Alien Games: Do girls prefer games designed by girls?

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Abstract

This three year study used a mixed method design beginning with content analysis of games envisioned by 5th and 8th graders, followed by a survey of students in the same age range reacting to video promos representing these games. Results show that the designers' gender influences the design outcome of games and that girls expected they would find the girl games significantly more fun to play than the boy games while boys imagined the boy games would be significantly more fun to play than the girl games.   Boys overwhelming picked games based entirely on fighting as their top ranked games. Girls overwhelmingly ranked those same fighting games as their least preferred. When placed in the role of game designers, girls in our study consciously designed their games with both male and female players in mind, while boys designed only for other boys.   Both 8th grade boy games ideas were liberally "borrowed" from a successful commercial game.   Gender is far from the only factor that influences design outcomes. There are many factors that can affect the outcome of a game design, including the context, the content, the game genre, game goals, the age of the designers and designer gender.

Introduction

From the clunky bitmapped graphics of the Space Invader games to the complex 3-D landscapes that make up today's networked first person shooters, aliens, as in extraterrestrials, have long been a staple component of video games and video game culture. However, there is another meaning to the word alien that we would like to highlight, one that resonates more with alienation than little green men. For the most part, video games have been made by boys and men for boys and men. In that sense, video games alienate or are alien to half the population i.e. girls. Gaming culture is predominantly male, and the use of the word "alien" in the title of this article includes this deeper and possibly more insidious manner in which females are considered alien to the culture of producing and enjoying computer games.

The fact that the game industry is predominantly male is not a new observation. For instance, developers in the game industry are straight, white men. The International Game Developers Association (IGDA) surveyed nearly 6500 professionals in their first study examining game developer demographics and found that 88.5% of game developers were male, 83.3% were white, and 92% were heterosexual (Gourdin, 2005).

It has been argued that computer culture (and by extension, computer software) "could be positively transformed through the integration of girls' and women's insights" (AAUW, 2000, p. 8). The Ludica group proposes "a virtuous cycle" (Fullerton, Fron, Pearce & Morie, in press) for expanding the culture of the computer game industry to include females. If more women were involved in the game design process, Ludica argues, the games designed by women would be more likely to attract girls than games designed by men. This would lead to females being more likely to enter careers in the game industry, leading to more girl friendly games and thus establishing a virtuous cycle.

But, why presume games women design would appeal more to girls? Gender clearly is related to whether young people choose careers in game design (Gamasutra, 2007) and how much time they spend gaming (ESA, 2006, Roberts, Foehr, & Rideout, 2005). Girls and boys have a lifetime of cultural and individual messages about what it means to be their given gender. That said, gender is only one aspect of a child's identity, and each child interprets and performs gender in relation to individual, social and contextual influences (Butler, 1999). Thus we would not expect women game designers to create a single, uniform kind of girl game. Perhaps they would invent games much like commercial games today. Perhaps we would see as much variation among games designed by different women as between female- and male- designs.

These points of view (one that emphasizes gender differences, and another that minimizes them) lead to a set of critical, empirical questions. These include: Does gender influence the design of video games (i.e. would males and females design games differently)? If so, in what ways would these games differ? Also, would girl and boy players notice these differences in design? And finally, would girls and boys prefer games developed by members their own gender, the opposite gender or would gender not matter?

We designed two research studies that attempted to answer these questions. The first study looked at how the gender of a design team influences game design. We conducted a two week summer camp for 5th and 8th grade boys and girls where they worked in same-gender, same grade teams to

design the basic concept of an educational game that could be computer based. The design concepts were then adapted into 3 minute game promos by the PI, working with a space scientist and adult artists and game designers . We conducted content analysis of the two week design process and these game promos to identify differences and similarities between the games created. In the second study these game promos were shown to other students who were then surveyed and asked to rate and rank each game without knowing whether boys or girls designed them. The specific research questions, related to gender and game design, addressed by these two studies are: (1) Does the gender of the design team influence the design outcome of games? And (2) Do players prefer to play games designed by their same gender and age?

Background

There are certainly business reasons for the computer industry to develop software that appeals to girls. Beyond this, there are critical social reasons for doing so. Increasingly gaming provides rich educational terrain for a generation of virtual learners and a skill foundation for many future careers (Hayes, in press). Research evidence of the potential for a "virtuous cycle" could help motivate the male-dominated commercial and educational game design industry to integrate girls and women into their design teams.

Gender Gaps in Computing and Play

In contemporary culture, the computer is no longer an isolated machine: It is a centerpiece of science, the arts, media, industry, commerce, and civic life (AAUW, 2000). As AAUW Commission on Technology, Gender, and Teacher Education co-chair Sherry Turkle writes, computer culture has become linked to a characteristically masculine expertise, such that women too often feel they need to choose between the cultural associations of "femininity" and those of "computers" (AAUW, 2000, p. 7). Girls move away from computers and gaming at an early age and to a greater extreme in high school and even more extreme in college (Caywood and Heeter, 2006) with the ultimate effect of limiting women's choices later in life.   At the high school level, only 16% of computer science AP test takers are girls (The College Board, 2006), while women in college earn only 29.1% of bachelor degrees and 24.7% doctoral degrees in math and computer science (NSF, 2004). The trend continues within industry where women make up about 27% of computer and mathematical professionals (Bureau of Labor Statistics, 2005). Most computer games have subject matter of interest to boys, or feature styles of interaction known to be comfortable for boys (AAUW, 2000). As the AAUW report describes, girls assert a "we can, but I don't want to" attitude about participating in computer activities (AAUW, 2000, p. 7).

Research has shown that players can improve spatial skills, memory, and attention by playing video games (Okagaki & Frensch, 1994; Subrahmanyam & Greenfield, 1996; Green & Bavelier, 2003). Feminists argue that girls are disadvantaged in the long run by playing far fewer games (Cassell & Jenkins, 1998; Ray, 2003). Furthermore, gaming and productive activities associated with gaming such as modding (programming modifications of a game) and creating machinima (videos compiled by recording scenes within a game) open a door to computer literacy leading to potential technology careers (Hayes, in press; Cassell & Jenkins, 1998; Ray, 2003; Subrahmanyam, Kraut, Greenfield, & Gross, 2000).

Gaming As Masculine Activity

Research on game content shows most titles on the market are designed by males to please males (Miller, Chaika, & Groppe, 1996; Gorriz & Medina, 2000; Klawe, Inkpen, Phillips, Upitis, & Rubin, 2002). Lazzaro (in press) points out that the 20 top-selling PC and console games of 2005 targeted a narrow male demographic and all fit within four categories: role-playing fighting games, war simulation games, racing games, and sports games. Playing commercial console games is more popular among males than females (Bryce & Rutter, 2003; Colwell, Grady, & Rhaki, 1995; International Hobo, 2004). Males and females generally play different kinds of computer and video games. Boys choose more aggressive (Colwell & Payne, 2000) and more competitive games (Hartmann, 2003) than girls do. Jenson and de Castell (2005) found that boys say they play exclusively with other boys while girls play alone or with boys but only rarely with other girls. When girls compete directly with their male peers they tend to "discount themselves as equal-opportunity competitors" and define themselves as less skilled and less competent (Jenson and de Castell, 2005).

