Electronic Games: 2D or not 2D?

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1 Introduction

Although popular culture does little to support children's mathematical learning, electronic games may be an exception [Rubin et al. 1997]. Video games are versatile; they can be didactic and a positive motivating force for adolescents. Video games could be used as a teaching tool in one's home as well as in schools, and give middle-school-aged girls confidence and motivation to learn about science and technology [Inkpen et al. 1994]. In spite of these notions it seems the majority of female youth do not play video games regularly, if at all [IDSA 2001].

Unfortunately, the media depicts video games as negative stimuli that often contain little substance [Aguilera and Mendiz 2003]. Misconceptions have led politicians, many media professionals and critics to blame video games for the growth of a culture of violence [Aguilera and Mendiz 2003; IDSA 2001]. Perhaps stereotypes of video games hinder females from being part of the video game market, as 81 percent of video-game players are male. These stereotypes may also prevent video games from being welcomed in most classrooms [Inkpen et al. 1994].

Schools play a vital role in our society, and it is important for educators to adapt to the digital culture that now surrounds us. Specifically middle school students, whom hereafter I will refer to as students, no longer use slide rule, are bored by textbooks, but must have a calculator. Students need more technology in the classroom to compete with that which they know lays outside of the classroom. In this day and age working with computer technology such as Lego Mindstorms Robots is appealing to students who were raised on Sony PlayStations. Dr. James Paul Gee, a professor in the School of Education at the University of Wisconsin-Madison regarded video games as often having "a greater potential than much learning in school" [ESA 2003].

1.1 Motivation

It is a valuable notion that video games do have the potential "to call on the intellectual curiosity and capabilities of the player" [Vail 1997]. From an educator's standpoint, video games can benefit students with different learning styles, approaches to learning, and special needs. There are several characteristics of a game that coincide with learning. Combine these characteristics with a video game environment and you have created a powerful learning tool; Merriam-Webster calls it "edutainment." Dr. Gee stated video games "operate – that is, they build into their designs and encourage – good principles of learning, principles that are better than those in many of our skill-and-drill, back to basics, test-them-until-they-drop schools" [ESA 2003].

The gaming industry has "the potential to significantly affect girls' experiences with and attitudes towards technology" [Murray and Kliman 1999]. Research indicates girls subconsciously decide whether or not to study science or engineering while they are in their adolescence. Girls begin to lose their interest in mathematics and science somewhere between 4th and 8th grade [Fennema 2000]. Thus it is viable to attempt to influence girls by means of technology during their teenage years. As female gaming entrepreneur Brenda Laurel has stated, "use popular culture to empower young girls" [Jenkins 2001]. The industry is consistently missing opportunities to get girls involved in technology, the foremost being video games [Beato 1997].

1.2 Obstacle

If we are to bring educational video and computer games into grades K-12 education, we need to understand why the majority of females do not partake in the video game industry. Despite research that investigates what females would like to see in video games, there still does not seem to be an answer to the question. It is easier to say what females do not like about video games than what they do like [Murray and Kliman 1999]. While the answer to why video games are not played by more females may be complex, the gaming industry and educators need to keep researching and pursuing various avenues that may gain female interest. While women have never been part of the gaming market, it is not to say they cannot be.

1.3 Research Question

Fennema [2000] had realized after 25 years of hard work and dedication that her research needed a new direction, and that direction came from two directions: feminist scholarship and cognitive science. Research on video games and girls can also benefit from a new direction using feminist scholarship and cognitive science. If video games were studied with a feminist perspective, one would see that a female's point of view is ignored in current video games. Cognitive science studies reveal males do considerably better than females when navigating in virtual environments, possibly because a female's mental process in navigating in 3D environments is different than a male's mental process [Czerwinski et al. 2002]. Considering these findings, this research investigates whether the use of 2D and 3D graphics in video games affect the extent of how attracted a male is to playing a video game versus how attracted a female is.

2 Related Work

2.1 From a Female Perspective

Flanagan [2000] took the discussion of females and navigation in cyberspace to even another level by stating:

> "Women in the sciences and in the arts investigate space in different ways using categories that may vary from the traditions in their fields. This is problematic in the examination of virtual reality in several ways: first, women haven't historically been privileged to define fields such as geography or architecture; and second, women have not

been the primary designers of the computational architecture of virtual spaces."

We must study the connections between gender and cyberspace in order to understand the underlying structure of virtual bodies and space [Flanagan 2000]. Computer-generated worlds would change significantly in functionality, control/navigation metaphors, and aesthetically if there was consideration of the implications of gender and virtual space issues [Flanagan 2000].

Video games, like computer-generated worlds, would undergo a considerable transformation if created from a female perspective with an understanding of gender and virtual space issues. Needless to say the "video vixens" of games such as Grand Theft Auto would fade away along with competition, time pressure, repetitive action, twitch games where speed and action are key, crime and violence, but of more significance would be the transformation in the game's look and feel, navigation, and control [Beato 1997; Kliman and Murray 1999]. In order to conjecture what this transformation would result in, it is necessary to review the distinctiveness of today's video game industry.

2.2 3D Video Games are Mainstream

Video games are reaching deeper into the mainstream; in a twice-annual report on trends *The Wall Street Journal* listed video games as one of ten important industries, alongside defense, agriculture, and higher education. Game publishers will continue to generate games that sell, and what sells are realistic graphics. 3D graphics are widely accepted by the gaming world, and mainstream video game players. Video games are now filled with texture mapped polygons and 3D environments. Ask any industry professional what the most important advancement in video games has been, and most likely you will be told that it is the industry's move toward 3D graphics and environments [Rouse 1998].

