Game Your Life: Health, Behavior, and Personal Data Gaming

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Abstract: This session presents a novel genre of games, personal data gaming, in which players wear digital monitoring devices that collect data about aspects of their everyday lives and behaviors, and then the data become useful in a game context. We describe the genre itself and our game design, applications in a health education context, and results from a multi-year DBR study of personal data gaming with middle school youth, specifically students' motivations and engagements as well as socio-economic comparisons across field sites.

Introduction

Gaming scholars and designers assert that games can leverage transformative change, within individuals and within society as a whole, because games afford risk and experimentation within rich simulated realities, and they also offer opportunities for complex identity work in a low-threshold, low-threat environment (e.g., Bogost, 2011). With few exceptions, however, empirical studies of such transformation—what it looks like in terms of everyday behavior and how it takes place—are rare. The Quantified Self movement similarly claims that life altering behavioral change is possible when users employ wearable devices and other technologies to collect and analyze data about their own lives, and then employ findings from that data toward more informed decision making (Lee, 2013; Swan, 2012; Wolf, 2010). Combining these two approaches, gaming and personal data, has vast potential for creating a new genre of playful and planful cyberlearning technology that fosters personal change.

This session presents such a novel genre of games, personal data gaming, in which players wear digital monitoring devices that collect data about physical activity aspects of their everyday lives and behaviors, and then the data become useful in a rich game context. Each of the four papers to be presented in this session describes in turn: (a) game development within in a health education context, and how that development is related to other kinds of gaming and health data innovations; (b) the development of our personal data game itself, currently funded by the National Science Foundation, and the design principles it is based on; and (c-d) results from a multi-year DBR study of personal data gaming with middle school youth.

Fun for Health/Health for Fun

Sara Schaefer

Metabolic health problems in the U.S. have reached epidemic proportions. Excess weight and obesity affect two-thirds of the adult population, and chronic diseases are responsible for nearly 70% of deaths (U.S. DHHS, 2012). Childhood obesity affects 18% of young people and is a strong predictor of dangerous chronic diseases later in life (Reilly & Kelly, 2011). These trends have been blamed, at least partially, on the ubiquity of computing and entertainment technology. "Screen time," which includes video gaming, is blamed for low rates of physical activity across the developmental spectrum (Gordon-Larson, Nelsen, & Popkin, 2004; Hager, 2006; Vandewater, Shim, & Caplovitz, 2004). Many obesity prevention interventions target reduction of screen time to encourage youth to be more physically active.

The growing Games for Health movement is changing the negative dialogue on gaming among health researchers, with the advent of games designed to inspire fitness and manage disease (Lu, et al, 2013; Rahmani & Boren, 2012). Exergames, video games that involve exercise such as the Nintendo Wii have shown to be as effective as traditional aerobic exercise (Guderian, 2010). Playing Dance Dance Revolution has been shown to equate to moderate intensity exercise for kids, making it "a safe, fun, and valuable means of promoting energy expenditure" (Graf et al, 2009). Research on exergames has shown moderate effect on weight; about 40% of overweight and obese youth who played exergames showed positive effects (Lu et al., 2013, Douglass-Bonner, 2013). More research on effectiveness is needed, particularly among overweight and obese youth. A study showed that healthy youth who are already physically active were more likely to engage in active gaming as a recreational choice than overweight and/or sedentary youth (Wethington et al., 2013). Researchers suggest that brief increases in physical activity during exergaming do not translate to real world behavior change (NYT, 2012).

Figure 1a: Workouts in *Second Life*

Figure 1b: *Squire's Quest!* game aimed at food choices

Research has shown that some games do have promise in affecting real world behavior change on topics related to health and beyond. For example, people who received workout advice through virtual reality game *Second Life* (Figure 1a) reported more positive changes in healthy eating and physical activity than people who went to a traditional gym, but weight loss was the same in both groups (Graf, 2009). Games can also integrate behavior change theories and principles, like *Squire's Quest!* (see Figure 1b) which is designed to encourage children to increase their fruit and vegetable consumption (Baranowski, 2003).

The Quantified Self is another movement that offers a technology driven solution to health. It suggests that powerful personal transformation place via using wearable devices, leading to improved awareness of how personal health metrics are connected to everyday behavioral patterns such as step counts, heart rate, food intake, etc (Lee, 2013; McFriedes, 2013; Wolf, 2010). But without the existing motivation to collect one's own personal fitness data and use that data for decision-making purposes, corresponding behavioral change may not be forthcoming. Health improvement studies that have attempted to introduce pedometers or other activity tracking devices as an intervention, to motivate increased movement and weight loss among overweight and obese participants, usually have found short-term novelty effects on incidental exercise behavior but not long-term changes (Gardener & Campagna, 2011; Schofield, Mummery, & Schofield, 2005).

Our project takes these two technology-based approaches, self tracking and video-gaming, and combines them, essentially making health "gameable". In Project GETUP (Gaming to Educate Teens to Understand Personal health) youth players use Fitbit physical activity monitors to measure their own fitness and physical activity, and learn to engage in data over the long term. Game play then engages them in planning and hypothesis testing that can lead to sustainable behavioral change.