In short, commercial games have traditionally advantaged boy related values (over girl related ones), such as "victory over justice; competition over collaboration; speed over flexibility; transcendence over empathy; control over communication; and force over facilitation" (Brunner, Bennett, & Honey, 1998, pp. 81-82).

Study 1: Does gender influence the design outcome of games?

Our methods and analysis extend Kafai's (1998) and Denner and Campe's (in press) research on the relationship between game designer gender and game design outcomes among youth. Kafai used a variety of qualitative methods to compare games to teach science and math made by fourth grade boys with those made by fourth grade girls. Denner and Campe studied girls only, analyzing games created by two-person middle school girl teams.

Kafai (1998) analyzed 32 video games created by fourth graders, developed as part of normal classroom activities over a six-month period. Kafai compared game designs by gender, looking at differences related to game genre, game worlds, game characters, interaction modes and feedback provided to the player, and narrative development. Denner and Campe (in press) observed 126 sixth to 8th grade girls over 23 sessions either after school or during the summer in the Girls Creating Games (GCG) Program as they created interactive choose-your-own-adventure games. They were encouraged to make games to help other students, but were given no specific context or subject area to design for. Girls worked in pairs to write and program their story using a branching narrative template to create adventure games with choice points leading to different story outcomes. Two researchers coded each game focusing on three main themes of competition and conflict, real world or fantasy contexts, and whether the game was in line with or challenged gender stereotypes.

Methods

Unlike the Kafai and Denner and Campe studies where the children actually created the games, in our research child teams worked on generating game concepts to support learning about space and space exploration. Our study included twenty-two boys and twenty girls (5th and 8th graders) coming together for a 2-week Space Pioneer Learning Adventures (SPLA) summer camp. They worked together in same-gender, same-grade 5-6 person teams (with a teacher facilitator of the same gender) in developing their game concepts. SPLA camp began with a representative from NASA telling the group that NASA needs their help to recruit the next generation of space scientists. In their small same-sex, same grade teams the youth were charged with inventing a space related educational game which would motivate "kids just like you" to want to become space scientists.

The process of design was facilitated by a series of sessions where they learned about space exploration and game design by playing digital games, watching video clips, and participating in diverse technology-mediated space learning activities (including a Challenger Center museum space exploration role play experience, Lego robotics, teleconference with NASA engineers, etc.). In the second week of camp girl and boy design teams participated in six guided brainstorms (game backstory, characters and goals, interaction and navigation, science content, graphics, and sound) to help them think through key aspects of designing educational games.

At the end of two weeks, the 8 same-sex, same-grade teams each generated a final game concept. These game concepts were adapted into short (roughly 3 minute) promos for hypothetical space learning games. Because camp participants imagined instead of creating games, their brainstorms and envisioning were not limited by either their technological skills or by practical considerations of how long it would take to implement an idea. They could imagine anything, and describe what they wanted their game to be like. Camp ended with each team presenting their game plans to parents, NASA, and game designers.

Throughout camp a wide range of quantitative and qualitative data was collected. After each video, game, and technology learning experience the teacher-facilitator conducted a focus group interview, followed by a short individual written survey. Two researcher-observers (of the same gender as the child team) watched and took continuous notes on each group.   The six game brainstorm sessions were also videotaped. Each team's white board notes and drawings were saved for analysis. Each team's final presentation was videotaped and their PowerPoint presentation was saved.

The (female) PI worked with the data collected, in consultation with a game designer and space scientist (both males), to develop short scripts for each game. These scripts were then used by the PI (working with artists and a sound design team) to develop short promos for each of the games. One professional female artist created artwork for half of the games (evenly divided by gender and age) and a male professional artist did so for the other half of the games. The sound team was of mixed gender.

One year after camp, the game promos were shown to a subset of participants (those who were able to attend the meeting) and they were asked whether each promo was true to the groups' game

ideas. Seven of the 8 groups strongly agreed that the promos reflected their concept, and one (a 5th grade girl group) did not agree.

To answer the question as to whether girl-envisioned games are systematically different than boy-envisioned games, we looked at a variety of data, building on categories and themes identified in prior research (Kafai, 1998; Denner & Campe, in press). The promos were analyzed by two researchers independently (similar to methods used by Denner and Campe). When researchers were uncertain how to code a promo on a particular category, they discussed the decision and consulted the qualitative and quantitative data about that child team.

Results

Our promos reveal some similarities and differences between the games envisioned by the boys and the girls, as well as similarities and differences between 5th and 8th grade game designs. In the next section we discuss these findings under two overarching categories, that we label, Game Design and Affective Components. Each of these categories has sub-categories that we describe in greater detail. Note: each team is labeled by gender (G or B for Girl or Boy) and grade (5 or 8) followed by a or b to distinguish the two same gendered teams per grade.) The list below shows each group and the name they chose for their game:

G5a: Dr. Evil Stinky and the Poison Cake
G5b: The Great Probe Rescue
G8a: Mars Virtual Reality Resort
G8b: Desdemona IX
B5a: Never Safe in Space
B5b: Virus Hunters: Defeat of Juppa
B8a: Mission to Mars: The Race to Save Humanity *(aka Moon Tycoon)*
B8b: The Universal Challenge *(aka Halo)*

Figure 1: Screen Shot from G8a (Mars Virtual Reality Resort)

Figure 2: Screen Shot from B8b (The Universal Challenge, *aka Halo*)
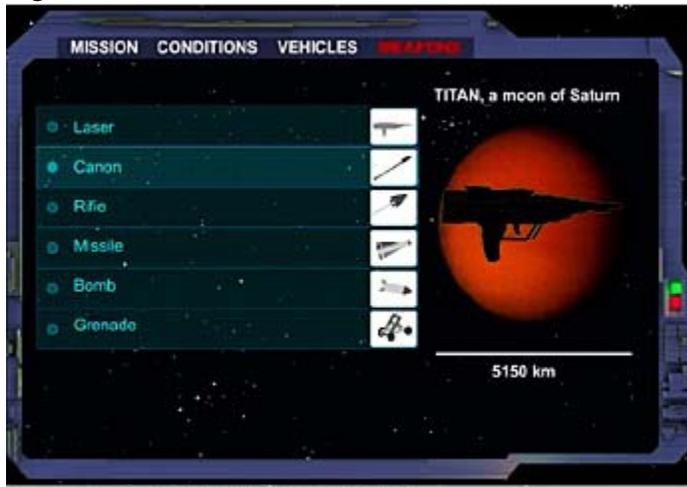
Game Design

The game design findings are divided into 4 sub-categories: Game Genre, Game Goals (winning and ending); Game Setting; and Player Characteristics (including main player and non-players). Taking each in turn:

a.   Game Genres

The final SPLA game concepts were classified as belonging to one or more of five genres: Adventure, Simulation, Combat, Racing, and Learning. Our qualitative analysis of the researcher-observer notes taken during camp revealed that both 8th grade boy teams argued whether to base their game on sports in space, but chose not to do so for the final games they created.

Adventure. In Adventure games the player experiences a story by exploring the game world and controlling one or more characters in the story (Moby Games, 2007). Seven of the eight SPLA games (all except one 8th grade boy game) were adventure games. In every game, the player played a role in or controlled an unfolding story (NASA astronaut, Starship captain, fighter pilot, Mars resort entrepreneur, and Mars colonization tycoon).

