Underrepresented rather than misrepresented?

A content analysis of female characters' (non)sexualization in virtual reality (VR) games

Shay Xuejing Yao, Joomi Lee, & Reed M. Reynolds

This is a pre-copyedited, author-produced version of an article accepted for publication at Analyses of Social Issues and Public Policy. *The accepted manuscript is the final draft author manuscript, as accepted for publication, including modifications based on referees' suggestions, before it has undergone copyediting, typesetting and proof correction. This is sometimes referred to as the post-print version. The version of record,*

Yao, S.X., Lee, J. & Reynolds, R.M. Underrepresented Rather than Misrepresented? A Content Analysis of Female Characters' (non)Sexualization in Virtual Reality (VR) Games. *Sex Roles* (2024). https://doi.org/10.1007/s11199-024-01488-9

Author Note

Shay Xuejing Yao, Ph.D., Assistant Professor, Department of Communication, Georgia State University, Atlanta, GA, 30303, U.S., shayyao@gsu.edu

Joomi Lee, Ph.D., Assistant Professor, Department of Communication, University of Arkansas, Fayetteville, AR, 72701, U.S., joomil@uark.edu

Reed Reynolds, Ph.D., Assistant Professor, Department of Communication, University of Massachusetts Boston, Boston, MA, 02125, U.S., reed.reynolds@umb.edu

Correspondence concerning this article should be addressed to Shay Xuejing Yao, Department of Communication, Georgia State University, Atlanta, GA, 30303, U.S. Email: shayyao@gsu.edu

Underrepresented Rather Than Misrepresented?

A Content Analysis of Female Characters' (Non)sexualization in Virtual Reality (VR) Games

Abstract

With the increasing popularity and availability of virtual reality (VR) video games, the representation of women within these immersive environments becomes crucial to explore. Although the sexualization of female characters in traditional video games has been widely studied, the sensory-rich nature of VR may introduce changes in character representations and emergent adverse outcomes. In the present study we content analyzed female characters in popular VR video games to investigate the potential underrepresentation and misrepresentation of female characters. Results demonstrated that male characters were represented four times more frequently than female characters. The underrepresentation of female characters was more severe in competitive VR games than casual VR games, however there was no significant difference in the underrepresentation of women between game genres or ESRB ratings. In addition, female characters were presented in a sexualized manner in 30% of cases. The sexualization of female characters was associated with their portrayal as physically capable, violent, or a victim. We also found that sexualization of female characters did not differ based on the type of game (casual vs. competitive), game genres, or ESRB ratings. We discussed these findings in immersive VR video games in comparison with those in traditional 2-D screen media video games.

Keywords: video games, virtual reality, content analysis, sexualization, gender

Underrepresented Rather Than Misrepresented?

A Content Analysis of Female Characters' (Non)sexualization in Virtual Reality (VR) Games

Virtual reality (VR) games have gained immense popularity in recent years, offering immersive and interactive gaming experiences for players. Although VR games fall under the broad category of video games, it is pertinent to ask whether the documented concerns surrounding sexism and sexualized representations in traditional video games (Lynch et al., 2016; Tang et al., 2020) extend to this nascent platform. Indeed, previous research has highlighted two major issues concerning female characters in videogames: *underrepresentation*, where female characters appear far less frequently than their male counterparts (Downs & Smith, 2010), and *misrepresentation*, where female characters are portrayed in biased or stereotypical ways (Lynch et al., 2016). These negative portrayals can perpetuate harmful gender stereotypes and contribute to the marginalization and mistreatment of women in the gaming community (Tang & Fox, 2016; Tang et al., 2020). In the present study we content analyzed female characters in VR video games to investigate the potential underrepresentation and misrepresentation of these characters.

