they learn, in a step-by-step fashion, the complex nature of how the underlying causes of their disease ultimately cause their symptoms, from the microscopic to macroscopic scale. Interestingly, learning about the pathophysiology of one's own chronic disease is a form of complex systems learning (Papathanassoglou, Bozas, & Giannakopoulou, 2008). For example, children with sickle cell disease are taught not only about their expected symptoms such as arm/leg pain and difficulty breathing, but also the underlying mechanisms that sickle cell disease is caused by one small genetic mutation in their DNA, which leads to an abnormal hemoglobin molecule that has a propensity to pathologically polymerize into long chains in their red blood cells under certain conditions (dehydration, high temperatures, low oxygen). When this occurs, during a fever or when a patient doesn't drink enough water, the mutated sickled hemoglobin polymerization increases, causing the red cells to stiffen and leading to painful physical symptoms.

Chronic diseases affect all members of the child's family who have the potential to become a secondary audience for informal STEM learning efforts. The patient's siblings, who also spend a great deal of time in hospitals and doctor's offices with their family, can be learning partners and game users with their chronically ill sibling (Goszer Tritt & Esses, 1988). We propose that using their child's disease pathophysiology can increase a whole family's general scientific literacy and their understanding of their child's disease. By engaging parent and siblings with our learning experiences, families have the opportunity to continue the conversations and learning at home.

Health Literacy

Promoting health literacy has been identified as a successful method for improving health outcomes among children (DeWalt & Hink, 2009) and in the transition of care that begins in early adolescents with chronic illnesses (Carden, Newlin, Smith, & Sisler, 2016). In a literature review, Wolf et al. (2009) identified that the need for greater health literacy was well documented, but the tools to improve such literacy were unclear. They found that most research to improve health literacy was focused on reading literacy and encouraged the use of simple language and design choices to limit the cognitive load. Rothman et. al (2009) utilized a more comprehensive approach with an intense, personalized, Diabetes management program for low-literacy patients. This intervention showed promising results with the study group reporting better health outcomes than the control group.

Games for Children's Health

Previous serious games research, in relationship to childhood illnesses, have sought to effect behavior change and improve children's compliance in managing their illness (Kato et al., 2008; Thompson et al., 2008). In the game Packy & Marlon, Brown et al. (1997) found that the game was effective at improving the children's' ability to manage their diabetes. The game in and of itself was not teaching new information to the children, but it did improve their communication with friends and family about their disease. The children were positioned as experts in the domain of their illness in these interactions. This improved their understanding of their disease and improved their health behaviors. Many of these games have auxiliary learning outcomes, but learning is not the primary goal, nor is the learning structured in a systematic way to meet larger learning goals for STEM education.

Learning Motivation and Islands of Expertise

Currently, the field of informal learning focuses on interest driven topics that are personally meaningful for learners in traditional settings such as museums, after school activities, and software. We see many positive learning experiences, for example learning with dinosaurs (Palmquist & Crowley, 2007) or cooking (Clegg, Gardner, & Kolodner, 2010). Crowley and Jacobs identify these deep content areas that children develop as islands of expertise. They have observed that islands of expertise develop through a fundamentally social process where children and family negotiate a co-construction of the child's interest and abilities. As the child becomes an expert in a domain, or island, that topic becomes a platform for developing learning habits and for conversations that can address both general and abstract model of the world that might not be possible without the rich content knowledge. But what happens when your audience is deeply engaged with their own crisis? We sought to develop a suite of learning experiences that are adaptable to these adverse, but personally meaningful experiences to help answer these questions and build learning theory.

Previous Work

Our project was building upon an outreach component of research on SCA which proposed an educational enrichment program in collaboration with a children's hospital. In this project undergraduate students iteratively designed, developed and deployed interactive science and math learning activities for chronically-ill hospitalized children, where the child's own disease was used as the springboard and hook for learning. This program included a STEM curriculum and the undergraduate students were able to integrate relevant concepts into teaching patients, emphasizing that medicine is interdisciplinary and involves biology, physics, chemistry, and math. During that pilot program, approximately 36 patients for 40 total hours were taught, in the patient's hospital room or in the hematology clinic while receiving a blood transfusion. As part of this program we observed two primary contributors to the successful engagement of children with the STEM content. First, the undergraduate students were enthusiastic teachers in the hospital environment. These students are well informed about diseases and STEM content and they are a near-peer age group to the hospitalized patients. Second, we observed that the children's interest in their own illness helped to build interest in the STEM content related to their disease. While this program is continuing, the primary challenges are scalability and consistency of student led teaching.

Methods

We conducted two types of game testing sessions with children. The first was prototype testing sessions in two 5th grade classrooms of a public school. The second prototype testing session was with patients who have SCA at a children's hospital.

Prototype Testing with Middle School Children

Our initial round of user testing involved approximately sixty 5th grade elementary school children.

Testing took place in two 45-minute science classes with approximately 33 students in each class (some students may have been absent on the day of testing). Across the two classes there was an even distribution of male and female students. These children were selected because they were a diverse population, that were within the age range of our target demographic. We obtained IRB approval from our institutions for a waiver of parental consent because the activity was similar to classroom activities. We asked the children if they wanted to participate in the study, and all of them gave verbal consent. One of the researchers has an ongoing, working relationship with the teacher and the school where she regularly conducts educational activities similar the activities we conducted.

To structure their play experience, student participants in each class were split into three small groups of ten players, which rotated between the three different gameplay stations. At each station, participants engaged with a game prototype for 10 – 15 minutes of play facilitated by researchers. The play sessions were then followed by a ten-minute discussion in the small groups where students shared general impressions and feedback on the game before moving on to the next station with their peers. Testing concluded after three rounds of both play and discussion with breaks for moving from one game to the next.

At this stage in the iterative development process the three *Hemonauts* mini-games ranged from a fully digital prototype of the game, *Cell Counter*, a paper prototype simulating the mechanics of a second game, *Vein Navigator*, as well as a functional prototype of the *Body Balance* game in the form of a tabletop board game. The meta concept of the three games is that the player is piloting a microscopic robot (a nanobot) that is placed into the body to perform tasks.

The initial meta-concept was a collaborative design effort between the professional game designers, SCA experts, and educational technology experts to find a unifying theme to bring together many of the learning activities developed in the previous work described above. Our constraints were to find a concept that would allow us to magnify the interworking of the of function in the human blood stream and something that would help to distance the player from the dark prognosis of SCA. In this stage we were in part testing young people's reaction to this meta-concept.

When testing the fully digital *Cell Counter* game, students played in groups of two or three on one of four Apple iPad's with researchers by their side to help or answer questions. In *Cell Counter*, players have a bird's eye view of their nanobot passing through a series of veins filled with red blood cells, white blood cells, and platelets. The game mechanic (i.e., the action undertaken by the player) is to pause their ship at specific targets and collect blood samples that will be visually analyzed to determine the total cell count. This play experience not only introduces basic concepts related to hematology (e.g., veins, red and white blood cells, platelets) but also introduces the mathematical concept of ratios (e.g., a patient's blood volume to cell count). This game visually translates the mathematical concept of ratios to the patient's common experience of blood sampling (complete blood count), which is an important indicator for those with SCA.