Simulation. A Simulation game tries "to realistically simulate a real world situation" (Hannon, 2007). One 8th grade boy game (B8a: Mission to Mars: The Race to Save Humanity) was a classic simulation, or "god" game, based on building, populating, and managing a colony on Mars, with the goal of getting rich. It was a slight variation of the commercial simulation game, Moon Tycoon. The Mission to Mars simulation game was based on building, populating, and managing a colony on Mars, with the goal of getting rich.

Combat. None of the girl games involved combat, but all of the boy games did to some extent. Three of four girl game promos alluded to a possible need to fight aliens, but for each girl team the example alien encounters they described turned out to be friendly. Boys imagined pleasure in getting to fight with aliens. Girls imagined pleasure in anticipating encounters with aliens which might or might not be hostile.

Racing. Two boy groups (B8a and B5b) included mini-games within the larger structure of their primary game. In each of those groups, one of the mini-games suggested involved racing on other worlds.

Learning. Interestingly, though all the SPLA games were supposed to be teaching games none of them were set in classrooms and none incorporated teachers or students either as the player character (PC) or as non-player characters (NPCs). In all of the SPLA promos, the narration and backstory were riddled with space science throughout the story. Girl teams assumed that learning would occur naturally in the context of play in these realistic space settings and ships. Three boy groups (B5b, B8a, B8b) worried about how to incorporate learning, and decided to embed space trivia games as a way of achieving the "learning goal." (It is interesting to note that the groups that did include the trivia games called them "trivial games" during their presentation, possibly subconsciously revealing the lack of esteem the boys hold for the genre of educational games.) In stark contrast to our results, Kafai's analysis found the teaching genre, games set in a classroom with a teacher, was the second most popular theme and was particularly favored by girls.

<p align="center">**Table 1: Game Genre by Gender and Grade**</p>

Genre	Girls (n=4)	Boys (n=4)	5th (n=4)	8th (n=4)
Adventure	100%	75%	100%	75%
Simulation	0	25%	0	25%
Combat	0	100%	50%	50%
Racing	0	50%	25%	25%

   b.   Game Goals (winning and ending)

Denner and Campe found that games designed by girls "unlike most popular games, … created opportunities for winning that were not at the expense of someone else losing. Consistent with what others have recommended for games that target girls, winning often entailed accomplishing something meaningful, such as succeeding at school or having your pets love you." This is similar to what we found in our study. We found that winning, in three of the four games designed by boys, involved defeating an opponent (either another human player or a virtual opponent). In one of the games designed by boys (B5a) it is unclear what winning means. In contrast, in every game designed by girls the player wins by succeeding at the game, not by defeating an opponent. A 5th grade girl-designed game did present problems that were caused by an antagonist (G5a), but, interestingly, the game is won by solving the problem, not by defeating the antagonist.

   c.   Setting and Game Worlds: Fantasy versus Reality

All of the SPLA games incorporated real world simulation elements. For the most part, the physical distances and properties of stars, planets, moons, and asteroids in all of the games were

realistic. Technologies and techniques for space travel were more realistic for games set closer to the present. Aliens were featured in almost all games and were mostly not realistic, with the exception of the beginning of one 5th grade boy game (B5a).

None of the SPLA games were set in the real world. In our study, the grade-level of the participants was strongly related to the type of game world they choose for their setting. One of the 5th grade boy teams (B5a) had the most realistic game setting, closest to our present day scenario, while the other 5th grade boy team (B5b) was the most extreme with a far-future setting and characters. The other 5th grade teams (the girl teams, G5a and G5b) envisioned games where space travel within the solar system was possible and fast, but not routine or easy. 8th grade games were further out in time. Both 8th grade girl games (G8a and G8b) and one 8th grade boy game (B8a) included constructing a colony or resort on Mars, though in very different ways. B8a colonized Mars as a way of saving humanity from an overcrowded Earth and becoming rich. G8a focused on day to day managing construction and operation of a resort on Mars. G8b traveled further out, commanding a giant starship that began its journey near Mars, situated colonists there, then continued its search for a better home for humanity. The furthest future 8th grade boy game (B8b) involved aliens and humans fighting all over the galaxy. Overall more of a difference in setting was found between 5th and 8th graders, with 8th graders looking further to the future, than between boys and girls.

These findings are somewhat in contradiction to the existing literature on gender preferences and games. For instance, Laurel (2003) predicted girls would prefer everyday realistic roles, while boys like fantasy roles. Similarly, in a gender study of adult reactions to a virtual reality prototype, Heeter (1994) found that females were significantly more likely to say they wanted virtual reality experiences to have meaningful real life parallels. Seventy-one percent of game adventures produced in Denner and Campe's all-female design setting took place in real-world settings. Their finding parallels the AAUW prediction that what girls want in games are opportunities to work through real life problems and the chance to face struggles one has not encountered yet in life but will someday (AAUW, 2000). However the SPLA games contradict those expectations, since none of the SPLA games dealt with children's everyday realities. All of our girls and boys envisioned roles beyond earth, most on space ships traveling to planets and moons pursuing quests to save humanity.

A subtle difference in game play was observed within the 8th grade games. The SPLA game worlds were not real world settings, but 8th grade girl games both included maintaining interpersonal relationships in the game play, consistent with research that these issues match girls' real life concerns.

<div align="center">Table 2: Setting</div>

Time frame	Girls (n=4)	Boys (n=4)	5th (n=4)	8th (n=4)
Near future	50%	25%	75%	0
Medium future	25%	25%	0	50%
Distant future	25%	50%	25%	50%
Worlds				
Fantasy	25%	50%	50%	25%
Realistic	75%	50%	50%	75%

    d. <u>Player Characters</u>

Researchers have found that the elements girls enjoy in games include role playing (Brunner et al., 1998) and narrative (Gorriz & Medina, 2000; Laurel, 2001). Girls like to construct narratives and hence, need complex characters to develop stories (Laurel, 1998). Role Playing Games with a single player is a genre with an extensive female audience, involving complex story lines and adventures (Bryce and Rutter, 2003). Girls also say they want software that is personalizable and customizable, allowing players to create their own characters, scenarios and endings (AAUW, 2000). Girls also prefer games involving simulation and identity play (AAUW, 2000) with the chance to swap identities (AAUW, 2000).

All four SPLA girl games let the player customize their avatar, usually in great detail. While some boy games offer a choice among several avatars, girls provided separate controls for hair, eyes, nose, lips, skin, and accent, in addition to skills and knowledge attributes. The boy games offered much less player customization. Half of the boy games had no customization options for the player; in fact, they did not include a visual representation of the player in their game design. The two boy games that did include customization (B8b and B5b) let the player select from among a small set of pre-constructed characters and did not allow selection of particular attributes.

Girl designers seem to consider and accommodate the possibility that males may play their games. Boy designers did not consider female players. All of the girl teams specified players could select their gender. Selectable gender in girls' SPLA games may parallel Kafai's category of a generic "you" main player, which served the purpose of accommodating girl and boy players and was a more common design among girl designers in her study. 8th grade SPLA girls were very conscious of designing their games to be played by both girls and boys. G8a even named the main character SAM expressly because the name could be used for males or females. Three of the four boy groups never discussed the possibility that females might play their game. The fourth (B5b) drew a choice of five avatars. Two of their avatars were female, both noted to have the characteristic of being "bad tempered." One was a bad tempered female robot and the other a bad tempered alien female kangaroo/boxer from Saturn. None of the three male avatar choices were bad tempered.

