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ORIGINAL ARTICLE

A Content Analysis of Female Body Imagery in Video Games

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Abstract The 150 top-selling video games sold in the U.S. across nine platforms were content analyzed to study representations of female bodies. All human females in the games were captured via screenshot and body parts measured. These measurements were then compared to actual anthropometric data drawn from a representative sample of 3,000 American women. The results show that female video game characters at low levels of photorealism are systematically larger than the average American woman whereas female characters at the highest level of photorealism are systematically thinner. This study also found that games rated for children featured females that are thinner than characters in games rated for adults. These findings are discussed in terms of cultivation theory.

Keywords Video games · Body image · Women · Cultivation

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Introduction

Body image dissatisfaction among adolescent girls and women is considered so common that some researchers claim it is a normative component of life in Western society (Grogan 2007). Indeed, evidence indicates that 40% to 60% of adolescent girls and women are dissatisfied with some aspect of their appearance (Thompson 2004). This discontent with body weight is associated with the prevalence of eating disorders: it is estimated that 10 to 15 million women suffer from anorexia or bulimia in the United States alone (National Eating Disorders Association 2007).

The causes of disordered eating are complex, but one explanation for the link between body dissatisfaction and disordered eating is sociocultural pressure. In particular, researchers point to the mass media for perpetuating an unrealistic ideal of thinness as attractive (Byrd-Bredbenner 2003; Sypeck et al. 2006; Wilcox and Laird 2000). The research in this arena demonstrates that exposure to the thin ideal results in women evaluating their bodies more negatively, which in turn, leads to an increase in disordered eating symptomology (Grabe et al. 2008; Harrison et al. 2006).

Evidence indicates that media play a role in young people's internalization of the thin ideal because media images accumulate over time in the minds of viewers and eventually result in expectations of the real world that correspond to media presentations (for a review see Harrison and Hefner 2008). However, this body of work is limited because it has only examined the ideal-body imagery in television and print. Noticeably missing from this line of inquiry is a systematic examination of the body imagery present in video games. Video games are a popular medium and now vie with movies and television for mind share among consumers. In fact, among some populations

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(e.g., adolescents), people spend more time with video games than with television (Sherry et al. 2006). It follows that if games are a significant portion of the media diet, they need to be understood as important systems of symbols that might also promote an unrealistic ideal of thinness.

Existing content analytic work done on video games has focused on two topics of special interest to communication researchers: violence (Dietz 1998; Heintz-Knowles et al. 2001; Schierbeck and Carstens 2000; Shibuya and Sakamoto 2004; Smith et al. 2003; Thompson and Haninger 2001; Thompson et al. 2006) and gender and sexuality (Braun and Giroux 1989; Dietz 1998; Downs and Smith 2005; Heintz-Knowles et al. 2001; Janz and Martis 2007). Although these studies are important steps in examining video game content, there is still much left to discover, including a more basic study of female body imagery. The present study addresses this gap in the literature by quantifying the body sizes of female video game characters in a sample of top-selling video games sold in the U.S. Using cultivation theory as a framework, the images in these video games were examined to see if they reflected actual bodies found in the U.S. female population. This study also investigated whether female video game characters varied by levels of realism, and whether the processing power of video games and consoles emphasized or de-emphasized certain body proportions of female video game characters. Finally, differences by game rating in the body proportions of female video game characters also were tested.

Mass Media and the Thin Ideal

Research on magazines and television has investigated women's body imagery over time. In print media, several studies have found that the models depicted in U.S. magazines have grown thinner over time (Byrd-Bredbenner 2003) and have been significantly thinner than the average American female (Sypeck et al. 2006). For example, Spitzer and colleagues (1999) translated the heights and weights of *Playboy* centerfold subjects from 1977 to 1996 to body mass index scores (BMI). Results revealed that the average BMIs of the Playmates ranged from 17.91 to 18.40, which is considered underweight according the Centers for Disease Control and Prevention (2009). The study also showed that average BMIs did not decline over time leading the authors to conclude that models' BMIs were already as low as they could reasonably be.

Studies of the female body in electronic media have yielded similar results. Fouts and Burggraf (1999) content analyzed 28 different American prime-time television comedies for female body imagery and found that below-average-weight female characters were significantly over-represented and above-average-weight female characters were significantly underrepresented as compared to the general population U.S. population. And in a more recent study, Greenberg and colleagues (2003) analyzed the apparent body sizes of characters in ten top-rated American prime-time fictional television programs. The study showed that whereas about 5% of U.S. women are underweight, nearly 33% of female television characters were underweight.

Taken together, the research demonstrates that the standard of physical attractiveness for women presented in traditional mass media has become much thinner and more socially valued. Yet this thin ideal represents the body shape of less than 5% of the American population (Smolak 2004). Indeed, the average fashion model is 5 feet 11 inches tall and weighs 117 pounds, with a body mass index of 16.3. In contrast, the average American healthy woman (e.g., non obese) has a body mass index between 18.5 and 24.9 (CDC 2009). Given this disparity, it is no surprise that exposure to idealized images has been linked to body dissatisfaction and disordered eating behaviors. Grabe et al. (2008) conducted a meta-analysis of experimental and survey research measuring the effect of exposure to mediated depictions of the thin ideal on female body image. Specifically, they found small to moderate effect sizes in the relationship between exposure to the thin ideal and body satisfaction, internalization of the thin ideal, and disordered eating (d=−.28, −.39, and −.30 respectively). This is to be expected among audience members whose bodies do not match the depicted ideal, and as Smolak (2004) pointed out, this represents the vast majority of the population. Smolak's (2004) comparison of the dimensions of models with those of real women is highly informative and provides a much-needed baseline for comparison. We adopt a similar approach in the work summarized below, by comparing video game women's proportions to those of a large representative sample of women living in the United States.