Two cardboard mock-ups of the second game, *Vein Navigator* were used to guide students through a representation of the gameplay experience that was then being developed for the iPad. A side scrolling "endless runner" style game, *Vein Navigator* was demonstrated using a long horizontal cardboard and game board with a strip of red crafting felt representing the side cutaway view of a human vein. Players pushed small felt-backed cardboard ships along the surface of the game board and the friction of the rough fabric texture was used to explain the fact that the speed at which blood flows is based on its thickness and "stickyness" or viscosity. Game pieces scattered throughout the vein, some which were without felt backing and slid more quickly, represented different kinds of beverages which could speed up or slow down the player's progress based on how effective they were at aiding hydration.

Our third mini game, was originally conceived as a design activity to see if the meta concept involving a narrative of a *Body Balance* including collecting cards and points would be a motivator for the students and did not follow the nanobot narrative. Gameplay involved seven rounds of play, representing seven days of the week. Students chose between cards featuring randomized pairings of physical activities, both active and sedentary, alongside food and beverages with various levels of nutrition. Overall health or "balance" between calories and hydration versus levels of physical activity would change day to day based on the student's choice of card.

Pilot Implementation

Building upon findings from the initial prototype testing we develop digital prototypes of all three games. An evaluation of the suite of these high-fidelity games was conducted with 20 pediatric sickle cell patients aged 8-12 from a children's hospital in the form of play test sessions. The children were randomly selected from pediatric sickle cell patients in the hospital's blood and disorder center All the participants parents were given IRB approved Parental Permission Form, completed and signed by the children's parents. Prior to the study, children completed Child/Minor Agreement Forms to participate in the research study. The study was conducted at the hospital over two weeks. Each child participated in a 1-hour session. Upon completion, the children were compensated with a $25 Visa gift card. The aim of the playtest sessions was to gather data to evaluate the game mechanics and the children's conceptual understandings of the games so as to inform future improvements of the games.

The suite of games were introduced to the participants and they were asked to interact with the game on the iPad while using a think-aloud method in which participants speak aloud while playing (Nielsen, Clemmensen, & Yssing, 2002). Researchers observed the activity and recorded observations on how the participant engaged with the games and reacted to them. This allowed researchers to gather qualitative data to evaluate design implications of playing the game; this data was not analyzed for generalizable findings but was used to understand where the design was breaking down and what mechanics were successful in the games.

After the participant had finished playing all three games, a thirty to sixty-minute semi-structured interview was conducted by the researchers in which participants reflected on their experience and understanding of the games. The interviews were audio recorded, transcribed, and the resulting qualitative data was imported into a qualitative data analysis software and analyzed to reveal patterns and themes.

Two researchers worked collaboratively side by side to generate a codebook based on reviewing the data generated by the twenty participant interviews. Codes were created to capture content related to all of the structured questions covered in the interview guide as well general themes that emerged naturally from the interviews. Parent codes were generated in association with both the general topics of the questions posed and to themes and then child codes were generated to capture a greater level of detail with regards to the subjects covered both in questions regarding STEM content and the participants subjective responses (See Table 1). The codebook was revised in three phases. Phase one, one researcher coded a set of 3 interviews and the second researcher then took a code application test. Discrepancies were then discussed and the codes were refined to clarify the researchers' understanding. This was repeated two more times until the researchers reached an interrater reliability of 94% correlation. The code application test results are reported using Cohen's kappa statistic (Cohen 1960). Sage suggest that inter-rater reliability should approach .90 (Miles & Huberman, 1994). With a score of 94%, there is strong confidence in agreement of these codes.

Pilot Intervention Description of Digital Game

The three games were again part of overarching narrative that introduced players to the "Hemonauts," microscopic robots that players could pilot through the human body to complete tasks in support of the body's overall health. The three games were *Cell Counter* (Figures 1a-c2), *Vein Navigator* (Figure 23), and *Body Balance* (Figure 34).

Cell Counter, was very similar to the game prototype tested initially in the classroom and described in the prototype methods section. Players look at their nanaobot from above as they navigate through the veins to collect blood samples. Based upon feedback we slowed down the game and added in boxes for the player to fill in the equations used to calculate ratios on the final game screen (see Figure 12cC).

In *Vein Navigator*, players raced their nanobot through a cross section of a vein. In keeping with a quintessential "side-scroller" genre of video game, players had to carefully avoid vein walls and choose to pick up "bonuses" representing beverages that could affect the speed at which they moved. Sugary beverages (e.g., juice and soda) lead to dehydration and increased blood viscosity and vasoconstriction, which slowed down the player's robot. Conversely, drinking water would speed up the robot through vasodilation and decreased viscosity of the blood. This game supports a player's understanding of day-to-day healthy lifestyle choices, while also introducing the disease-concepts of hydration, dehydration, and blood viscosity all of which are factors which can contribute to an SCA pain crisis (Figure 2).

Body Balance, the digital game, again moves away from the nanobot function and challenges players to progress through 7 rounds (days) of a card-style game. Players choose cards representing daily diet and activity choices in an effort to balance hydration and calorie intake and output as seen in two fill meters: representing calories in vs. energy expended and hydration gained vs lost. Players try to balance sedentary choices (e.g., watching TV) with physically active choices (e.g., biking and walking) while selecting from a variety of foods and beverages (e.g., water and apples, donuts, and milk, hamburgers and soda, etc.). This game directly promotes healthy lifestyle choices and mimics the day-to-day decisions of our target population (Figure 3).

Findings

Findings from Prototype Activities in Classrooms

The prototype testing provided feedback from the target age group on functionality and game design.

Cell Counter was the only digital prototype. Students expressed excitement about this game and the general prospect of using digital technology although when playing some struggled to pilot the onscreen nanobots using the game's touch screen controls, which lead to crashing their nanobot into the vein walls, ending the game quickly. Although feedback was generally positive, the students requested that the speed of the game be slowed down to allow them to easily control the ship, minimizing the discouraging feedback from collisions which caused the screen to shake upon impact. We also noted that shorter and better instructions were needed for students to understand game play and STEM content more quickly and with less assistance. (Figure 2a).

Vein Navigator was prototyped using a a 30-inch long by 8 inch game board physical prototype where the side-scrolling path of the vein was represented on a 30 inch long by 8 inch foamcore game board illustratingillustrated.   printed with the outline of the vein walls. Students navigated by pushing small cardboard ships left to right through the vein where game pieces representing different beverages were placed for them to "pick up" on their journey. Although this prototype was a preview of the digital game experience, our playtesting demonstrated that the students had previous game play knowledge to draw on and that the concept of a side-scrolling game was easy for them to conceptualize regardless of the content. Competition was a significant motivator, as was social play. Students enjoyed physically interacting with the tangible prototype but offered feedback on the graphics which represented the beverage choices as different colored batteries or fuel cells assigned the properties of different drinks. Based on the feedback revisions were made to introduced more literal representations of different drinks to make the connection between various beverages, levels of hydration and blood flow more explicit for young players.