One 8th grade girl group (G8b) was the most thoughtful about identity play. A key initial choice in starting the game is to decide whether to be a human or robotic starship captain. They enumerated the strengths and weaknesses of both choices as they explained the game. For one 5th grade and one 8th grade boy team (B5b and B8b), although one could chose to be robot or human or alien, there were no apparent consequences or benefits of that choice in the game.

In all of the SPLA games, the player character was an adult. The 5th grade girls envisioned themselves as captain of a one person ship, accompanied by a robot or animal sidekick. The 5th grade boys envisioned themselves playing a crew member on a fairly small space ship accompanied by other crew members. Girl and boy 8th graders all envisioned games which put the main player in an adult position of authority.

SPLA main characters interacted with many non-player characters (NPCs), including humans, aliens and robot and animal sidekicks. Boy and girl games took place in expansive, populated solar systems and galaxies with large casts of characters.
SPLA games included more and more diverse NPCs than Kafai's or Denner and Campe's games. All eight of the games included NPCs, and seven of eight included aliens. Parents, children, and teachers did not appear at all. In boy games, NPCs all seemed to be male. In girl games, NPCs included females and males.

It was striking that every girl team, despite their emphasis on virtual social interaction, chose to go with single player games. In other words, girls thought about and included social interaction in their games, but wanted that interaction to occur with non-player characters. The two 5th grade girl games described interacting with a sidekick and with aliens, while in the 8th grade games the player interacted with many computer-generated human and alien NPCs. Conversely, boys all mentioned that their games would have the option of being multiplayer, then, somewhat paradoxically, envisioned games with no social interaction. Both 5th grade boy games said the player was a part of a team, but mentioned no social interactions with team members as part of the gameplay. One of the 8th grade boy teams (B8b), despite being multiplayer, said "you fight alone." In B8a, the other player was "your rival," competing against you to earn more money.

In general the girls in both grades spent more energy and time imagining how the player and NPCs would look. During brainstorming and presentation of all of the girl games, the girls illustrated what the different aliens would look like, in addition to magic pets and robotic or dog sidekicks. Neither 8th grade boy game envisioned what the aliens looked like.

<div align="center">Table 3: Main Players</div>

Main Player	Girls (n=4)	Boys (n=4)	5th (n=4)	8th (n=4)
Choose gender	100%	25%	75%	50%
Main Player Role				
Space Ship crew member	0	50%	50%	0
captain	75%	25%	50%	50%
Resort Manager/ Tycoon	25%	25%	0	50%

<u>**Affective components of game design**</u>

The affective components of the game design include elements that contribute to the mood or style of the game. We describe these elements in 3 sub-categories: Humor and stress relief, violence, and moral and epic themes.

   a.   <u>Humor and Stress Relief in Games</u>

Analysis of the SPLA games indicates that boys and girls had different ideas about what is fun and funny in a game. Only one of the four girl games (G8b) did not include humor, while in contrast, only one boy game (B5a) included humor, and that was a single humorous moment in an otherwise deadly serious game.

In the girl-designed SPLA games, players face life-threatening circumstances as they try to save humanity, but the obstacles include a lighthearted element of silliness. For example, both 5th grade girl groups created silly looking and silly sounding aliens (such as G5a's antagonist named "Dr. Evil Stinky"). While managing the Mars resort, G8a players earn a magic pet who confers magic abilities, when they succeed at a (scientifically authentic) quest. This is consistent with the finding that thirty-five percent of the girl games in the Denner and Campe study used humor (Denner and Campe, in press).

The boy teams seemed to include less silliness. B5a is silly only in beginning where a scientist spills beer while celebrating the discovery of life, which provides nutrients permitting the rapid growth of slime and leads to the apparent death of the science team. Though the boys groups often giggled when they talked about killing aliens during their game brainstorms, in the final games

fighting aliens was seen as being serious and dangerous business. To offer relief from the seriousness of the games the boy teams sometimes provided a less rigorous, play option that emphasized fun over achievement. For instance, the B8a promo describes a "free play" mode with no financial limits while in the game designed by B8b, players can choose to be aliens destroying humanity, or humans protecting humanity.

b. Violence in Games

There was a distinct difference between the games developed by boy and girl teams with respect to the presence of violence in games. SPLA girl games' players face life threatening circumstances but there was never an expectation they might actually die. In three of four boy games you die often, as part of play. B5a is the most bleak – the storyline is a steady string of major disasters. The player's character is safe from any danger in only one boy game (B8a) because the player controls the simulation rather than playing a character role.

These findings are consistent with prior research that report that girls object to the violence in today's computer games (AAUW, 2000). Laurel's (2001) research on girls and computer games concluded, "girls didn't mind violence so much as they disliked the lack of good stories and characters." According to one survey, not only did three-fourths of children agree that in general boys prefer fighting games, but the sampled boys tended to consider violent games inappropriate for girls to play (Funk & Buchman, 1996b). Some researchers suggest content such as fighting, competition, or sports is a turn-off to girls (Bryce & Rutter, 2003; Greenfield, 1994; Kafai, 1996; Provenzo, 1991). Among girls who like violent content, Buchman and Funk (1996a) indicated that they usually prefer fantasy or cartoon violence while boys prefer realistic, human violence. In general, girls do not especially enjoy "shooting bad guys and monsters" (Klawe, et al., 2002, p. 211).

Table 4: Violence

Main Player	Girls (n=4)	Boys (n=4)	5th (n=4)	8th (n=4)
Possible Violence	75%	100%	100%	75%
Actual Violence	0	100%	50%	50%
Player death	0	75%	50%	25%

c. Moral and Epic Themes in Games

Previous research has indicated that there may be a gender difference in the moral dimension of games designed by children (Kafai; Denner & Campe). For instance, Kafai observed a moral dimension (a contest between good and evil) in all of the boys' math adventure games but not in girl's games. This moral dimension could be seen in almost all SPLA games. Unlike Kafai and Denner and Campe, both girl and boy-designed games had strong epic themes. Seven of eight of the SPLA games in our study involved proactive, often quite grandiose themes of helping

humanity.   In SPLA games, all of 8th grade teams selected space exploration themes related to finding, building, or protecting homes on new planets or moons for humanity to inhabit. Half of the 8th grade games (G8b and B8a) begin with self-induced problems on earth motivating the need for new homes (overpopulation and world war). Although not a self-induced problem, the other 8th grade boy game (B8b) has the noble goal of fighting invading aliens on every planet and moon in the solar system, to protect Earth.

In G8b and in three of the four 5th grade games, the player contributes to humanity's ongoing accomplishment of space exploration. In half of the 5th grade game, aliens threaten the exploration process either by stealing NASA's planetary probes (G5b) or by killing the scientists at the Europa base (B5a). In the other two 5th grade games, an evil alien (G5a and B5b) unleashes a virus intended to infect all of humanity. The 5th grade boys battle the aliens and the virus; the 5th grade girls' astronaut avatar searches the solar system for a cure.