Personal Data Gaming: Genre and Design

Cynthia Carter Ching

Game scholars are starting to examine games as persuasive technologies, including those that foster ethical or pro-social behavior (Jenkins, et al, 2009; Steinkuehler & Owen, 2013, Horn et al, 2014). Research on learning in and around games demonstrates that, using the tools available to them through sense making in game worlds, youth players often engage in sophisticated reasoning from data and use evidence-driven argumentation to form and test hypotheses about play strategies, avatar builds, mods, weapon selection, etc (Squire, et al, 2005; Zimmerman, 2007). This reasoning, articulation, and data-driven decision making is often far more sophisticated than what these players are able to demonstrate in a school setting (Steinkuehler & Duncan, 2008). Yet data that comes from participants' off-screen lives has largely not been part of this kind of in-game data inquiry. While Quantified Self (QS) technologies provide a myriad of "real-life" data that could be leveraged in a game environment, existing QS approaches are largely designed for mainstream, middle-class adult populations who already have existing technological infrastructures to support syncing and analysis (Authors, 2014; Lee, 2013). Additionally, the forms that QS data streams and their accompanying dashboards take (typically query-able databases returning multiple types of graphs and/or charts) also require levels of data literacy that many youth, particularly from underserved populations, tend to struggle with (Gándara & Contreras, 2009; Vahey, et al, 2006).

In our lab, we took on the development of a personal data gaming model that integrates the power of gaming to create enjoyment, capture the imagination, and engage learners, combined with the personal data analysis and reflection of a Quantified Self approach to health and fitness, in a form factor that is low-threshold, accessible to data literacy challenges, and easily integrated into an educational environment. Informing our ongoing development are several principles about the relationship between gaming and personal data, in our case step-counts and other data from Fitbit activity monitors.

We determined first, via youth user groups and early prototype testing feedback at participating fieldsites, that the game world has to be compelling. Youth were very clear that the idea of a game explicitly about health and fitness would be *boring* and *school-like*. Consequently, we developed *Terra,* a game about a team of astronauts and explorers discovering and developing a far-off planet. Second, it is not sufficient for a game to deliver only bonuses for physical activity; rather, real-world physical activity has to actually drive the action in the game. In our case *Terra* converts daily Fitbit steps into energy points that are required for planet exploration and development (see Figure 2).

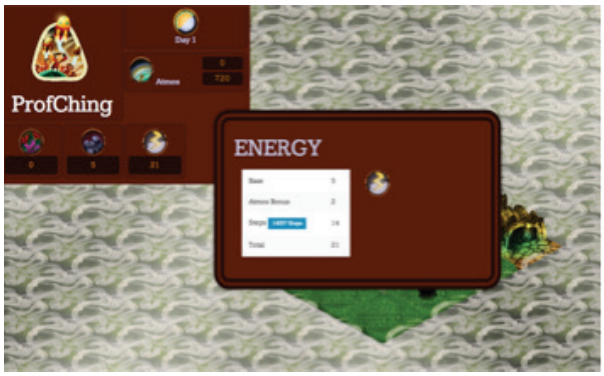

Figure 2: Energy screen showing fitbit steps

Figure 3: Landscape as aggregate representation of fitness and game progress

A third principle is that the game needs to contain alternative visual representations of personal data, not only in terms of daily totals (as in Figure 2) but also aggregates. Our participating youth were largely uninterested in and unmotivated by the kinds of personal data representations provided to them on the Fitbit website, which consisted of bar graphs, pie charts, line graphs, and other mathematical representations. In *Terra,* the evolving landscape that the players create becomes an aggregate representation of their physical activity over time (see Figure 3), as the extent of exploration and the kinds of buildings, creatures, and land features that players attain are contingent on their energy levels each day. Finally, a fourth principle is that the game world should not only enable players to see the results of their daily physical activity after it happens, but it should also help them plan for and set long-term goals for future physical activity. We are currently working on developing unlockable features in the game that can be attained via players setting long-term physical activity goals and attaining them. As we continue working on development of *Terra*, we also want to further flesh out these design principles for the expansion of possibilities for personal data gaming and to inform other similar developments by others in this space.

Motivating Physical Activity and Reflection on Personal Fitness

Mary K. Stewart

Health tracking technologies are changing the way people engage with health and lifestyle management (Klasnja, 2012; Swan, 2009). Healthy behaviors acquired early in life are most effective for disease prevention (CDC, 2014), but feasibility of health tracking among youth is unclear. This study analyzed focus groups that assessed the extent to which wearing a Fitbit physical activity monitoring device motivated physical activity behaviors and reflection on personal fitness.

Our research team conducted and analyzed focus groups and interviews. Recordings were transcribed, and researchers used a grounded theory approach to create codes that described common and interesting patterns and perspectives. All coding and analyses were conducted in Dedoose, a web-based software application for collaborative data analysis. We identified three codes that will be discussed in detail during this presentation: awareness/noticing, increased activity, and social competition.