Body Balance was played as a tabletop game with a board featuring an outline of the body and various card choices representing activities and dietary choices scored with simple positive and negative number values representing calories lost and gained and hydration lost and gained based on different combinations of food and beverage with different activities in these prototype sessions. . Their score was represented by game pieces placed on a hydration and a calorie scale where and the pieces were moved up and down to represent changes in calories and hydration. The values of each scale could be "balanced" when the game piece was within a certain number range, or either one or both the hydration and calorie scales could become "imbalanced" with too high or low of a value. The interest players showed in picking cards demonstrated that students (even these without disease) had an interest in their bodies. They liked the meta view of the body and could relate to their choices to the consequences demonstrated through game play. The students were receptive to the overall concept of Body Balance, quickly grasping the concept of how choices of both activity and diet could impact overall health of the body As a result of this initial testing phase we chose to build a digital version to better refine the relationship between the body/health knowledge and the game experience.

Findings from Pilot Implementation in Hospitals

Based upon these findings we refined and developed digital versions of these three games and piloted these In addition to building the games we sought to assess learning and motivation, and to evaluate the potential for learning about STEM content in the context of the body. Piloting the three aforementioned prototypes, we conducted play testing and interviews with pediatric SCA patients. Researchers conducted nineteen sessions with the 20 children (in one session siblings participated together), which ranged from approximately twenty to forty-five minutes, across two locations of the Children's Healthcare of Atlanta.

While the general feedback from our pilot test was positive regarding user experience and usefulness of the app, the games were successful at delivering health educational (e.g., effects of exercise and nutrition) and unsuccessful in communicating higher-level STEM content.

Overall experience.

Participants described the overall experience as positive, they were able to quickly understand how the games operated and noted elements of traditional digital game play and content that was related to Sickle Cell Anemia. There were few cases were the participant asked the researcher to explain how the game was played, and in those cases, participants were given simple instructions, as a friend might offer when sharing a new game. All of the participants demonstrated a recognition that the game was "educational" and related to human bodies. For most participants the educational nature of the game was complimented as a positive aspect of the game, although one participant did share that learning games were not to her taste, noting, "I don't play those type of games." Approximately 50% of the participants described the game as if it were taking place in their body. Sometimes this embodiment of the game mechanics was made clear with descriptions about interactions in specific games. For example, one participant told us, "The *Cell Counter* one [game] is to count the cells by scanning yourself." And when asked how they would describe the games as a whole, participants often talked about how the games related to their own bodies. The goal was, as one participants described, "To have to take care of your body. It was about your cells and stuff."

Prior Experience with Games.

19 of 20 participants described having previously played some form of digital game, whether on a tablet or smartphone, a console system or computer and as a group they demonstrated a high level of fluency with digital game play, quickly grasping the physical controls and mechanics of the *Hemonauts* games. 16 out of 20 participants said they played games on tablets or smartphones regularly but play preferences also varied throughout the group with several students saying that they preferred playground games or board games to digital games. Several reported playing primarily on phones and a few described playing primarily on consoles such as the PS4 and Xbox. (See Table 3).

Hemonauts Gaming Experience.

During play testing, participants were able to readily grasp how to operate the games and recognized familiar game mechanics as well as that the games contained SCA-related themes. Overall, participants expressed that the games were "fun," intuitive, and easy to manipulate toward an understood goal.

However, we discovered that the timing of the *Cell Counter* game was still too quick and that several players needed to stop and restart the game. Most participants did not read directions and instead started, stopped, and then restarted the games after gaining a basic understanding of game play. Because the STEM content was integrated into the directions, the participants missed opportunities for learning the content. For the *Cell Counter* game, some understanding was necessary to play, so players later took time to read.

While participants understood the *Vein Navigator* game, many did not grasp how it was contextualized in the body. However, because game play was based upon a traditional side navigator game, players were able to pick up and play the game without first reading instructions or understanding the context. Some users were confused about the effects of beverage choices (e.g., milk or water icons) and while most of these participants knew that there were "good" and "bad" things to pick up they were primarily operating upon their prior knowledge about side navigator games, rather than knowledge based on SCA content.

The *Body Balance* game was perhaps the easiest for players to understand, as its mechanic of choosing between different food and activity choices required little explanation and leveraged basic knowledge about diet and exercise. While the game did not involve the microscopic view of the body featured in *Cell Counter* and *Vein Navigator*, an outline of a body was featured alongside the food and activity cards and students were able to make the association between the body, the health levels represented on screen, and in-game choices.

Sharing the Game.

Based upon previous success with games related to childhood diabetes (Brown, 1997) we were interested in understanding if a game about SCA would be something that the participants would share with their friends and family. When asked if they would recommend the games to others, most participants were enthusiastic about playing the games with friends or family members. They thought that a game about SCA would be a positive way to engage their friends in conversations about their disease. For example, in an interview with one patient, a 13 year old male:

> Patient: *Yes, I would [play the games with friends]. [The games could] teach them a little bit about [my disease] 'cause …my friends aren't that smart.*
>
> Interviewer: *What would this teach them?*
>
> Patient: *Homeostasis and Sickle Cell and your red blood cells and white blood cells.*
>
> Interviewer: *Do you ever talk to your friends about Sickle Cell?*
>
> Patient: *No, I keep it a secret*.
>
> Interviewer: *So, if you played this game with your friends, would you talk about Sickle Cell?*
>
> Patient: *Yeah. I'd tell them a little about it.*

Similarly, others told us they tried to not talk about their disease because other kids did not understand why they were sick or could not play sports at times. All but two participants thought that sharing information about their disease with these games would be helpful, and that if other children understood they would be more supportive. One participant explained that playing the game with peers would be good,

> "Cause sometimes when I'm at school I don't feel good, like I feel sick, and I don't have just keep on explaining myself like everything that's going on with me and my body. Like if I tell one friend and they just realize how sick I can get they can just tell a teacher that I'm not feeling that good that day or they can just tell a teacher to call my parents to help or ask them to come pick me up because I'm not able to do any of my work at school." (female, age 14)

One participants told us a story about why she felt positive about sharing the games with peers.

Previously she had been picked on in school because of issues around SCA. When her best friend told her classmates about her SCA, the classmates asked her for more information about SCA, apologized and stopped picking on her.

Learning in the games

During the interviews, most participants mentioned liking the educational aspects of the games and noted that they saw the connection to their disease. For example, when asked if they had learned anything about SCA from playing the game, several players noted lessons about the effects of nutrition and expressed a desire to learn how nutrition might help them manage their pain crises. As one play tester expressed, "Don't overdo it. Drink more water. And the calories you burn, try to maintain it. Like keep it balanced…. Don't [get] dehydrated… just keep going, checking, do research on what's going on in your body. You're not a doctor… so just do your research and maybe try to find more games about Sickle Cell" (female, age 13).

Although players could identify that the game was educational, not all were as confident when asked to describe *what* they learned from the games. Only the *Body Balance* game appeared to deliver the intended educational content with all participants, who describing having learned "That you need to stay hydrated and eat and drink healthy foods and drinks, and don't eat unhealthy food or drinks…" (female, age 11). While the importance of hydration and avoiding sugary beverages was also mentioned independent of eating choices, it was often still spoken of in connection with the *Body Balance* game and not with the more relevant *Vein Navigator* game which focused on drinking alone. Often participants had a hard time understanding and recalling the goal of the *Vein Navigator* game, explaining "The *Vein Navigator*, I didn't really understand that one." Or mischaracterizing the game as having been, as one participant, explained, "…about like finding all the veins."