Only one SPLA game (G8a) focused on the more personal theme of building and managing a Mars Resort rather than saving humanity. Within that game, a big part of the resort manager's job is keeping the residents happy.   As a starship captain in G8b, crewmember NPCs each had an emotion display disc beneath their feet to show how much they liked or disliked the captain at any moment. Unhappy crew members might mutiny. Thus, both 8th grade girl games included a significant focus on NPC happiness and their variable attitudes towards the player. B8a is primarily intended as a game to get rich, but in that simulation, the right mix of basic services needed to be provided to the Mars colony, or else profits would suffer and the player would lose the game.

<p align="center">Table 5: Moral and Epic Themes</p>

Moral Theme	Girls (n=4)	Boys (n=4)	5th (n=4)	8th (n=4)
Space Exploration	50%	25%	50%	25%
New Home for Humanity	50%	25%	0	75%
Protect from Alien Threat	50%	100%	100%	50%
Keeping NPCs Happy	50%	25%	0	75%

Study 1 Conclusion

Games envisioned by SPLA girl and boy teams had many similarities. SPLA girl games embraced the Adventure genre as much as boy games did. Unlike prior research, both genders located their games in fantasy, bigger than life, epic settings, usually with a mission undertaken for the larger good of humanity such as saving the planet. All of the girl games and half of the boy games cast

the player as an adult in a position of authority. Both genders included many NPCs in the game. Almost every game included aliens, who were potentially dangerous.

These findings of gender similarities in choosing epic, far flung fantasy adventures conflict with Kafai's research findings that space games lacked imaginative themes and settings. It is likely that the game design context (space pioneer learning adventures camp) and game design goals influenced the design decisions, motivating both boys and girls to gravitate towards distant future space adventure games. This greater focus on what is fascinating about space, and not on particular sets of facts to be learned, likely influenced game concepts.

Apart from the similarities the SPLA games also showed some significant gender differences. Girl game designers seemed to demonstrate greater sense of empathy for players, most visible in their considering the possibility that boys would play their games. As described above, girls included the ability to customize the gender of the main player character, and they included both male and female NPCs. In contrast, boys were less inclusive in their thinking of potential players of the game, ignoring the possibility that girls could be a potential audience and almost exclusively imagining their main players (and NPC characters) as being male.

Games designed by girls also differed from games designed by boys in their inclusion of silly and light hearted elements such as magic pets and goofy looking aliens. The games designed by boys were for the most part more serious. Boys built in stress relief in their games by relaxing the rules of play, while stress relief in girl games showed up as fun sidekicks, improbable strange looking creatures, and impossible magic powers.

Boy games were violent, including themes of combat, and in three of four game concepts, possible player death. The main player in boy games fought with hostile aliens and won by beating rivals. Girl games included the possibility but no actual violence. The main player in girl games negotiated with potentially hostile aliens and won by succeeding at quests, not by defeating an enemy or doing better than a rival.

Girl teams in SPLA program designed single player games, though there was a strong virtual social element built in as well. The social element was most often characterized by interactions and negotiations with alien and fellow human NPCs. For 8th grade girl games, the interactions included a focus on interpersonal relations and indicators of how NPCs felt about the player at any point in time. In contrast, despite explicitly stating their games would have the option of being played as single-player or multi-player games, when boys planned their games they did not discuss how the presence of more than one player would work. Boy games included fighting with enemy NPCs but did not include negotiating or otherwise interacting with enemy NPCs. Although the 5th grade boy teams included virtual NPC team members, they never planned whether or how NPC team members would interact with the player.

Learning was also considered and conceptualized quite differently by the boy and girl design teams. Girls seemed to expect learning would be a natural outcome of game play involving space exploration, while boys saw the need for learning as a distraction from game play, and introduced it through digressions such as multiple choice trivia mini-games.

In summary, although there are certainly similarities in the design of the games, this study shows that gender does influence design outcomes. Girls and boys have some common and some distinctive preferences, which are reflected in the design of their games. The question that arises next is whether boys and girls who were not involved in the design process would exhibit any preference for these different game designs, i.e. would boys and girls like games created by their gender or would they be indifferent to these design and affective elements.

Study 2: Do players prefer to play games designed by their same gender?

Participants

The game promos were shown to a large number of 5th to 8th grade students and after watching each promo they were surveyed about their preferences. Surveys were administered to 521 5th through 8th grade students (266 from schools in California and 255 from schools in Michigan). Thirty-five percent were 5th graders, 14% 6th graders, 40% 7th graders, and 11% 8th graders. Half were female. Almost all of the student participants in this study spent some time gaming every week. Ninety-one percent of girls and 96% of boys spent at least some time each week playing video games, but as expected based on other studies, girls in this study devoted significantly less time to gaming than boys did. Slightly more than half of girls played less than two hours per week, compared to one 5th of boys (see Table 6). Yet gaming is far from an exclusively masculine pursuit. A substantial subset of girls (18%) reported playing for 6 or more hours per week, as did nearly one third of the boys.

Table 6: Time Spent Playing Games Per Week

	< 2 hours	2 to 5 hours	6 or more hours
Girls	52.0%	29.7%	18.3%
Boys	20.4%	39.0%	30.6%

Method

Students were shown the eight child-envisioned space learning game promos in their regular classrooms. After viewing each promo, they answered questions about that promo, including how fun they thought the game would be to play and whether they thought the game was for girls, for boys, or equally for both girls and boys. The four 5th grade promos were shown first, alternating boy and girl promos. Participants were not informed of the gender of the child design teams. After all four 5th grade promos had been shown, respondents rank ordered those promos from their most to least favorite. The same process was repeated for the 8th grade promos as well.

Two promos received consistently low ratings and were excluded from subsequent analyses. Dr. Evil Stinky and the Poison Cake (G5a) was the only promo the child team felt did not fairly represent their team's concept. That promo also received the lowest fun rating of any promo, among both boys and girls. Never Safe in Space (B5a) also received universally poor ratings by both boys and girls. That child team struggled with a game concept and in the end only presented

a backstory introduction, with no sense of how game play would occur. Thus, three girl promos (two 8ᵗʰ grade and one 5ᵗʰ grade) and three boy promos (two 8ᵗʰ grade and one 5ᵗʰ grade) were retained as viable representations of the design teams' game concepts. It should be noted that these two fifth grade team concepts are reasonable to have included in the content analysis because that analysis was based both on the promos (however inadequately described) *and* on qualitative data collected throughout the two week design period, and did not rely exclusively on the promos.

Results

We present the results of the survey in 3 sections. The first describes the data regarding how much fun these games would be to play. The next section looks at rank order preferences for playing these games and finally we discuss respondent perceptions of whether each game seems as if it is more for girls, more for boys, or equally good for girls and boys.