Code Name	Frequency of Code Occurrences	Code Meaning
Awareness/Noticing	High (more than 50)	Use of device to make observations about self and/or others
Increased Activity	Moderate (30-40)	Deliberate actions to increase step count
Social Competition	Low (less than 20)	Comparing data with peers to see who has the most steps

Table 1: Code Frequency & Meaning

In our focus groups, many students explained that the device increased their awareness of their physical activity (i.e., they were surprised or impressed by the amount of steps they took or the calories they burned in a day). Sometimes this awareness presented itself as broad generalizations about daily activities ("I take 10,000 steps a day"), and sometimes as particular instances that increased their step count, such as soccer practice or walking around the neighborhood. Some participants also extended their awareness of physical activity to reflection on their personal fitness. As one student explained, "the Fitbit's gonna make you recognize how much calories you're burning and tell you if you're lazy or not."

This awareness, coupled with social competitiveness or collaboration, motivated some students to increase their activity. Several participants reported using the Fitbit to compete with each other: one male participant said, "Me and my friends, we would always see who could get the most steps in the day, who can get the most miles in a day…who could burn the most calories in a day." While some female participants also reported competing with their friends, these comments were often framed within the context of working collectively to increase personal activity data: a girl participant said, "It was fun to, like, compare the steps… we'd be like, oh lets do this and talk and walk."

In addition to increased activity in social situations, several participants described initial unsustainable changes to their activities, such as shaking the device or running in place. Others reported more sustainable attempts, such as walking to school, playing basketball at lunch, or participating more in P.E. However, as the novelty of the device waned, participants started to forget they were wearing it and abandoned attempts to increase their activity.

Consequently, while our research indicates that wearable devices can motivate youth to both increase their physical activity and reflect on their fitness, the presence of the device is not sufficient to consistently motivate behavior change. One possible explanation that the next presenter discusses in more detail is that socioeconomic factors and community environment have an important influence on youth behavior.

Socioeconomic Challenges to Implementation and Impact with Diverse Youth

Danielle Hagood

Students from two dissimilar schools make up the counterpoint case studies in this project. Students recruited at School A included mainly lower socioeconomic (SES) and racial minority students (N = 40, M_{age} = 12.6) participating

in an after school program at a middle school in urban Sacramento. Conversely, students recruited from School B included students from a well-resourced community (N = 61, M_{age} = 13.7) enrolled an educational technology elective course at a junior high school. The school is located in a university town at the rural bounds outside Sacramento. These two unlike cases spurred our consideration comparisons of SES differences in both methodological planning and exploring student experiences. Data from our interviews and observations informed further exploration of how youth from these two different schools engage with health tracking, activity monitor use, and help to identify equitable avenues for using health tracking in health education.

	School A	School B
Technology at School	Limited technological resources; old model laptop computers and inconsistent internet bandwidth. Charging issues with computers led to researchers bringing equipment.	Working computers in a lab with desktop computer stations and decent internet. The lab is enriched with a 3D printer, CNC mill, and various software (e.g. video game design).
Technology at Home	85% own a computer at home; 67% access the internet at home; 40% own cell phone	98% of own a computer at home 96% access the internet at home 85% own a cell phone
Nearby Environment	The middle school located in an urban neighborhood in an urban district of a major metropolitan area with busy traffic due to close proximity to a highway interstate and industrial factory nearby.	The junior high school sits off a moderately busy street with several greenbelt and bicycle routes for easy access to the campus on the edge of a small town containing a large research university.
Barriers to Exercise	Safety; few options for after-school teams and clubs.	Proximity to school; busy scheduling.

Table 2: Comparison of Higher and Lower SES Cases

Though the device-and-game model in this study allows a more direct and quantified link to individuals' behavior and affords self-reflection on typical physical activity patterns, as discussed in "quantified self" literature (Swan, 2012), a criticism of the quantified self movement is that it tends to target well-resourced adults (Lee, 2013; Author, 2014). Resources of both technological capabilities and environmental conduciveness to activity separate the students in our case studies.

Such concerns extend to the viability of health tracking for teaching healthy behaviors to diverse youth. Limitations in adequate training, programmatic support, and technology access, necessary to sustain ongoing engagement, may create an equity gap precluding lower SES students from benefiting in both health and data literacy. Our initial findings suggest that SES is related a divide in both the implementation and uptake of physical activity monitor use patterns and behavior change.

Conclusions

While wearable devices, personal data, and exergaming are becoming more visible in the commercial marketplace, these innovations have not yet made significant inroads into formal and informal educational environments. It may only be a matter of time before this happens, however, as personal data has close connections to science and mathematics standards for data literacy (Lee, 2013; Lyons, 2014). One of our goals for research and development is to get in front of this inevitability and have developed playful and empowering applications that put youth in charge of their own physical activity decisions and their own data. Based on our findings so far, however, (a) designing game features that not only reward physical activity but encourage reflection and sustainable change, and (b) overcoming challenges to equitable access across settings and socio-economic status of participating communities will be key in this ongoing endeavor.

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