Some students correctly identified that the *Vein Navigator* and *Body Balance* games shared themes related to diet and hydration and responded positively. When describing her favorite game, one female participant, age 13, shared that she "…loved the *Body Balance*. It was *Body Balance* and *Vein Navigator*. I loved those two the most because it's like telling you what's going on inside of a body in a game, the body of the game. It's very creative, because it's like helping you. Like this is what I should start doing. This is what I shouldn't do. Then with the *Body Balance*, it's making you choose like, "Should I really choose this?" or, "Should I stop doing this?" However, for other players, this connection was not as clear and a few described the *Vein Navigator* and *Cell Counter* games as connected, perhaps because of their visual similarities, despite the fact they address different learning content. As one participant (female, age 12) put it "…the first one [*Cell Counter*] and the third one [*Body Balance*] were mostly related because it was mostly focused on keeping your body hydrated." This accurately describes the goal of the *Body Balance* game but misidentifies the idea behind the *Vein Navigator* game as that of the *Cell Counter* game.

The concept covered by the *Cell Counter* game was often recalled only partially, and it was often described as a game focused on "counting" or "scanning" blood cells rather than counting blood cells *and* liquid. Participants didn't remember that counting the number of cells repeatedly was for purposes of determining a ratio of cells to liquid and to later arrive at an average. Instead, participants understood simply that "You have to count how many red blood cells the patient has" (female, age 11) or that the goal of the game was, to "Find all the blood cells and scan them" (female, age 11). Only one participant recalled the fact that the scanning in the *Cell Counter* game was used to measure more than just blood cells, explaining "The *Cell Counter* one is to count the cells and something by scanning yourself and collecting the water on yourself…" (female, age 13).

Further, some players expressed incorrect learned concepts. For example, one player said, "Well you have a lot of white blood cells that stop the red blood cells from flowing through [the veins]." In other cases, participants had difficulty articulating their ideas. One thirteen-year old female player vaguely revealed that the new thing they learned about SCA was that "it could do different things in the body. Stuff I didn't know about…I did not know about blood clots." And when pressed could not explain how they learned about blood clots, what blood clots did or how they formed.

General knowledge and feelings regarding SCA.

Most strikingly, many patients demonstrated a large deficit in knowledge of SCA physiology and disease management. While they understood that their blood cells were different, specifically that they "look like a moon" or were shaped, "like a crescent…or a C", players' vocabulary (i.e. disease fluency) and understanding of concepts related to the vascular system were very limited. Often in explaining the disease they referenced their experience of treatment or symptoms, but struggled to describe mechanics of it:

> Interviewer: *Why don't you tell me what you know about sickle cell?*
>
> Participant: *Well I know that that keeps me in here Monday and Wednesday. Sometimes Tuesday. They just give me blood. Sometimes they take it away and I come back up here Wednesday. They stick me then they give me blood and I just watch TV."*
>
> Interviewer: So sickle cell to you is something that makes you come back here?
>
> Participant: *Yes.*
>
> Interviewer: *Come back to the hospital and they do stuff related to your blood?*
>
> Participant: *Yes*
>
> Interviewer: *Ok. So do you know how it affects the body?*
>
> Participant: *No*. (Male, age 10).

Only a few players seemed confident when describing the science of their disease. Most could only name the effects of the disease, such as lethargy, a pain crisis brought on by exercising too rigorously: "It kind of holds a grudge on you 'cause it keeps you from doing things that you actually want to do like a normal kid would do that doesn't have sickle cell… It keeps me from running a lot. I don't get to run. Sometimes my knee starts to hurt from running a lot so it keeps me from running" one 12 year old girl explained. By and large, many patients expressed feelings of loneliness and embarrassment, unable to explain their disease.

> Interviewer: *Okay. What do you know about Sickle Cell? Like if you were to tell a friend of the family. They're like, "What is that? What do you have?"*

Participant: *I wouldn't really know. I would go to my Grandma.*

Interviewer: *Okay*.

Participant: *I just know that our cells are different. They're crescent and not round is all I know.*

Interviewer: *Okay. So, what affect does it have on your body to have Sickle Cell?*

Participant: *I don't know.* (Female, age 13)

In connection to this finding, and in answers to our prompt to gauge patient interest in sharing the game with friends, players frequently remarked that the game would help explain their disease experience to peers and seemed enthusiastic about the idea of others better understanding their experience. As one patient put it "I could explain it to them like they don't understand, well, like, there is this game you can play to try and understand and figure out what it is" (female, age 13).

Discussion

Our initial motivation in developing this project was to develop a learning environment for chronically ill children that would be engaging and support children's health literacy and learning about STEM disciplines. Our first goals were to address the games' usability and if participants learned from the games. We specifically tried to address the question, can something personally negative serve as the catalyst for learning the same way that positive and playful experiences do? Two aspects of learning with the game that emerged as promising opportunities were the embodied experience of the participants in the game and the social development that the games offered.

While participants we able to play the games, there were some usability issues. Unsurprisingly players did not read directions. While we had tried to make the text short and easy to read, we recognize that it is unlikely players will read unless it becomes more integrated into the game play. However, the game mechanics, particularly within the *Body Balance* game, did support health literacy and most players felt they learned something about balancing food and beverage intake and exercise and exertion that might help them avoid a pain crisis. In contrast the lack of reading and the lack of, or awkward, integration of STEM content into the game play of the other two games left us with little evidence of learning STEM content. Overall the games were fun and playable, and improvements in health literacy were noticed, however it was our assessment that the learning goals needed to be better aligned and then integrated into the game mechanics.

In answering the initial question, *Can something personally negative serve as the catalyst for learning the same way that positive and playful experiences do?* We identify that the participants eagerness to share and play the games with friends and family suggest it can. This is similar to Brown et al. (1997) research on games about childhood diabetes, in that this type of shared gaming experience can become a collaborative learning experiences because of the dialogue it starts and the ways that these discussions align the patient as "experts" in conversations around their medical condition. We had expected that "expert" role would be something that the participants already had to some degree. However, while participants showed a strong interest in learning about SCA and their bodies, their lack of understanding about SCA and their body suggest that their chronic illness is not currently an *island of expertise*.

Instead our findings indicate that the need for disease literacy among this age group is much more critical than we anticipated. This game was, in all but one case, was the only informal learning experience about SCA, outside of direct instruction from healthcare providers, that participants could recall. So while participants enjoyed the game, this was their first opportunity to build an interest with informal or playful learning about SCA. However, the strong interest they had in the games about SCA demonstrated to us promise in leveraging their disease, a typically negative experience, into an asset for motivating learning.

The meta concept of the game was designed to suggest that players were controlling a nanobot and exploring a body, yet many players understood themselves as the owners of the body being explored. We had anticipated they would play as the robot, not as the body. This raises some interesting issues. There is a growing recognition that the body plays a significant part in reasoning and thinking across disciplines and an embodied learning seems to be natural fit with learning about the body. However, the embodied talk of the participants was also concerning. We had hoped to create some distance between the body and the player because of the negative consequences of chronic childhood illnesses. This poses a challenge in design that should be explored further.