Appeal of the Promos

Respondents rated how fun each promo would be to play, from very fun (1) to not fun at all (5). In brief, three of the four games which appealed most to girls were envisioned by girl teams. Three of the four games which appealed most to boys were envisioned by boy teams. Girls' and boys' fun ratings for three individual promos, all of them boy team promos, were significantly different, with boys in each instance rating the boy promo more fun than girls did. The two games with the most violent themes (B8b and B5b) appealed substantially less to girls than to boys. Mars Colony Tycoon (B8a) was a boy game that appealed to boys and girls, although it appealed more to boys. It had the highest fun rating by girls and tied for first place along with the B8b Halo-like knockoff, by boys. One other promo fun rating approached statistical significance. Girls tended to rate the G5b promo as more fun than boys did (t-test significance of p=.073). Enthusiasm for the promos was highest among younger students and lowest among older students. Fun ratings dropped significantly from 5th to 8th grade (F=19.43, df=3,492, p<.001). 5th grade respondents' average expected fun rating was 2.1, sixth grade was 2.4, seventh and eighth grade were 2.7.

Table 7: Ratings of Promo Fun

	Girls	Boys	T	df	p
B8a Mars Colony Tycoon	2.1 (1)	1.8 (1.5)	2.70	510	.007
G8a Mars VR Resort	2.2 (2)	2.4 (5)	1.15	509	.249
G8b Desdemona IX	2.4 (3.5)	2.3 (4)	.56	511	.576
G5b Great Probe Rescue	2.4 (3.5)	2.6 (6)	1.80	510	.073
B5b Virus Hunters: Defeat of Juppa	2.6 (5)	2.2 (3)	3.01	508	.003
B8b Universal Challenge (aka Halo)	2.7 (6)	1.8 (1.5)	7.88	501	.000
B5a Never Safe in Space	2.9 (7)	2.7 (7)	1.17	512	.244
G5a Dr. Evil Stinky	3.2 (8)	3.2 (8)	.15	510	.880

Promos at the top of the table are those girls rated as the most fun (B8a), with least fun (G5a) at the bottom. The Girls and Boys columns list that gender's average fun rating for each promo. Numbers in parentheses indicate the order, from most fun (1) to least fun (8), within the girls' column and within boys the boys' column.

The fun ratings for the 3 girl games were summed and averaged, as were fun ratings for the 3 boy games. Table 8 shows the average fun rating for girl-designed games and for boy-designed games, as rated by girls and boys and by elementary school and middle school students. Two way ANOVA analyzed effects of gender and grade. Overall F and degrees of freedom are reported, along with the significance level for gender, grade, and the interaction between gender and grade. Boys tended to think boy games were more fun and girls tended to think girl games were more fun. Girls and boys were not significantly different in their expectations of how fun the girl games would be to play (2.3 and 2.4, $F=11.09$, $p=.282$). Girls were significantly less enthusiastic about boy games than boys were (2.5 versus 2.1, $F=52.77$, $p=.000$). On all measures, elementary students rated the games more fun than middle school students did ($p=.000$). The significant interaction effect for boys games ($p=.052$) was elementary school boys' extreme enthusiasm for boy games and middle school girls extreme dislike of boy games.

Table 8: Combined Average Fun Ratings of Girl and Boy Promos

	GIRLS	BOYS	elementary	middle school	F	df	gender	grade	interaction
girl games	2.3	2.4	2.1	2.6	11.09	2,503	.282	.000	.235
boy games	2.5	2.2	1.9	2.5	52.77	2,493	.000	.000	.052

Paired t-tests were run within girls and within boys in order to address the question as to whether girls like games created by girls more than they like games created by boys. The results show that indeed, girls expected they would find the 3 girl games significantly more fun than the 3 boy games (2.32 versus 2.49, $t=2.84$, $df=243$, $p=.000$). Paired t-tests also showed that boys expected the boy games would be significantly more fun than the girl games (1.91 versus 2.42, $t=8.96$, $df=247$, $p=.000$).

Rank Ordering the Promos by Preference

Respondents were asked to rank order the 5th grade and 8th grade promos, from most to least favorite. Ranking required them to weigh one promo against the others and order them from most to least preferred.

Results of rank order were consistent with ratings of fun. Two games tied as being the top-ranked game by girls. One was the boy Mars tycoon game (B8a) and the other was Mars VR Resort (G8a). G8b (where the player is a starship captain) was a close third, and the fighting game B8b was a

distant fourth. Among 5th grade games, the girl game Great Probe Rescue (G5b) fared much better among girls than did the boy combat game (B5b).

Table 9: RANKINGS of Six Viable Promos

	Girls	Boys	T	df	p
8th grade promo rankings					
G8a Mars VR Resort	2.3	2.8	5.74	471	.000
B8a Mars Colony Tycoon	**2.3**	**2.5**	**2.05**	**470**	**.041**
G8b Desdemona IX	2.5	2.9	3.96	468	.000
B8b Halo in the Solar System	**2.9**	**1.8**	**10.27**	**481**	**.000**
5th grade promo rankings					
G5a Great Probe Rescue	2.0	2.4	4.70	471	.000
B5b Virus Hunters: Defeat of Juppa	**2.5**	**1.8**	**6.43**	**477**	**.000**

The game preferences of the boys were almost exactly the opposite of the girls' preferences. The two fighting games (B8b and B5b) were tied at 1.8 as top-ranked favorites. Mars Tycoon (G8a) was a distant third, and the two 8th grade girl games (G8a and G8b) had the lowest rankings of the 8th grade games among boys.

Table 10: Combined Girl and Boy Promo Rankings for the 6 Viable Promos

	GIRLS	BOYS	5th	8th	F	df	gender	grade	int
girl games	2.28	2.72	2.51	2.48	45.68	2,449	.000	.277	.961
boy games	2.55	2.00	2.23	2.34	52.89	2,452	.000	.013	.911

Paired t-test analyses showed that girls ranked girl games significantly higher than they ranked boy games (2.28 versus 2.56, t=4.08, df=232, p=.000). Paired t-tests showed that boys ranked boy games significantly higher than they ranked girl games (2.01 versus 2.72, t=11.31, df=218, p=.000).

Gender Appropriateness

In this part of the survey, respondents were asked, for each promo, whether they thought the game was "more for girls" (coded as 1), "more for boys" (coded as 3) or for "both boys and girls equally" (the neutral position, coded as 2). The assessments of gender appropriateness of the six promos dramatically illustrate the extent to which games still are a masculine medium. Table 6 shows the average gender appropriateness rating for each promo, ranging from the most strongly "more for

boys" Universal Challenge (B8b) to the gender neutral Mars VR Resort (G8a). None of the six promos were seen (on average) more appropriate for girls. One (Mars VR Resort, G8a) was deemed for both boys and girls equally. All of the rest were slightly or strongly appropriate for boys.

Table 11: Gender Appropriateness of the Six Viable Promos

	Average
B8b: Universal Challenge (Halo)	**2.5**
B5b: Virus Hunters: Defeat of Juppa	**2.4**
G5a: Great Probe Rescue	2.2
B8a: Mars Colony Tycoon	**2.1**
G8b: Desdemona IX	2.1
G8a: Mars VR Resort	2.0

Surprisingly even the games designed by girls were seen as being equally preferred by boys and girls while games designed by boys were considered "more for boys." The three boy games averaged 2.36, the three girl games averaged 2.09. Paired t-tests confirm the difference was significant (T=14.97, df=473, p=.000), see Table 11. In fairness, Mars Colony Tycoon (B8a) appealed to both genders. It was the two heavily violent games that tipped the scale, yet it is interesting to note that there were no games that were perceived as being strongly and uniquely for girls.

