

The Role of Story in Computer Science Games for Girls

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Abstract: This poster describes the goals and preliminary findings of a study aimed at designing games to introduce girls to computer science concepts. The specific focus of the research is on the role of story in supporting learning and engagement.

Introduction

In this study, we are investigating the role of story in promoting girls' engagement with and learning from games that aim to foster understanding of computer science (CS) concepts. Story is commonly cited as an element of games that might have particular appeal for girls (Kelleher, Pausch, & Kiesler, 2007). While we are skeptical of broad generalizations about girls' or boys' preferences for particular game features, we believe that stories have affordances for engagement and learning that might help to overcome, for example, stereotypes or misconceptions about domains such as computer science. Here we describe the initial stages of our research, including an analysis of story in existing STEM games and the analog game prototypes we have created to introduce several core CS concepts.

Rationale and Approach

A plethora of efforts are underway to change how computer science is introduced and to expand the participation of traditionally under-represented groups. One popular approach is teaching participants simplified programming languages using game design as a vehicle or goal for learning to code. Our project is based on a different vision of how to introduce computer science and how games might be a useful vehicle for this purpose, particularly for our target population of middle school girls. We will use game *play* to teach girls about CS concepts: in this approach, games provide an engaging way to enhance players' understanding of these concepts in a situated way (Gee, 2007).

Our vision rests on the importance of a motivating and appealing story to make CS concepts meaningful and relevant to the girls we seek to reach. Our interest in story is inspired in part by popular books that introduce CS concepts through narratives appealing to girls, such as *Lauren Ipsum* (Bueno, 2011). Yet we know little about the actual value of story, alone or combined with games, for enhancing learning in STEM fields. Furthermore, stories involve many elements, such as plot, character, setting, and conflict, and these elements can be incorporated into games in varied ways. Investigating the full range of approaches to integrating story and games is beyond the scope of an exploratory study such as this one. Instead, we are designing and assessing the impact of games in two different story conditions. The first will be games contextualized within a fictional setting, and the second will be games integrated with an actual story-line with a plot and dramatic arc. We will compare the impact of these conditions to that of game play alone to determine whether either condition enhances players' learning and engagement.

Story and Games

We have adopted Bal's (1997) definition of story as "a series of logically and chronologically related events that are caused or experienced by actors" (p. 1). We define a fictional setting, or story context, as the elements of a story world that provide a concrete scenario and vocabulary for the CS concepts to be learned and applied. Bateman's (2006) discussion of explicit and implicit storytelling in games is helpful in clarifying this distinction. An explicit story in a game is spelled out for the player, as in a book or movie. An implicit story consists of the elements of the game world that set the stage and give meaning to a game but do not specify a sequence of actions or plot, such as the environment, available tools and objects. These elements can be fashioned into a story through the player's imagination.

One literature review on educational games indicates that narrative context provides motivation for learners to continue playing (Dondlinger, 2007). Research about learning and games suggests that story could have a strong impact on learning. Consider Gee's principles of learning found in effective video games (Gee, 2007). Stories may help learners adopt an identity and feel part of a field's academic activities; a story setting may not allow players

to invest as fully in such an identity. A story's structured progression of events can be used to ensure problems are well-ordered. A story setting might give context to information needed on demand, but a story could help control the flow of information so it is not only just-in-time, but also more deeply meaningful. Essentially, while the context of a story setting may help situate educational content, a story may be able to do so in a more structured and meaningful way.

Game Analysis

To better understand possible ways of incorporating story and fictional context with educational game play, we conducted a content analysis of 49 games that address STEM content or skills. These included explicitly educational games, such as *Lightbot*, as well as games designed for entertainment but happen to involve STEM-related content or ideas, such as *Plague, Inc.*. We included analog as well as digital games. While we sought out games designed for computer science, we also included games with other STEM content to capture a potentially wider range of story examples. Only seven (14%) of these games had an explicit story, while 29 (59%) had a fictional context. While we cannot make claims for the representativeness of this sample of games, it seems evident that fully developed stories are not widely used in STEM games. We also analyzed more specific elements of the games' story and fictional setting, including the characteristics of protagonists, the type of setting, and how well the story or context was aligned with the educational objectives of the games and game mechanics.

Game Prototypes

Currently we are pilot testing game prototypes that introduce players to CS concepts of data representation, algorithm writing, and data searching/sorting. Each prototype has three conditions: (a) a basic game without story elements, (b) a game with a fictional context, and (c) a game with a more fully developed plot and characters. For example, the basic game condition for writing algorithms is a relay race in which teams race to accomplish a series of tasks (such as writing directions to locate an object on a map) by writing and following instructions for their team mates. The game with fictional context adds the scenario of an escaped cat that the teams compete to find by solving puzzles related to tracking and trapping the cat. The full story condition is based on the true story of a calico cat named Colins, who ends up on a long sea voyage. There are news reports, a radio retelling of her story, and pictures. The stops in the relay race are locations and events in Colins' "great adventure" and the story unfolds as players take on the role of international rescue groups.

Implications

While the focus of this project is to teach CS concepts, the findings can be a starting point for further exploration of the role of story in the effectiveness of educational games in other STEM areas. More specifically, the findings will be used to guide the development of a more comprehensive digital game intended to introduce learners, particularly girls, to multiple CS concepts. Developing and testing nondigital prototypes will allow us to focus on core design issues without the complications of technical constraints and tools. In addition, the analog games we develop will be useful products in themselves, that can be used immediately in a wide range of informal learning settings.

References

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