Cultivation Theory and Game Worlds

Given that body dissatisfaction is related to media exposure to idealized media images, what are some theoretical explanations for this relationship? One possible mechanism is cultivation theory, which posits that people's view of social reality is molded by the media (Gerbner et al. 2002). One of the assumptions of the original cultivation theory was that certain common features of the television landscape pervade all forms of programming. The content analyses summarized above suggest that this is the case with the thin body ideal. Cultivation theory provides one explanation for how the thin ideal propagated by the media becomes viewed as a normal and desirable attribute. These

normative beliefs may then lead to an internalization of the thin ideal and excessive dieting in an attempt to be "normal" (see Harrison and Hefner 2008). In support of this theoretical model, Harrison and Hefner (2006) found that overall television exposure predicted the choice of a thinner ideal adult body shape one year later in their longitudinal study with girls aged 7–12 living in the United States. Further, in a study of elementary school boys and girls, Harrison (2000a) found that television exposure among American boys was correlated with an understanding that thinness was socially valued and fatness was socially stigmatized such that boys who were heavier television viewers tended to negatively stereotype a fat girl (i.e., to assume that she will be lazy, greedy, and have no friends).

A variety of sociodemographic and individual differences can produce sharp variations in cultivation patterns. The most common of these is a phenomenon called mainstreaming, whereby heavy television viewers' beliefs tend to share a commonality that lighter viewers' beliefs do not. Mainstreaming effects have been found for expectations of the ideal female bust, waist, and hip sizes. Harrison (2003) found that heavier-television watching American college women reported the same thinner ideals as found in previous studies. However, those women who deviated from this norm felt compelled to meet it; the larger-busted viewers favored breast-reduction surgery, while the smaller-busted viewers favored augmentation surgery, supporting the mainstreaming hypothesis.

Assuming that cultivation processes are largely responsible for these effects, the next question is whether similar findings with video games should be expected. Research in this area is relatively new, but there is evidence to indicate that cultivation is possible with this medium. Using a month-long controlled, longitudinal experiment, Williams (2006b) found cultivation effects for perceptions of danger (e.g., robbery with weapon). This study demonstrated that cultivation effects are possible with video games, although not specifically with body ideals. In a related study, Harrison and Bond (2007) examined cultivation effects related to the drive for muscularity among grade-school boys living in the United States. They found cultivation effects among readers of video game magazines, but not sports, fashion, or fitness magazines. Specifically, heaver video game magazine reading predicted an increased drive for muscularity one year later, independent of initial drive for muscularity. Therefore, body-related cultivation seems likely for the video game medium. To date, there is no published systematic research on female body imagery in video games, but a casual examination of the video game landscape suggests that the female characters featured in many of these games may conform to the skinny-yet-busty ideal featured in other media. Lara Croft, the popular heroine in *Tomb Raider,* for example, resembles a "pin-up" with conspicuously thin waist and hips and large breasts. The creation of characters like Lara has caused some critics to observe that video games are also responsible for reproducing a "stereotyped, ideal woman's body" (Fantone 2003, p. 60).

Our theorizing comes from research done on traditional media, but we hesitate to replicate the same thinking and methods with them to video games. Prior research on video games has often made the assumption that effects and theoretical models that have proven appropriate for traditional media are equally applicable to video games or perhaps more so due to their interactive nature (e.g., Anderson and Bushman 2001). As logical as this seems on the surface, these approaches have generated mixed outcomes (see Williams 2006a for further discussion). So, rather than assuming that games will be "like TV but more so," we offer a more conservative approach by posing a series of exploratory research questions, beginning with the most general:

> RQ_1: Do the body proportions of female video game characters reflect the proportions of the average American female?

Realism

In video games, unlike traditional media, the power of the game system may have a great bearing on the realism and potential shapes of the characters. There is wide variation of processing power across game systems, and a wide variety of software functionality even among games of one system. Thus, we should expect variation in realism across games. Consoles and games with less power are likely to feature characters that are cartoonish, or they may compensate in unforeseen ways. Games with higher processing power are likely to feature more realistic characters because they have the technological capacity to do so.