While we anticipated that participants might like to share the game with friends and family with chronic illnesses, the social and emotional aspects of their disease were surprising. SCA has unique properties in that the children do not look ill even when in great pain. A pain crisis has little external identifiers and this seems to cause some social and additional emotional discomfort for the participants. The participants saw promise in sharing this game not only to help others learn and have fun, but also as a social lubricant to improve others empathy and reaction to their illness. And while health literacy generally addresses issues around physiology, these emotional issues, and tools to navigate them, seem just as critical for improving children's lives.

Conclusions and Future Work

We concluded from this initial implementation that children with SCA lacked comprehensive knowledge about SCA, but were motivated to share the games with peers. This suggest that we could best serve our target population by (1) Understanding the mode of delivery of educational content that leads to desired outcomes and (2) Ffocusing on children's knowledge about their disease rather than STEM concepts, to empower the students to engage in diseased-based dialogue with family and friends. To address issues related to mode of delivery and to increase reading and the desire to learn through play we anticipate several studies with future iterations of the games. We anticipate testing integration of a graphic novel with the game, testing options for audio or text, and specific game design that will offer learning remediation through narrative branching. Narrative branching can be used to identify misconceptions and direct players towards better understanding of STEM concepts. For example, Players might choose between three options that would represent the correct path and two paths that might be taken if the player has misconceptions about the STEM content. If they choose a path based upon misconception we would allow for productive failure with a non-player character assisting in problem-solving then directing them towards the correct path with remediation.

While our initial goals with this project did not include measuring health literacy, findings indicated that most players improved their health literacy. A greater focus on health literacy through gaming could help us in identifying methods for supporting children as they make the transition away from parental responsibility for their health compliance.

References

Austin, K. A. (2009). Multimedia learning: Cognitive individual differences and display design techniques predict transfer learning with multimedia learning modules. *Computers & Education*, *53*(4), 1339–1354.

Brink, S. J., Miller, M., & Moltz, K. C. (2002). Education and multidisciplinary team care concepts for pediatric and adolescent diabetes mellitus. *Journal of Pediatric Endocrinology and Metabolism*, *15*(8), 1113–1130.

Brown, S., Lieberman, D., Gemeny, B., Fan, Y., Wilson, D., & Pasta, D. (1997). Educational video game for juvenile diabetes: results of a controlled trial. *Informatics for Health and Social Care*, *22*(1), 77–89.

Carden, M. A., Newlin, J., Smith, W., & Sisler, I. (2016). Health literacy and disease-specific knowledge of caregivers for children with sickle cell disease. *Pediatric Hematology and Oncology*, *33*(2), 121–133.

Clegg, T. L., Gardner, C. M., & Kolodner, J. L. (2010). Playing with food: moving from interests and goals into scientifically meaningful experiences (pp. 1135–1142). Presented at the Proceedings of the 9th International Conference of the Learning Sciences-Volume 1, International Society of the Learning Sciences.

Cohen, J. (1960). A Coefficient of Agreement for Nominal Scales. *Educational and Psychological Measurement*, *20*(1), 37–46. https://doi.org/10.1177/001316446002000104

Crowley, K., & Jacobs, M. (2002). Building islands of expertise in everyday family activity. In *Learning conversations in museums* (pp. 333–356). Citeseer.

DeWalt, D. A., & Hink, A. (2009). Health literacy and child health outcomes: a systematic review of the literature. *Pediatrics*, *124*(Supplement 3), S265–S274.

Harskamp, E. G., Mayer, R. E., & Suhre, C. (2007). Does the modality principle for multimedia learning apply to science classrooms? *Learning and Instruction*, *17*(5), 465–477.

Kahana, S., Drotar, D., & Frazier, T. (2008). Meta-analysis of psychological interventions to promote adherence to treatment in pediatric chronic health conditions. *Journal of Pediatric Psychology*, *33*(6), 590–611.

Kato, P. M., Cole, S. W., Bradlyn, A. S., & Pollock, B. H. (2008). A video game improves behavioral outcomes in adolescents and young adults with cancer: a randomized trial. *Pediatrics*, *122*(2), e305–e317.

Kilewer, W. (1997). Children's coping with chronic illness. In S. A. Wolchik & I. N. Sanders (Eds.), *Handbook of Children's Coping: Linking Theory and Intervention*. New York: Plenum Press.

Mattsson, A. (1972). Long-term physical illness in childhood: A challenge to psychosocial adaptation. *Pediatrics*, *50*(5), 801–811.

Mayer, R. E. (2002). Multimedia learning. *Psychology of Learning and Motivation, 41*, 85–139.

Miles, M. B., Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook*. SAGE.

Nielsen, J., Clemmensen, T., & Yssing, C. (2002). Getting Access to What Goes on in People's Heads?: Reflections on the Think-aloud Technique. In *Proceedings of the Second Nordic Conference on Human-computer Interaction* (pp. 101–110). New York, NY, USA: ACM. https://doi.org/10.1145/572020.572033

Palmquist, S., & Crowley, K. (2007). From teachers to testers: How parents talk to novice and expert children in a natural history museum. *Science Education, 91*(5), 783–804.

Papathanassoglou, E. D., Bozas, E., & Giannakopoulou, M. D. (2008). Multiple organ dysfunction syndrome pathogenesis and care: a complex systems' theory perspective. *Nursing in Critical Care, 13*(5), 249–259.

Rothman, R. L., DeWalt, D. A., Malone, R., Bryant, B., Shintani, A., Crigler, B., … Pignone, M. (2004). Influence of patient literacy on the effectiveness of a primary care–based diabetes disease management program. *Jama, 292*(14), 1711–1716.

Schweppe, J., & Rummer, R. (2016). Integrating written text and graphics as a desirable difficulty in long-term multimedia learning. *Computers in Human Behavior, 60*, 131–137.

Thompson, D., Baranowski, T., Buday, R., Baranowski, J., Thompson, V., Jago, R., & Griffith, M. J. (2008). Serious video games for health: how behavioral science guided the design of a game on diabetes and obesity. *Simulation & Gaming*.

Tritt, S. G., & Esses, L. M. (1988). Psychosocial adaptation of siblings of children with chronic medical illnesses. *American Journal of Orthopsychiatry, 58*(2), 211.

Witteman, M. J., & Segers, E. (2010). The modality effect tested in children in a user-paced multimedia environment. *Journal of Computer Assisted Learning, 26*(2), 132–142.

Wolf, M. S., Wilson, E. A., Rapp, D. N., Waite, K. R., Bocchini, M. V., Davis, T. C., & Rudd, R. E. (2009). Literacy and learning in health care. *Pediatrics, 124*(Supplement 3), S275–S281.