But do all computer and video games need to be 3D? If you ask an industry-savvy businessman of course the answer will be yes based on previous sales. Making a game 3D signifies it will be able to compete technologically with other games, whether or not it would actually improve game play [Rouse 1998]. While 3D models may not evoke the same emotions for women and men, females do value detail and beauty in computer and video games. However, if the purpose of a video or computer game is compelling, this attribute alone will be enough to make up for everything else within the game, and girls will want to play. Consequently, if a game only utilizes the latest and greatest graphics technology, deeming storyline and game play unimportant, in general girls will not be attracted to the game; but boys will be.

2.3 Gender Makes a Difference

The fact that males and females may be attracted to different characteristics of video games is not a surprise since differences between men and women have been studied since the time of ancient Greece and Rome [Lane 2001]. The difference in spatial ability between men and women is one of the most consistent gender differences in cognitive abilities, and most research provides evidence for male advantages in spatial tasks [Lawton and Morrin 1999; Czerwinski et al. 2002]. Males and females also use different navigational strategies [Czerwinski et al. 2002]. Females look for landmarks when navigating, while males tend to use the cardinal direction they are headed [Lawton and Morrin 1999; Czerwinski et al. 2002]. In particular, males are more likely than females to keep an overall sense of an environment's spatial layout [Lawton and Morrin 1999].

Males not only outperform females in spatial tasks in real world scenarios, but males also score higher than females in computer-generated environments [Lawton and Morrin 1999; Czerwinski et al. 2002]. Males not only do better when judging speed or anticipated position of moving targets on a video screen, but the gender gap increases even more when the spatial task is navigation in a virtual environment [Lawton and Morrin 1999; Czerwinski et al. 2002]. Men consistently do much better than females in navigating virtual environments [Czerwinski et al. 2002]. Lawton and Morrin [1999] found that women were less accurate when pointing to their starting point within a 3D computer-simulated maze. Research suggests females do not create mental maps of a virtual environment that are reflections of the actual environment [Czerwinski et al. 2002].

2.4 Closing the Gender Gap

With all the prior research indicating males outshine females in most spatial ability tasks, one might assume nothing can be done to close the gender gap regarding navigation in virtual environments. However Czerwinski et al. [2002] published results, which were the first they were aware of, that suggest females can achieve efficient navigation in virtual environments when given the right design. The design they refer to is that of a large display in conjunction with a wider field of view of the virtual environment. "Women take a wider view," even though environments appeared to be cluttered on the larger display, women could now make effective use of their navigational strategy that uses landmarks [Czerwinski et al. 2002]. Furthermore, Czerwinski et al. [2002] believed females' cognitive resources that were being used to make inaccurate mental maps of environments were freed using their design. This design truly reflects a woman's point of view; it is proof that if consideration is taken of implications of gender and virtual space issues significant changes would occur.

3 Discussion

The fact that published reports indicate males outdo women when navigating in 3D virtual environments has important implications on how well women do when playing electronic games and how attracted they are to these games. Unfortunately, computer and video games are not made with a wider field of view, nor are large displays in homes or schools. Males are attracted to the latest and greatest video and computer graphics, including complex 3D models, environments, and visual special effects. This speculation can be seen by simply looking at the gender composition of attendees of the annual ACM SIGGRAPH conference. Does this attraction influence the decision of males and females to play video games? In particular, are males more attracted to the 3D graphics in video games? Does the use of 2D and 3D graphics in video games affect the extent of how attracted a male is to playing a video game versus how attracted a female is?

Perhaps answers to these questions would help us understand why females are not the frequent players of computer and video games. If females get lost within the 3D worlds that are now in all of the popular video games it could prevent females from enjoying electronic games the same way their male counterparts do. Czerwinski et al. [2002] noted navigational strategy is "important to the design of both 2D and 3D virtual worlds, since potentially subtle differences in navigational strategies are magnified in computer-generated environments". Females have been immersed in 2D for quite some time. Perhaps because females have spent so much more time thinking in 2D they do not want to spend extra time and effort to learn to play a 3D video game, especially when video games are perceived to be a masculine domain.

3.1 Preliminary Results

Preliminary results from a usability study to assess whether 2D and 3D video games attract females and males differently indicate 2D electronic games are easier than 3D electronic games for females. 36 grade-eight students (13- and 14-year olds; 19 females, 17 males) from a middle school located in a lower-middle-class neighborhood near Denver, Colorado, participated in the study over the course of two weeks. While data analysis is underway, current results point toward a steeper learning curve for females when playing a 3D game than a 2D game. Females may also have steeper learning curves than males when playing 3D electronic games. In spite of this, a female could be attracted to a 3D game because the game is a "fun challenge."

3.2 Conclusion

In today's market, educational electronic games cannot compete with the over $10 billion U.S. video game market. But educational electronic games do not have to compete with video games, so it is acceptable to make them 2D. It appears males could be attracted to 2D electronic games as well, but research needs to be conducted to ensure males would not be put at a disadvantage if educational games primarily used 2D graphics.

Acknowledgements

I would like to thank Alyn Rockwood for all of his help, suggestions, and insight, and Maria Klawe for her inspiration and contributions to this research.

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