Research on technological advancements in video games indicates that realism can impact the user experience along several important dimensions such as physiological arousal, involvement, and aggressive thoughts. For example, Ivory and Kalyanaraman (2007) examined the effect of video game realism on players' sense of presence, involvement, physiological arousal (i.e., skin conductance), self-reported arousal, and affective and cognitive aggression in a 2 (video game content: violent/nonviolent) x2 (video game realism: recent/ older release date) factorial experiment. The authors found a main effect for video game realism on physiological arousal such that video game players experienced more arousal (higher skin conductance levels) when playing more a realistic or newer game than did those who played a less realistic or older video game. Similarly, Barlett and

Rodeheffer (2009) found that playing a realistic violent game significantly stimulated more aggressive feelings and arousal over the course of 45 min of game play than playing an unrealistic violent video game did. These two studies suggest, then, that video game realism is an important variable to examine when considering the potential impact of video games on game players. If we make the assumption that game makers seek to portray a thin female body ideal, then we further assume that highly realistic characters will approach that thin ideal more closely than less realistic characters purely because of the level of detail afforded. However, given that this is the first study to assess whether realism impacts how closely female video game characters will approximate the thin ideal, we pose the following research question:

RQ$_2$: Will the body proportions of female video game characters vary by level of realism?

Processing Power

Another important factor vis-à-vis video game body ideals is the ability of a given game to properly display human expressions. For example, video game characters on the more advanced Xbox 360 may look noticeably different than those played on a handheld system, such as the Nintendo DS. On smaller screens or with less processing power, developers may need to overcompensate for this lack of detail by increasing the size of body parts such as heads and faces so that the player will recognize expressions. Conversely, games with higher processing power may not need to do this because the characters and body parts are relatively easy to see. Although there is an absence of studies specifically investigating the effects of processing power on video game players' experiences, research exploring technological advancements in other media can inform the present research. For example, increased audio and visual fidelity has been shown to affect responses to film and television (Bracken 2005; Reeves and Nass 1996). Given the vast number of consoles and games used in this study, we asked:

RQ$_3$: Will artifacts of processing power emphasize or de-emphasize certain body proportions of female video game characters?

Ratings

Game ratings have received attention in the literature and should be examined because they may be an important source of content variation. Created in 1994, the Entertainment Software Rating Board (ESRB) rates video games with age-based symbols and content descriptors. Games rated "E" (for everyone) have been deemed suitable for players 6 years of age and older. In contrast, games rated "AO" are suitable for "adults only." Studies of the ESRB ratings system suggest that games with different rating levels do have different kinds of content (Thompson et al. 2001). Thompson and Haninger (2001) found that ratings are an important indicator of variation for violence, implying that they may be a source of variation for other forms of content. And Downs and Smith (2005) found significant differences between "E" (i.e., for everyone), "T" (i.e. for teens), and "M" (i.e., for mature audiences) games for character nudity, such that characters were more likely to appear nude in games rated "T" and "M" than were those in games rated "E." Given the differences in game content by game rating reported here, it seems reasonable to expect that game rating may influence the body sizes of female video game characters. Thus, the final research question is posed:

RQ$_4$: Are there differences by game rating in the body proportions of female video game characters?

Method

The Game Sample

Sales data were obtained from the research firm The NPD Group for a calendar year stretching from March 2005 to February 2006 for the 9 major game systems sold in the United States in that time span: Xbox 360, Xbox, PlayStation 2 (PS2), PlayStation (PS), Nintendo Gamecube, PlayStation Portable (PSP), Nintendo Gameboy Advance (GBA), Nintendo Dual Screen (DS), and PC. Of these, the PSP, GBA and DS are portable systems, PCs are standard computer systems, and the rest are TV-based console systems. The sampling frame included the top 150 games across all platforms, with a minimum of 15 titles per system. Seventeen games were available on multiple systems, leaving 133 games to be tested. In these duplicate system cases, the system with the most advanced graphical processor was used. An exception was made for Nintendo DS games, which were substantively different from the rest of the sample due to the unique dual screen. The DS games were all measured; thus, if a particular game was available on the DS and another platform, that game was coded twice. These 133 titles (see Appendix A) constituted a highly representative frame for the universe of games as made by developers by accounting for more majority all game sales within the sampling period, and all of the most successful and high-profile titles in the hits-driven games business.

An expert game player, who was not one of the coders, played each game for the first 30 minutes on the default difficulty setting, typically "low" or "easy." A limitation to this method is that the rest of the game is missed after the first 30 minutes. However, the benefit of recording the first 30 minutes of game play is the ability to record the content everyone will see because every player has to start at the beginning. These 30-minute segments were recorded digitally and stored on a high-end desktop computer for later coding.

Within-Game Coding

Every character in the sample was recorded as an individual unit and coded, for a total of 8,572 characters. Of these characters, only adult female human characters were retained for analysis (n=368). Screen shots were obtained for 134 adult female human characters and imported into Adobe Photoshop. We were only able to capture and import 134 characters for analysis because there were some screen shots of female characters present in handheld games that were simply too small to obtain a reliable measurement. There were also several female characters that were present in the background of the game, and these characters were also too small to measure. It also should be noted that of these 134 characters, 98 of the characters were coded as White. Thus, statistical tests of significance on differences between racial groups were not conducted because there were so few minority female characters in the sample.

For each adult female human character, the height, head width, chest width, waist width and hip width were measured in inches. For chest and waist widths, measurements were taken at the widest part of the chest but at the narrowest part of the waist. The measurements were then converted to circumferences and scaled using classical allometry (Norton et al. 1996) to a height of 64.48 inches based on our anthropometric sample data from a 1998 nationally representative sample of adult women living in the U.S. (see below).