Tables

Table 1

Parent Code:	Subcode	Description	Example Quote
First Impression of Game		Comment that the game was enjoyable, fun or not very good.	“It was more fun than I expected.”
Game is Educational		Comment that the game was educational in some general way	“People could learn things from playing this.”
Motivation to Share with Others		Comment that they would or would not share with their friends and why.	“I might show them what is in there and tell them about it if they don’t know, like tell them the details of what sickle cell disease is”
Learned Specifically:	Body Balance, Hydration, About the body, Sickle Cell	Comment on content learned from playing the games.	“I learned about platelets in the vein game.”
Prior Knowledge:	Vein, Artery, Capillary, Average, Ratio, Volume, Sickle Cell	Comments on what they already know or what they don't know about these specific topics.	"I know about how platelets go to a cut in your skin and form a scab" or "I don't know what an artery is."
General Impression		Comments on meta game or specific game; suggestions or qualities.	"I like how everything is related to the body?" or "I like the game with the ship."
Personal Disease Experience		Talk about how SCA effects them on a personal level.	"It keeps me from running a lot. Sometimes my knee starts to hurt"

Interview Codes

Figures

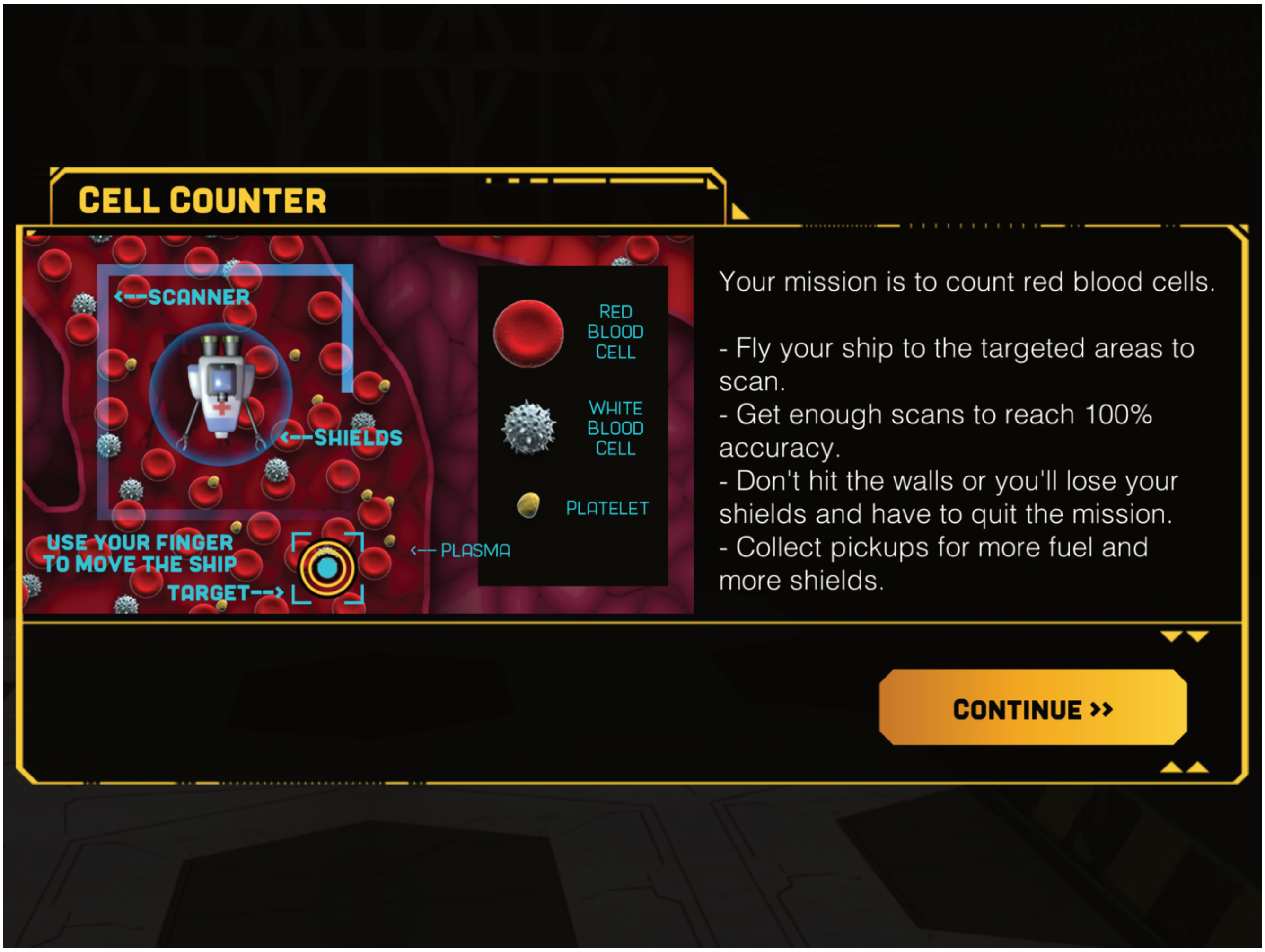

Figure 1a. A Cell Counter instruction screen.

Figure 1b. Cell Counter gameplay

Figure 12c. The Cell Counter results screen during initial prototyping (above) and after our first round of playtests when it was changed to require input from the player in an effort to encourage more engagement with math content.