Study 2 Conclusion

Girls expected they would find the girl games significantly more fun to play than the boy games and boys imagined the boy games would be significantly more fun to play than the girl games. Looking at the individual games, boys' enthusiasm for each of the 3 boy games was significantly stronger than girls' enthusiasm for those games. The rank order measure showed larger differences than the individual fun ratings. Boys overwhelming picked games based entirely on fighting as their top ranked games. Girls overwhelmingly ranked those same fighting games as their least preferred.

These results support the idea underlying the "virtuous cycle" that when girls envision game concepts, the concepts they invent appeal more to girls and less to boys and vice versa. However, the results are not a blanket condemnation of all boy-designed games by girls. In fact, girls rated a game designed by boys as likely to be the most fun, and also ranked it highest among all the games. Boys and girls were particularly polarized by the two boy games with violent themes. On average, girls preferred girl designed games, but that preference was not particularly strong. On the other hand, there was something different enough about girl designed games that both genders considered girl designed games as being appropriate for both girls and boys equally, whereas boy designed games were clearly more for boys.

Though the girl design teams were more sensitive to the gender of the players (creating opportunities for characters to be male and female) it was the boy audiences who seemed to be more sensitive to subtle cues about the gender of the game designers. This can be seen by the fact that boys were on average slightly more likely to say the girl games were "more for girls" than girls were. This sensitivity could be due to boys devoting more time to playing games and the fact that both 8th grade boy games ideas were liberally "borrowed" from a successful commercial game. The boy game, Mars Colony Tycoon (B8a) was a direct derivative to the commercial simulation game Moon Tycoon and Universal Challenge (B8b), an 8th grade boy promo, focused entirely on Halo-like combat. This finding is consistent with Kafai's finding that students' gaming experience, and lack thereof, greatly influenced the design of the games. The math games created by boys in her study seemed to have been greatly influenced by commercial video games, with characters paralleling commercial video games and the use of violent feedback in response to player interactions (Kafai, 1998). "The students drew from models of commercially available software in many ways: boys emulated video game design in the beginning and included characters and prizes found in popular video games; girls took existing educational software as a model" (Kafai, 1998, p. 93). Kafai observed that girls found inspiration not from commercial games and common game settings but rather from familiar locations and situations from their real life (Kafai, 1998). The 8th grade boys' games in our study deeply mimicked commercial games.

In contrast, girls devote less time to playing games and all of the girl games were original concepts. This indicates that the frequency of game play may impact design decisions and supported by the fact that the 5th grade boy games (who played games less than the 8th graders) were original concepts as well. More frequent game play may also influence player expectations leading frequent gamers (which were more often than not, males) to detect something "alien" about the games designed by girls.

Discussion

Electronic Arts Vice President Steve Seabolt commented (2004), "girls feel locked out of the [gaming] clubhouse." These studies dramatically support that observation. Half of the games in our study were envisioned by all girl teams, half were drawn by a female artist, and all were produced by a female producer. Yet, at least four-fifths of male respondents considered every single promo to be gender appropriate for boys (combining good for boys or good for everyone) and the female respondents had significantly lower perceptions that any of the games were intended for girls. In fact, when placed in the role of game designers, girls in our study consciously designed their games with both male and female players in mind, while boys designed only for other boys. Thus, the girl designed games really were for both boys and girls, and the boy designed games really were for boys.

Six promos lasting nearly 20 minutes comprise a small stimulus from which to draw far-reaching conclusions about the impact of gender on game design. All manner of factors may have influenced the creation of the promos, from the brainstorming by the child teams at camp through the scripting and production process. Attempts were made throughout the process to segregate child designers by gender. Girls came to camp in the mornings, boys in the afternoons. Teacher-facilitators and researcher observers were the same gender as the child teams they worked with. One male and one female artist each created half of the art for both girl and boy promos. The respondents viewing the promos had no idea which gender created which promo. These

precautions do help support the findings of this study. Though this study by no means puts the issue of gender and game design teams to rest, but it does provide evidence that the gender of the design team impacts reactions to the design outcome.

It is apparent from our study, and other industry and academic research, that boys play more commercial games than girls and gaming experience influences the type of games they make. It is a closed, self-perpetuating cycle. Men create games that they like, which end up appealing to boys and men. They make new games based on the foundation of the games they have played before. Commercial game companies hire design team members who passionately love the company's existing suite of games (WIGI careers panel, 2006). The result is more of the same games.

Although we did find evidence that the designers' gender influences the design outcome of games and that girls do prefer to play games designed by their same gender, we also note that gender is far from the only factor that influences design outcomes. There are many factors that can affect the outcome of a game design, including the context, the content, the game genre, game goals, the age of the designers and designer gender. That said, our research shows that males and females in general do have some basic differences in what they would like to see in a game and what would appeal to them. These underlying predilections are apparent both in the game designs and in child reactions to the promos.

Our findings support the first half of the virtuous cycle—games designed by females would be more likely to attract females than games designed by males.   We have yet to see if more females playing games, because they are attracted to the games, will result in females being more likely to enter careers in the game industry. Women in the industry would lead to more girl-friendly games and thus the cycle to establish a virtuous cycle of inclusion is complete.   Games are rehearsal for adult roles.   The social costs of females not being engaged early in this digital revolution are high. This study gives us some insight into the dynamic of why females are still alien to the gaming culture and some points of entry in moving from a closed circle to a virtuous cycle.

This study is unique in multiple ways. First, is the use of a mixed method design, content analysis of games designed by students, followed by a survey of students in the same age range of these games. This combination of qualitative and quantitative approaches allowed us to balance both the specificity and richness of the games designed (through an analysis of the games) as well as understand broader preferences of the true audience of these games (through statistical analysis of survey data). We believe that such mixed designs have great potential for research on the design and development of educational video games.

References

AAUW. American Association of University Women. (2000). *Tech-Savvy: Educating Girls in the New Computer Age.* Washington, DC: American Association of University Women Educational Foundation. Retrieved from http://www.aauw.org/research/girls_education/techsavvy.cfm

Brunner, C., Bennett, D., & Honey, M. (1998). "Girl games and technological desire." In J. Cassell & H. Jenkins (Eds.), *From Barbie to Mortal Kombat: Gender and Computer Games* (pp. 72-88). Cambridge, MA: MIT Press.

Bryce, J., & Rutter, J. (2003). Gender dynamics and the social and spatial organization of computer gaming. *Leisure Studies, 22*, 1-15.

Buchman, D.D., & Funk, J.B. (1996). Video and computer games in the 90s: children's time commitment and game preference. *Children Today, 24*, 12-15.

Bureau of Labor Statistics. (2005). Current Population Survey, Table 11. Retrieved from ftp://ftp.bls.gov/pub/special.requests/lf/aat11.txt

Butler, J. (1990, 1999). Gender Trouble: Feminism and the subversion of identity. Routledge Classics, New York and London.

Cassell, J., & 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.

Caywood, J. & Heeter, C. (2006). "Leisure Time and Gender: Understanding Why Non-Gamers Don't Play." FuturePlay International Conference on the Future of Game Design and Technology, London, Ontario, Canada.