Training and Reliability

Two trained undergraduate students measured the aforementioned body proportions of the 134 characters in the sample. Coding rates were assessed at regular intervals throughout the study. Cohen's kappas (Cohen 1960) were .98 for height, .93 for head breadth, .97 for chest breadth, .84 for waist width and .86 for hip width.

Realism

To assess realism, coders were instructed to code each character for how much detail and pixilation was present using four categories: *little to no detail* (1), *some detail* (2), *moderately detail* (3), and *very detailed* (4). Very few of the characters were coded as minimally detailed (19%) or very detailed (10%). Therefore, response options were collapsed into *detailed* (n=81, α=.92) and *not detailed* (n=54, α=.92).

Rating and Genre

Coders researched each game title on the ESRB website and noted whether the game was rated "E" for everyone, "E+10" for children ten years of age and older, "T" for teens, or "M" for mature audiences. There were no games rated "AO" (for adults only) in this sample. In order to test whether games rated for children would contain different body imagery than games rated for an older audience, the categories were collapsed into 2 groups: games appropriate for children, which collapsed the categories "E" and "E+10" (n=59), and games appropriate for an older audience, which collapsed the categories "T" and "M" (n=61).

We also explored differences by game genre, but did not find any meaningful differences; thus they are not reported.

Anthropometric Comparison Sample

The anthropometric comparison sample was taken from the Civilian American and European Surface Anthropometry Resource (CAESAR) study (Harrison and Robinette 1998). Anthropometric data (e.g., height, head, chest, waist, hip measures) of 6,000 U.S. citizens (ages 18–65) were collected in 1998 for the purpose of comparing the U.S. population to similar populations in Italy and The Netherlands. The CAESAR sampling strategy was a stratified sample with gender, ethnicity, and age all equally sampled. This sample was chosen as the comparison group because the 1998 data set is the most comprehensive and the most recent anthropometric data set available to the public.

Wire framing

A graduate student with extensive experience in 3-dimensional (3-D) modeling created the wire frame models to represent composite female bodies from the CAESAR data and the video game data (e.g., see Fig. 1). Wire frame models are the visual representation of an electronic 3-D object used in computer graphics. The models were created using *Poser3* software, a popular 3-D rendering tool. Within *Poser 3*, a low-resolution standard female model was chosen as the starting point for all of the figures. Each was then constructed with mean anthropometric data (for the real-world composite) or mean game-supplied data (for each of the game subgroups) for the figure's head, shoulder, arms, chest, waist, hip, and legs. Two models were thus

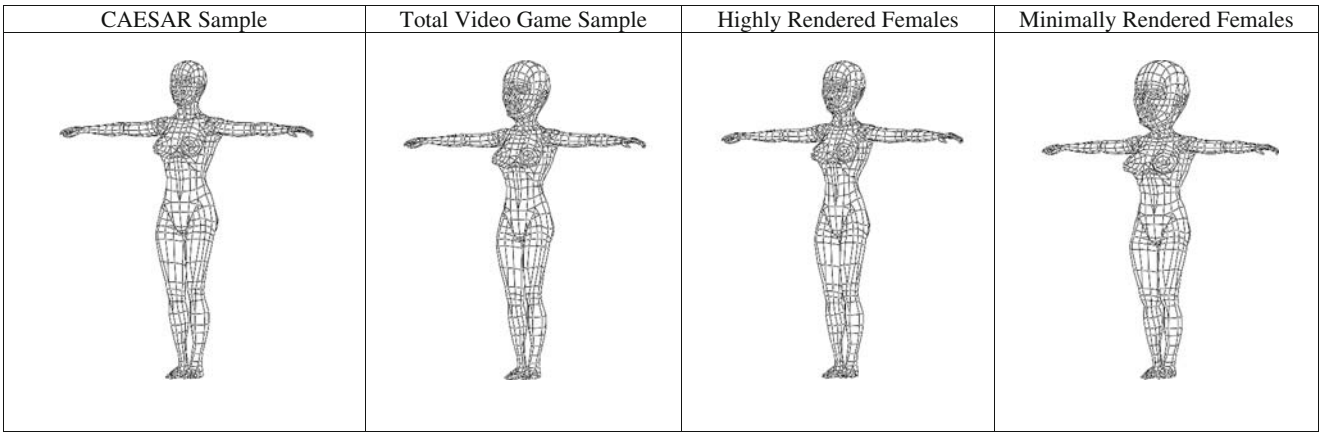

Fig. 1 Wireframe models scaled to a common height of 64.48 inches.

created for visual comparison, with tables supplying the means. For direct comparison, all of the game characters were extrapolated up or down to a fixed height of 64.48 inches, which was the mean value in the CAESAR sample. To statistically compare the pairs of figures, 1- sample t-tests were conducted to compare the video game proportions to a fixed mean (supplied by the CAESAR data for each body part). This has been a common approach in mass media research comparing media-character attributes with some real-population attributes (Dixon et al. 2003; Dixon and Linz 2000).

Results

Research Question 1 asked if the body sizes of female video game characters reflected the body sizes of the average American female. Single-sample t-tests indicated that the video game characters were significantly different on every dimension as compared to the real-world sample. Specifically, video game characters had significantly larger heads (M=29.67, SD= 12.46) than the CAESAR sample t (120)=7.01, p<.005. In contrast, video game characters had smaller chests (M=32.32, SD= 11.08, t(132)=−5.82, p<.005), smaller waists (M=24.65, SD= 10.15, t(125)=−6.37, p<.005), and smaller hips (M=35.44, SD= 11.44, t(133)=−7.34, p<.005) as compared to the real-world sample (see Table 1).