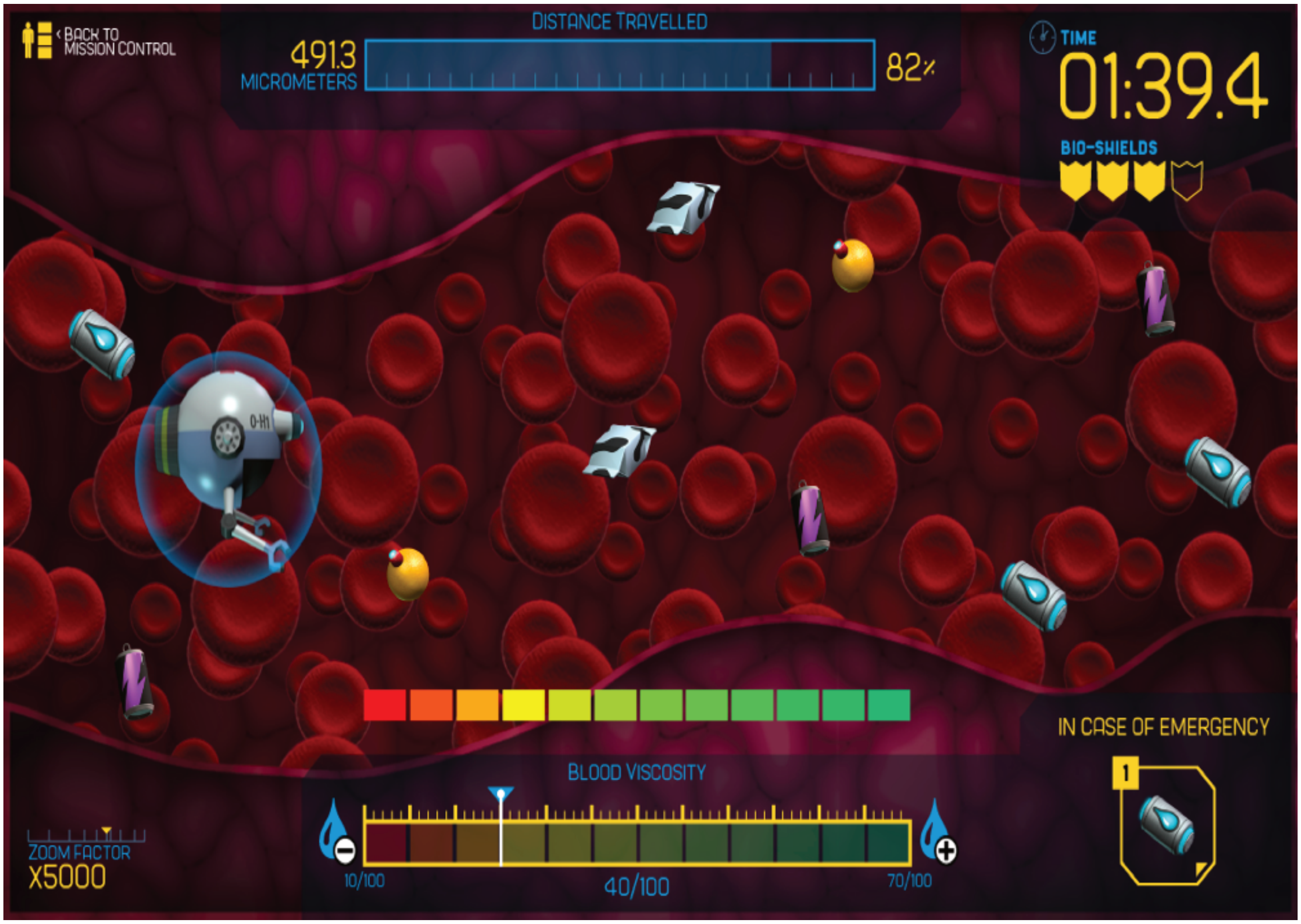

Figure 2. Vein Navigator gameplay

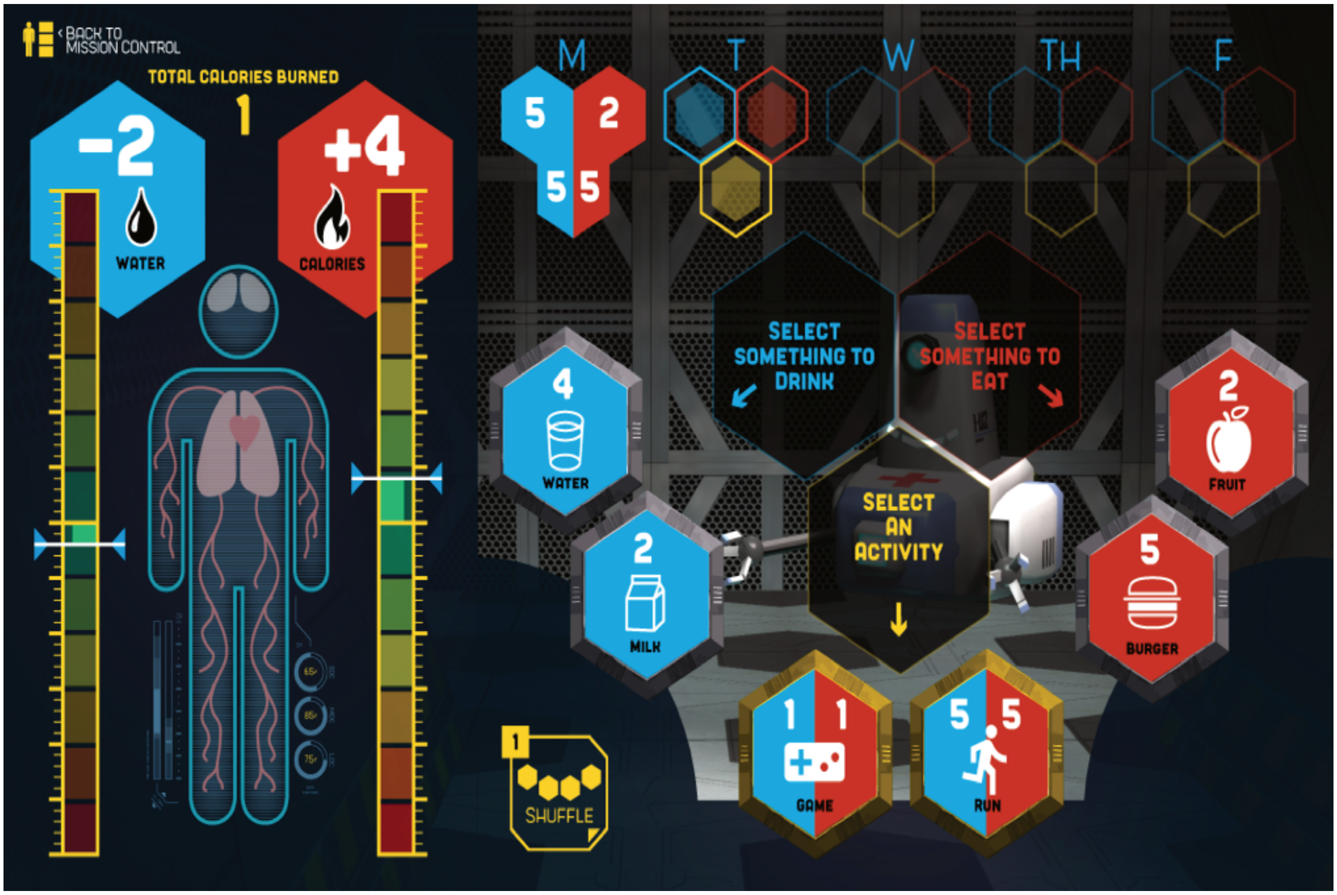

Figure 3. Body Balance gameplay

GAMES OF FELLOWSHIP: AFFECTION, EMPATHY AND MAKING FRIENDSHIP GAMES

Affection, Empathy and Making Friendship Games

CASEY O'DONNELL AND HERMIONE BANGER

Abstract

Various monikers have been used to designate games outside of the traditional "entertainment" space – Serious Games, Persuasive Games, Games for Impact, Games for Change, Learning Games, … – with an even smaller subset of those games focused explicitly on what might generally be referred to as "relationships" or "friendships" under the the name Affection Games (Grace, 2013; Grace, 2017) or Empathy Games (Lankoski, 2007; Hromek et al., 2009; Belman & Flanagan, 2010). However, little has been done to look explicitly at games designed to foster new connections and friendships, with one recent exception (Cook et al., 2017). In this presentation we examine the range of games that might be broadly categorized as "relationship games," not specifically focused on romantic or sexually themed games, but rather examine the category broadly. We do this through the context of the development of a non-digital card game, Fellowship of Fools, a conversation/relationship game. We then propose a very specific category of relationship games that we label, "Affinity Games" which we also trace the contours of.

While it might be stated that, "many games can foster friendship," with players learning or working together (Steinkuehler & Duncan, 2008; Taylor, 2009; Chen, 2011) or players using games to spend time with family members (Nardi, 2010) the focus has not been explicitly on games designed for creating or fostering new or old friendships. Fellowship of Fools (O'Donnell & Banger, 2018) is a game designed to help guide players through developing a friendship with someone new, or deepening an existing relationship. The game prompts players for situations to role-play together in which they must choose what are the best topics to explore in that given situation. Some topics may be too personal to ask too early in getting to know someone, or not appropriate for the situation at hand. In the game, players will navigate these possibilities and share feedback on how we choose to play and respond. The more time players spend in the game building experience, the deeper those relationships become.