The College Board. (2006). AP Program Summary Report 2006. Retrieved from http://apcentral.collegeboard.com/apc/public/repository/ap06_prog_summary_rpt.pdf

Colwell, J., Grady, C., & Rhaki, S. (1995). Computer games, self-esteem and gratification of needs in adolescents. *Journal of Community and Applied Social Psychology, 5*, 195-206.

Colwell, J. & Payne, J. (2000). Negative correlates of computer game play in adolescents. *British Journal of Psychology*, 91, 295-310.

Denner, J. & Campe, S. (In Press). "What do girls want? What games made by girls can tell us" In Y. Kafai, C. Heeter, J. Denner, & J. Sun (eds.). *Beyond Barbie and Mortal Kombat: New Perspectives on Gender and Gaming.* Cambridge, MA: MIT Press.

ESA. Entertainment Software Association. (2006). 2006 Sales, demographic and usage data: Essential facts about the computer and video game industry. Retrieved July 26, 2006 from http://www.theesa.com/archives/files/Essential%20Facts%202006.pdf

Fullerton, T., Fron, J., Pearce, C. & Morie, J. (In Press). "Getting girls into the game: Towards a 'Virtuous Cycle' " In Y. Kafai, C. Heeter, J. Denner, & J. Sun (eds.). *Beyond Barbie and Mortal Kombat: New Perspectives on Gender and Gaming.* Cambridge, MA: MIT Press.

Funk, J. B., and Buchman, D. D. (1996a). Playing violent video and computer games and adolescent self-concept. *Journal of Communication 46*(2): 19-32.

Funk, J. B., & Buchman, D. D. (1996b). Children's perceptions of gender differences in social approval for playing electronic games. *Sex Roles, 35*(3/4), 219-231.

Gamasutra. (2007) "Exclusive: *Game Developer* Survey Probes Game Industry Gender Gap," April. (Retrieved from http://www.gamasutra.com/php-bin/news_index.php?story=8928.)

Gorriz, C. M., & Medina, C. (2000). Engaging girls with computers through software games. *Communications of the ACM, 43*(1), 42-49.

Gourdin, Adam (October 2005). Game Developer Demographics: An Exploration of Workforce Diversity. International Game Developers Association (IGDA). Retrieved 6/8/2006 from http://www.igda.org/diversity/report.php

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. Nature, 423, p.534-537.

Greenfield, P. M. (1994). Video games as cultural artifacts. *Journal of Applied Developmental Psychology, 15*, 3-12.

Hannon, C. (2007). Genre Glossary: What the heck is an RPG? Grrlgamer Featured Article. Retrieved 7/3/2007 from http://www.grrlgamer.com/article.php?t=gametaxonomy

Hartmann, T. (2003, November). Gender differences in the use of computer-games as competitive leisure activities. Poster presentation at Digital Games Research Association (DIGRA), November 4-6, 2003, Utrecht, The Netherlands.

Hayes, E. (In Press). "Girls, Gaming, and Trajectories of Technological Expertise" In Y. Kafai, C. Heeter, J. Denner, & J. Sun (eds.). *Beyond Barbie and Mortal Kombat: New Perspectives on Gender and Gaming.* Cambridge, MA: MIT Press.

Heeter. (1994). "Gender Differences and VR: A Non-User Survey of What Women Want," *Virtual Reality World*, March.

International Hobo (2004). Demographic game design: How to make game design as valuable as marketing. Retrieved March 20, 2004, from http://www.ihobo.com/articles/

Jenson, J. and de Castell, S. (2005). "Her own Boss: Gender and the Pursuit of Incompetent Play" DiGRA conference.

Kafai, Y. B. (1996). Electronic play worlds: Gender differences in children's construction of video games. In K. Yasmin & M. Resnick (Eds.), *Constructionism in practice: Designing, thinking and learning in digital world,* (pp.97-123): Mahwah, N.J. : Lawrence Erlbaum Associates.

Kafai, Y. (1998). "Video game designs by girls and boys: Variability and consistency of gender differences." In J. Cassell & H. Jenkins (Eds.), *From Barbie to Mortal Kombat: Gender and Computer Games* (pp. 90-117). Cambridge, MA: MIT Press.

Klawe, M., Inkpen, K., Phillips, E., Upitis, R., & Rubin, A. (2002). E-GEMS: A project on computer games, mathematics and gender. In N. Yelland, A. Rubin & E. McWilliam (Eds.), *Ghosts in the machine: Women's voices in research with technology* (pp. 209-227/248): Peter Lang Publishing.

Laurel, B. (1998). "An interview with Brenda Laurel." In J. Cassell & H. Jenkins (Eds.), *From Barbie to Mortal Kombat: Gender and Computer Games* (pp. 118-135). Cambridge, MA: MIT Press.

Laurel, B. (2001). *Utopian entrepreneur*. Cambridge & London: MIT Press.

Laurel, B. (2003). Design research. As recorded by Jane Pinckard. Retrieved March 10, 2004 from *GameGirlAdvance*: http://www.gamegirladvance.com/archives/2003/05/08/brenda_laurel_at_stanford .html

Lazzaro, N. (In Press). "Are boys' games even necessary?" In Y. Kafai, C. Heeter, J. Denner, & J. Sun (eds.). *Beyond Barbie and Mortal Kombat: New Perspectives on Gender and Gaming.* Cambridge, MA: MIT Press.

Miller, L., Chaika, M., & Groppe, L. (1996). Girls' preferences in software design: Insights from a focus group. Interpersonal Computing and Technology, 4, 27-36. Retrieved from http://www.helsinki.fi/science/optek/1996/n2/miller.txt

Moby Games. (2007). Genre Definitions. Retrieved 7/3/2007 from http://www.mobygames.com/glossary/genres/

NSF. National Science Foundation, Division of Science Research Statistics. (2004). NSF 07-307. 2004 data. Retrieved from http://www.nsf.gov/statistics/nsf07307/content.cfm?pub_id=3634&id=2

Okagaki, L., & Frensch, P. A. (1994). Effects of video game playing on measures of spatial performance: Gender effects in late adolescence. *Journal of Applied Developmental Psychology*, 15(1), 33-58.

Provenzo, E. F. (1991). *Video kids: Making sense of Nintendo.* Cambridge: Harvard.

Ray, S. G. (2003). *Gender inclusive game design: Expanding the market.* Hingham, MA: Charles River Media.

Roberts, D. F., Foehr, U. G., Rideout, V. (2005). Generation M: Media in the Lives of 8–18 Year-olds. Menlo Park, CA: Henry J. Kaiser Family Foundation.

Steve Seabolt (2004). Personal interview.

Subrahmanyam, K., & Greenfield, P. M. (1996). Effect of video game practice on spatial skills in girls and boys. In P. M. Greenfield & R. R. Cocking (Eds.), *Interacting with video* (pp. 95-114). Norwood, NJ: Ablex.

Subrahmanyam, K., Kraut R., Greenfield P., & Gross, E. (2000). The impact of home computer use on children's activities and development. *The future of children: Children and computer technology* 10:2 (The David and Lucile Packard Foundation, Fall/Winter 2000): 123-144. Retrieved from: http://www.futureofchildren.org/usr_doc/vol10no2Art6.pdf

WIGI careers panel (2006). Women in Games International, San Francisco, February.