Research Question 2 asked whether game characters' proportions would differ by level of realism. Single sample t-tests revealed that the highly rendered characters were significantly different from the CAESAR sample on every measurement (see Table 2). Once again, highly rendered video game characters had significantly larger heads (M=26.30, SD= 7.50) than the real-world sample t (77)=5.39, p<.005. On the other hand, highly rendered video game characters had significantly smaller chests (M=28.92, SD= 6.81, t(80)=−11.85, p<.005), smaller waists (M=22.07, SD= 6.98, t(80)=−11.83, p<.005), and smaller hips (M=31.79, SD= 7.08, t(80)=−12.58, p<.005) as compared to the real-world sample.

Analysis of the minimally detailed video game characters revealed that these characters were significantly larger than the real world sample on only one measurement: head size (see Table 2). The minimally rendered video game characters had significantly larger heads (M=35.79, SD= 16.77) than the real-world sample t (42)=5.50, p<.005. These results suggest that more realistic female video game characters conformed more to the thin-ideal than did the less realistic characters.

The wire frame model visualizations afforded the ability to answer Research Question 3, which asked if artifacts of processing power would emphasize or deemphasize certain body proportions. Figure 1 clearly demonstrates that all of the video game variations feature larger heads than the

Table 1 Measurements of adult female video game characters extrapolated to a height of 64.48 inches.

	1998 CAESAR sample n= 3,000		Video game sample		Mean difference	% Change
	Mean	SD	Mean	SD		
Height	64.48		64.16			
Head	21.73	.71	29.67	12.46	7.01***	37
Chest	37.96	5.54	32.32	11.08	−5.82***	15
Waist	31.34	6.08	24.65	10.15	−6.37***	15
Hip	41.78	5.64	35.44	11.44	−7.34***	21

Head size of video game characters ranged from 28.54 to 30.80. Chest size of video game characters ranged from 31.35 to 33.28. Waist size of video game characters ranged from 34.45 to 36.42. Hip size of video game characters ranged from 34.51 to 36.50. Statistically significant differences versus the CAESAR data are noted ***p<.001.

Table 2 Measurements of highly and minimally rendered adult female video game characters extrapolated to a height of 64.48 inches.

	1998 CAESAR sample n=3,000	Highly rendered games		Mean difference	% Change	Minimally rendered video game		Mean difference	% Change
	Mean	Mean	SD			Mean	SD		
Height	64.48	64.48				64.48			
Head	21.73	26.30	7.50	5.39***	21	35.79	16.77	5.50***	65
Chest	37.96	28.92	6.81	−11.85***	24	37.73	14.11	−.12	0
Waist	31.34	22.07	6.98	−11.83***	30	29.29	13.03	−1.05	1
Hip	41.78	31.79	7.08	−12.58***	24	41.01	14.33	−.39	0

For highly rendered video game characters, the endpoints for each measurement are as follows: head=25.45 to 27.15; chest=28.16 to 29.67; waist=31.10 to 32.58; and hip=32.50 to 32.85. For minimally rendered video game characters, the endpoints for each measurement are as follows: head=33.23 to 38.34; chest=35.75 to 39.70; waist=39.04 to 42.98; and hip=39.1 to 43. Statistically significant differences versus the CAESAR data are noted. *** $p<.005$

CAESAR sample. The realistic video game characters' chest, waist, and hip sizes are significantly smaller, resulting in a figure that conforms to the thin ideal seen in other media. The minimally detailed characters have the largest head measurements, resulting in a wire frame model that appears cartoonish in nature.

Research Question 4 asked whether games rated for children would contain different body imagery than games rated for an older audience. As can be seen in Table 3, games rated for children were significantly different from the real-world sample on several dimensions. The characters in games rated for children had significantly larger heads (M=30.19, SD= 10.48) than the real-world sample t (59)=6.26, $p<.005$. In contrast, the females in games rated for children had significantly smaller chests (M=29.09, SD= 9.47, $t(59)=-7.24$, $p<.005$), smaller waists (M=21.12, SD= 6.41, $t(59)=-12.24$, $p<.005$), and smaller hips (M=31.93, SD= 8.01, $t(59)=-9.47$, $p<.005$) as compared to the CAESAR sample.

A similar pattern was found for games rated for an adult audience (Table 3). Female video game characters in games rated for adults had significantly larger heads (M=29.16, SD= 14.21) than the real-world sample t (60)=4.09, $p<.005$. Female characters in games rated for adults had significantly smaller chests (M=35.02, SD= 11.66, $t(71)=-2.14$, $p<.05$), smaller waists (M=27.86, SD= 11.78, $t(65)=-2.39$, $p<.05$), and smaller hips (M=38.28, SD= 12.98, $t(73)=-2.31$, $p<.05$), as compared to the CAESAR sample.