The presentation will focus on the evolution of the game and its background as well as how its design was built around various research focused on fostering intimacy and closeness (Aron, et al., 1997). This explicit goal of fostering friendships and closeness, while not "tested" in this work, is instead presented as an alternative kind of game format made explicitly for this purpose. The concept of "Affinity Games" is presented as a broad category of games designed around the definition of

affinity, “a spontaneous or natural liking or sympathy for someone or something” (Oxford, 2018a). An Affinity Game is a game that places as a core game mechanic or system two or more of these foundational tenets: Mutual Aid (freely given and freely taken gifts), Solidarity (associating together to satisfy common interests and needs) or as Richard Sennett writes, “The connection between everyday social bonds and political organization” (Sennett, 2012, Pp. 36), Autonomy, Voluntary Association, Self-Organization and Direct Democracy.

The conceptualization of an Affinity Game is based on the political philosophy of Anarchism and concept of “relationship anarchy.” The main tenants of Anarchism used in the conception of Affinity Games draw directly from the work of anthropologist David Graeber:

“Anarchist or anarchist-inspired movements are growing everywhere; traditional anarchist principles—autonomy, voluntary association, self-organization, mutual aid, direct democracy—have gone from the basis for organizing within the globalization movement, to playing the same role in radical movements of all kinds everywhere.” (Graeber, 2004, Pp. 2)

With respect to Graeber, solidarity is also considered a fundamental element of the political philosophy of Anarchism. As such, we include it in our definition of what makes an Affinity Game. The concept of the Affinity Game also connects to the concept of the “affinity group,” which the Oxford dictionary defines as, “A group of people linked by a common interest or purpose,” (Oxford, 2018b). This works well, particularly w/re to the concept of solidarity. The affinity group links the normal everyday work and interests with broader realms of political organization.

With respect to the concept of relationship anarchy, we draw heavily on writers who leverage the political philosophy of Anarchy, but direct it specifically onto the realm of interpersonal relationships. One writer in particular captures the relevance of relationship anarchy to friendship in this passage:

“By that definition, an anarchist relationship is first and foremost one of cooperation and setting our own rules. By that definition, it is not self-serving but always mutually beneficial. By that definition, it can be a monogamous relationship if that’s what makes the people involved feel happiest. By that definition, it can be about friendship, about romance, about sex, about a selection of those things, but by definition it will be about care. And intuitively, I’d say an anarchist relationship is a mutual support system against the brutal, oppressive capitalist world around us.” (queeranarchism, 2016)

This resonates well with Sennett’s work on cooperation and collaboration. Further, this contrasts well with Cook et. al.’s assertion that friendship is defined as, “another person with whom you have a mutually beneficial long term relationship based off trust and shared values.” Relationship anarchists have actually put a great deal of time and effort into defining this rather elusive term, “friendship.” Quoting another blogger who has written extensively on relationship anarchy:

“The word ‘friendship’ is widely used as a broad, vague, often meaningless term, but to me, friendship as this deep, intimate, important, positive bond between humans is described really well by the above set of principles. Friendship leans away from interpersonal coercion by default and can’t survive under the burden of it for long. Mutual aid and cooperation are in friendship’s very nature; you could even define friendship by those qualities: helping and supporting each other out of desire and not duty. And when friendship is committed, that commitment is done in a spirit of communication, not drawn up as a contract, which what marriage is: a legal contract binding romantic partners." (thethinkingasexual, 2016)

The idea that games can foster friendships, while not tested in this paper, is presented as a foil to much of the existing work around games that presents themselves as fostering new kinds of connections between people, be that affection or empathy. Rather, Affection Games make as an explicit requirement that players come together to play with one another rather than with characters, playable or non-playable.

With much of the focus currently being placed on the concept of empathy games, we posit, instead, that the focus be more on friendship games or Affinity Games more specifically. While the results of this kind of approach has yet to be tested, more games need to be made with this kind of approach in order to better understand their potential impact.

References

Aron, Arthur; et al. 1997. The Experimental Generation of Interpersonal Closeness: A Procedure and Some Preliminary Findings. Personality and Social Psychology Bulletin. 23(4) 363-377.

Belman, Jonathan; Flanagan, Mary. 2010. Designing Games to Foster Empathy. Cognitive Technology. 14(2) 5-15.

Chen, Mark. 2011. Leet Noobs: The Life and Death of an Expert Player Group in World of Warcraft. New York, NY: Peter Lang Inc.

Cook, Daniel; et al. 2017. Game Design Patterns for Building Friendships. http://www.lostgarden.com/2017/01/game-design-patterns-for-building.html. Accessed, July 1, 2018.

Grace, Lindsay. 2017. Love, Lust, Courtship and Affection as Evolution in Digital Play. Proceedings of DiGRA 2017.

Grace, Lindsay. 2013. Affection Games in Digital Play: A Content Analysis of Web Playable Games. Proceedings of DiGRA 2013.

Graeber, D. (2004). *Fragments of an Anarchist Anthropology*. Chicago, IL: Prickly Paradigm Press, LLC.

Hromek, Robyn; et al. 2009. Promoting Social and Emotional Learning With Games: "It's Fun and We Learn Things". Simulation & Gaming. 40(4) 626-644.

Lankoski, Petri. 2007. Goals , Affects, and Empathy in Games. Proceedings of The Philosophy Of Computer Games 2007.

Nardi, B. A. (2010). My Life as a Night Elf Priest: An Anthropological Account of World of Warcraft. Ann Arbor, MI: University of Michigan Press.

O'Donnell, C. & Banger, H. 2018. Fellowship of Fools. Madison, WI: The Game Crafter.

Oxford Dictionary. 2018a. Definition of Affinity in English. https://en.oxforddictionaries.com/definition/affinity. Accessed: July 1, 2018.

Oxford Dictionary. 2018b. Definition of Affinity Group in English. https://en.oxforddictionaries.com/definition/affinity_group. Accessed: July 1, 2018.

queeranarchism. (2016). Relationship Anarchy Could be About so Much More than the Freedom to Fuck. Retrieved October 18, 2018 from http://queeranarchism.tumblr.com/post/138814843863/relationship-anarchy-could-be-about-so-much-more

Sennett, R. (2012). *Together: The Riutuals, Pleasures and Politics of Cooperation*. New Haven, CT: Yale University Press.

Steinkuehler, C., & Duncan, S. (2008). Scientific Habits of Mind in Virtual Worlds. Journal of Science Education and Technology.

Taylor, T. L. (2009). The Assemblage of Play. Games and Culture, 4(4), 331-339.

thethinkingasexual. (2016). Relationship Anarchy is not about Sex or Polyamory. Retrieved October 18, 2018 from https://thethinkingasexual.wordpress.com/2016/06/06/relationship-anarchy-is-not-about-sex-or-polyamory/

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