Differences between game ratings were also explored. Games rated for children featured characters that were significantly smaller than characters in games rated for adults. In particular, characters in games rated for children had significantly smaller chests (M=34.19, SD= 11.18, t (72)=−6.97, $p<.001$), waists (M=39.24, $t(66)=-16.2$, $p<.005$), and hips (M=31.42, SD= 7.88 $t(72)=-6.25$, $p<.005$) than did characters in games rated "T" and "M." There was no significant difference between the game ratings in character head size. Therefore, it appears that

Table 3 Measurements of female video game characters in games rated for children and games rated for adults extrapolated to a height of 64.48 inches.

	1998 CAESAR sample n=3,000	Games rated for children		Mean difference	% Change	Games rated for adults		Mean difference	% Change
	Mean	Mean	SD			Mean	SD		
Height	64.48	64.48				64.48			
Head	21.73	30.19	10.48	6.26***	39	29.16	14.21	4.09***	34
Chest	37.96	29.09	9.47	−7.24***	23	35.02	11.66	−2.14*	1
Waist	31.34	21.12	6.41	12.24***	33	27.86	11.78	−2.39**	11
Hip	41.78	31.93	8.01	−9.47***	24	38.28	12.98	−2.31*	1

For games rated for children, the endpoints for each measurement are as follows: head=28.84 to 31.54; chest=27.86 to 30.31; waist=30.89 to 32.96; and hip=31.01 to 33.10. For games rated for adults, the endpoints for each measurement are as follows: head=27.34 to 30.98; chest=33.64 to 36.38; waist=36 to 39.68; and hip=36.77 to 39.79. Statistically significant differences versus the CAESAR data are noted *$p<.05$, **$p<.01$, *** $p<.001$.

game rating influences character proportions such that female characters in games rated for children are thinner than characters in games rated for adults.

Discussion

The purpose of this study was to examine female body imagery in video games and compare them to a real-world sample of American women. Overall, the results show marked differences in the way females are portrayed in video games in terms of differing levels of photorealism and game rating. Although the statistical significance thresholds do not allow strong statements, it appears that female video game characters at the highest level of photorealism and in games rated for children feature thinner female characters. Less realistic games and games rated for adults feature larger female characters in general. The findings are discussed, along with their implications for game players now and in the future, and for cultivation theory.

Our first research question concerned whether the body proportions of female video game characters reflected the body proportions of the average American female. This study found that females in video games had significantly larger heads, but smaller chest sizes, waists, and hips than the average American woman. This finding provides some empirical support for the notion that this medium is presenting female body shapes that conform to the thin-ideal observed with other mainstream media (Byrd-Bredbenner 2003; Sypeck et al. 2006).

The skinny part of this ideal becomes more apparent when highly photorealistic characters are separated from minimally photorealistic characters (Research Question 2). The females in the highly photorealistic group had larger heads, but smaller chests, waists, and hips than the CAESAR sample. In contrast, females in the minimally photorealistic group had larger heads than the average American female. These findings have several implications.

First, highly photorealistic games may be more likely than less photorealistic games to activate body dissatisfaction and a drive for thinness among female gamers, and to support the idealization of a markedly thin female body among male gamers. Gamers who encounter these characters would view a female who is 5′4″ tall, with a 29″ bust, 22″ waist, and 31″ hips. Since very few women can achieve these proportions naturally, the majority of female gamers will deviate from this ideal, and the majority of male gamers will never know a real woman whose body is actually this thin. Future research is needed to assess the impact of repeated exposure to such portrayals on male and female gamers' perceptions of themselves and expectations about women's bodies.

The findings for photorealism also raise several questions: Why do female characters at low levels of photorealism have such large heads? It may be an artifact of low resolution representations compared to the real-life visuals we experience; game characters cannot duplicate the same number of curves and nuances of real humans, and so may overcompensate by simply being larger. So what are the potential impacts of exposure to these unrealistic characters? The "uncanny valley" effect (Mori 1970) suggests that low-resolution video images are perceived as intentionally fake and are not processed as "real" (MacMillan 2007). In contrast, characters approaching realism, but not quite real, are also perceived as fake, and are forcefully rejected by humans as a defense mechanism (Mangan, 2007). As MacMillan (2007) notes, the "uncanny valley" effect explains why rudimentary cartoon characters like Homer Simpson are endearing to audiences because the simple use of shapes and color help the audience relate to Homer instead of focusing on the ways in which he is different from a real person. In contrast, the nearly (but quite) lifelike characters in the film *Polar Express* were seen as "creepy" and largely rejected by audiences en masse (Serviss 2005). Given that video game designers are aware of this effect, they may have purposely made females in these games more cartoonish in nature so as to not invite comparisons to humans.

Therefore, although media researchers may claim that video games pose a danger because of the increasingly realistic images they contain (e.g., Van Mierlo and Van den Bulck 2004), experts in the graphics industry argue that the current generation of hardware is in danger of moving into the "uncanny valley" (Serviss 2005). What this means from a cultivation perspective is that current "uncanny" imagery may be rejected in the mind as human, thus reducing any cultivation effects. Thus, it may be that cultivation effects will not be observed until another generation of hardware when imagery attains photo-realism. Future researchers confronting the next generation of game hardware and considering cultivation should control for the slight, but important differences between nearly realistic and totally realistic characters.

If the uncanny valley acts as a quasi shield for cultivation effects, is exposure to cartoonish characters like the ones examined in this study a cause for concern? According to Botta (1999), how the image is processed is more important when predicting body image outcomes than sheer exposure. For example, Botta (1999) found that while actual television exposure was not a significant predictor of body dissatisfaction and endorsement of the thin ideal among women, body image processing while viewing (as indicated by agreement with such items as "I think about how my body compares to television characters' bodies") predicted 33% of the variance in endorsement of the thin

ideal and 14% of the variance in both body dissatisfaction and drive for thinness. Applied in this context, characters that do not look human are presumably not processed, and the gamer may remain relatively "safe" from negative body image outcomes.

Therefore, if gamers are not likely to process images that are too realistic, nor process images that are too cartoonish in nature, why study the body imagery in video games at all? The answer can be found in fields where the uncanny valley has already been crossed. In advertising, digital manipulation is subtle enough to fool even educated consumers. For example, Bissell (2006) studied the relationship between college women's visual literacy (i.e., knowledge of digital manipulation of fashion and entertainment images) and their desire to be thin, their desire to look like the featured model, and their disordered eating. She found that visual literacy did not reduce participants' desire to look like the featured model. Respondents with knowledge of digital manipulation had no less desire to look like a swimsuit model and scored no lower on measures of disordered eating than women without knowledge of digital manipulation. Eventually, the body shapes found in games may have a norming influence akin to manipulated advertising images like magazine characters (Harrison and Cantor 1997; Stice and Shaw 1994) and television characters (Botta 1999; Harrison 2000b) do.

The findings here have theoretical implications as well. One of the assumptions of cultivation theory is that the mass media present a similar and consistent system of stories (Gerbner et al. 2002). Yet the results of this study support those critics who challenge cultivation theory for not taking into account significant content differences (Hawkins and Pingree 1981). The body imagery presented in these games varies by resolution and game rating. Therefore, exposure patterns become a particularly important variable in possible effects models. In Williams' (2006b) cultivation experiment, players played one game extensively over the course of a month, rather than the full range of games on the market. That single game's sustained set of images was enough to generate targeted and specific cultivation outcomes in a way that a more diverse set of images would likely not. With the range of female video game body imagery now established, future experimental work on effects must account for which images the player is viewing by taking a careful look at the particular games under consideration and play durations for each player. Moreover, the work here suggests that body proportions also differ when the processing power of the video games is considered.

An additional point to make when we think of effects processes is that the audience for games has been largely male (Fact and research: Game player data 2007). The audience, then, has made this medium different from television or magazines and this has two important implications. First, the male audience for this medium implies that male body-image may be impacted by the *male* ideal (e.g., muscular) often shown in popular video games. Indeed, a recent experiment conducted by Barlett and Harris (2008) found that college-aged males who played a video game that featured muscular characters for 15 min had significantly lower body esteem after game play than did those who did not play an ideal-body game. A second implication of a predominately male audience is that attitudes and expectations for how females should look may be most impactful among men, rather than as aspirational, or body-dissatisfaction-inducing figures for women—although this may certainly occur. Therefore, future body dissatisfaction impacts may be larger than any prior ones. However, there has a recent rise of video game play among females (Musgrove 2008), especially in casual games played on PCs, and on Nintendo's DS and Wii platforms.

The final research question asked if game rating influenced the nature of female body imagery. It may come as a surprise that it was the games rated for children that contained the thinnest female imagery. However, the thin ideal is communicated early to children, through dolls such as the popular Barbie for example. Indeed, Dittmar and colleagues (2006) found that girls as young as 5 to 7 years reported lower body esteem and a greater desire for thinness directly after exposure to such doll images. Given that Barbie has been joined by the more disturbing Bratz doll, which features an exceptionally thin body but also a heavily made-up face and collagen induced lips, it appears that young children are bombarded with a thin beauty ideal that in neither attainable or healthy both in and outside of the media.

Parents should understand that the exposure to the thin-ideal can impact even the youngest children. A large body of research supports the idea that children's body satisfaction is impacted by exposure to the thin-ideal (for review, see Harrison and Hefner 2008). Therefore, parents who use the ESRB ratings as a tool should be aware that the rating system will not filter out thinness.

Limitations

Content analysis is particularly useful in identifying frequent and infrequent depictions in the mass media. Understanding what types of depictions are present in video games begs the question of how people respond to the most prevalent types of images. However, effects are beyond the scope of any content analysis. Instead, the work here provides a baseline for future effects research. Follow-up experimental research would contribute to our understanding by examining how gamers process body imagery, and

whether these processes are related to expectations for how the female body should look. The results here can help those future studies make informed statements about the generalizability of the content they use.

This study was also limited in that screen shots for female characters in handheld games could not be captured and imported into Adobe Photoshop. Thus, the findings in this study may not be generalizable to characters in games made for handheld systems. And since these games often skew to a younger audience, we cannot know if our conclusions about youth-rated games will bear up with a more comprehensive sample. Finally, we only matched figures by height. As a result, people might assume that the character's head is the size of a human head and scale the body accordingly in the absence of background information clearly indicating a character's size. Therefore, we also matched the figures by head size and found that the resulting figures tended to have very small bodies compared to the real-life standard. Our own experience with games suggests that most characters are not in fact diminutive with normal heads, but rather of normal human height with enlarged heads. We concluded this because the characters in video games are in equal proportion to other objects (e.g., trees, buildings) and other character's in the virtual environment. Thus, the most informative way to compare the figures seems to be by matching them on height.

Clearly, descriptive data from content analyses raise interesting questions for academic researchers while providing knowledge and insight by detailing video game production practices. Williams (2006a) has suggested previously that games and gender work as a cycle: games feature more males and so attract more young males to play. Those males grow up and are more likely to become game makers than women, perpetuating the role of males in game creation, and so on. Indeed, a recent survey revealed that 89% of professionals in the video game industry were male (Game Developer Research 2007). The survey did not specify if the 11% of the women were involved in design, but it does raise some questions as to who is creating these characters and why. Perhaps game designers are consciously trying to change the media landscape by creating larger women in some games. Or, designers are creating thinner characters at high levels of photorealism to emulate what viewers are accustomed to seeing in mainstream media. Future research should consider the intentions of the developers along with the nuances presented here. When combined with controlled experimental work, this would yield a greater understanding of games and their effects on body satisfaction.

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Appendix A

1. 50 Cent Bulletproof
2. Advance Wars Dual Strike
3. Age of Empires
4. Animal Crossing
5. Animal Crossing (DS)
6. Advance Wars Dual Strike
7. Age of Empires
8. Bey Blade V Force
9. Blitz: The League
10. Bratz: Rock Angels
11. Burn Out 3
12. Burnout Legends
13. Call of Duty 2
14. Call of Duty: Big Red One
15. Castlevania Dawn of Sorrow
16. Chronicles of Narnia
17. Civilization 4
18. Coded Arms
19. Condemned:Criminal Origins
20. Crash Bandicoot 2
21. Crash Bash
22. Crash team racing
23. Dead or Alive 4
24. Sims Deluxe
25. Disney's Chicken Little
26. Disney Princess
27. Donkey Kong Country 3
28. Doom 3
29. Dragon Ball GT Final
30. Dragon Ball Z: Budakai
31. Dragon Ball Z: Ultimate Battle
32. Fable
33. Fight Night Round 2
34. Fight Night Round 3
35. Final Fantasy IX
36. Final Fantasy Tactics
37. Final Fantasy VII
38. Final Fantasy VIII
39. Fire Emblem: Sacred Stone
40. Forza Motorsport
41. God of War
42. Gran Turismo
43. Grand Theft Auto: San Andreas
44. GTA: Liberty Stories
45. Guild Wars
46. Gun
47. Halo 2
48. Halo: Combat Evolved
49. Harry Potter Goblet of Fire
50. Kameo: Elements of Power
51. King Kong

52. Kirby Airride
53. Kirby Canvas Curse
54. Lego Star Wars
55. Luigi's Mansion
56. Lumines
57. Madagascar
58. Madden '06
59. Major League Baseball 2K5
60. Mario and Luigi Partners in Time
61. Mario Golf
62. Mario Kart
63. Mario Kart Double Dash
64. Mario Party 7
65. Mario Party Advance
66. Mario Superstar Baseball
67. Medal of Honor: European Assualt
68. Metal Gear Acid
69. Midnight Club Dub
70. MVP Baseball 2005
71. Namco Museum
72. NBA 2k6
73. NBA Live '06
74. NCAA Football 2006
75. Need for Speed: Most Wanted
76. Need for Speed: Underground
77. NFL Gameday 2005
78. NFL Street Unleashed
79. Nintendogs: Chihuaha
80. Nintendogs: Dachschund
81. Nintendogs: Labrador
82. Perfect Dark Zero
83. Pokemon Coliseum
84. Pokemon Dash
85. Pokemon Emerald
86. Pokemon Firered
87. Pokemon Leafgreen
88. Pokemon XD: Gale of Darkness
89. Project Gotham Racing
90. Quake 4
91. Ratchet Deadlocked
92. Resident Evil 4
93. Ridge Racer
94. Rollercoaster Tycoon 3
95. Shadow of the Hedgehog
96. Simpsons Road Rage
97. Sims 2
98. Sims Deluxe
99. Sims University
100. Sims: Nightlife
101. Socom 3 US Navy Seals
102. SOCOM US Navy Seals: Fireteam Bravo
103. Sonic Heroes
104. Sonic Mega Collection
105. Sonic Rush
106. Soul Calibur 3
107. Splinter Cell Chaos Theory
108. Spongebob Supersponge
109. Spyro: Year of the Dragon
110. Star Wars Battlefront
111. Star Wars Battlefront 2
112. Star Wars III: Sith
113. Star Wars: Republic Commando
114. Super Mario 3
115. Super Mario 64
116. Super Mario Strikers
117. Super Mario Sunshine
118. Supersmash
119. Tiger Woods
120. Tony Hawk's American Wasteland
121. Tony Hawk: Underground 2 Remix
122. Twisted Metal: Head On
123. Untold Legends
124. Wariowear Touched
125. Wipe Out Pure
126. World of Warcraft
127. WWE Smackdown
128. Yoshi Touch and Go
129. Zelda
130. Zelda Windwalker
131. Zoo Tycoon
132. Zoo Tycoon DS
133. Zoo Tycoon: The Complete Collection

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