In this present study, we define video games that are accessed through VR platforms and played via a VR headset as VR games. In comparison, we define video games that are primarily accessed through 2-D screen media (e.g., computer, console, tablet, mobile phone) as traditional video games. Despite substantial research on gender representation in traditional video games, VR games remain underexplored. In immersive VR, users engage in real-time, continuous interactions with mediated content via physical movements, embodied in their avatar, which leads to the sensation that they are actually in the virtual space (Lombard & Ditton, 1997; Wirth

et al., 2007). Previous research on traditional video games has found a negative impact of biased representation of female characters on both male and female players (e.g., Behm-Morawitz, 2017; Yao, Ewoldsen, et al., 2022). For example, playing a video game with overtly sexualized female characters (e.g., small waist, wore only bikinis) was found to lead women participants to have less positive feelings about their own bodies and their sexual attractiveness (Barlett & Harris, 2008). Given its technological affordances of facilitating intense visceral experience, unrealistic representations within VR video games could also significantly influence players' perceptions, emotions, and attitudes. Indeed, skewed or biased gender portrayals may not only affect gameplay experiences within the VR context but also shape players' real-world attitudes toward women. In this regard, the present study investigates the representation and sexualization of female characters in VR games through a content analysis of commercially available VR games. Implications from this study could provide researchers and video game developers with meaningful insights into the current state of gender dynamics in VR games, potentially guiding more inclusive and balanced character portrayals in this emerging platform.

Underrepresentation of Female Characters in Video Games

The systematic underrepresentation of women in media remains a pervasive issue that is particularly evident within the context of video games. A large-scale content analysis from 2009 showed that female characters were significantly less represented (14.77%) than male characters (85.23%), along with non-white ethnic groups (Williams et al., 2009). This gender gap became more pronounced in the portrayal of primary action drivers within games, where male characters were even more likely to appear. Female characters, when present, were predominantly cast in secondary roles. This pattern of underrepresentation has been echoed across subsequent content analyses. For example, Downs and Smith (2010) found that male characters were represented

with over five times the frequency of female characters in a sample of 60 top-selling console games. A study that examined massively multiplayer online games (MMOGs) also found a consistent underrepresentation of female characters, that the gender distribution among user-controlled avatars in MMOGs was disproportionally skewed toward male characters (76.47%) compared to female characters (12.9%).

Misrepresentation of Female Characters in Video Games

Research on the representation of female characters in traditional video games has focused on 2D-screen platforms (e.g., computer, console, tablet, mobile phone), finding that female characters are both underrepresented and misrepresented, especially through highly sexualized depictions of female characters. In an early content analysis of popular console video games, almost half of the analyzed video games included no female characters, and about a third of the analyzed female characters had “large breasts” or “skimpy clothing” (Dietz, 1998, p. 435). Similarly, Downs and Smith (2012) found that female characters are more likely than male characters to wear sexually revealing clothing, reveal nudity, and have exaggerated and sexualized body proportions. However, newer research showed a decrease in female character’s sexualization in recent years. In a content analysis of video games featuring playable female protagonists, Lynch et al. (2016) found that games released 2007-2014 included less sexualized female characters compared to games released 1999-2006.

The degree of sexualization also appears to vary based on specific game metrics. For example, Lynch et al. (2016) found that traditionally male-oriented genres, such as fighting games, tend to have more sexualized female characters than role-playing games. Regarding ESRB rating, although Lynch et al. (2016) observed no difference in female character’s sexualization between games with the Everyone and Teen or Mature ratings (Lynch et al., 2016),

Haninger and Thompson (2004) found female characters in “Teen” rated games more frequently portrayed as partially nude or engaged in sexual behaviors than male characters. In a study that focuses on Mature-rated games, Thompson et al. (2006) found that about half of the selected video games include content like “pronounced cleavage, large breasts, or provocative clothing” (p. 408). Interestingly, for casual games (i.e., games characterized as simple and accessible games), no significant gender disparity in sexualization was observed (Wohn, 2011). This finding contradicts prior research when comparing sexualized representation between male and female characters. This contrast may be explained by gender stereotypes in video game culture, that women are stereotypically perceived as preferring casual video games rather than competitive video games (Yao et al., 2022). Thus, gendered stereotypes portrayed by game characters may reflect expectations of or about game players for particular genres or ESRB ratings.

Another angle of interest is the association among attributes that constitute character portrayals, for example, between a female character’s sexualization, violent tendencies, physical capabilities, and victimization. In video games, sexiness and physical capability tend to be coupled in the representation of a main character (e.g., Lara Croft in Tomb Raider; Jansz & Martis, 2007). In a longitudinal content analysis that sampled video games across three decades, Lynch et al. (2016) found that when female protagonists are sexualized, they are also more likely to be physically capable. The present study tested whether there is a relationship between sexualization of female characters and their physical capability in VR games. Additionally, prior content analysis showed that female characters are often portrayed as victims, who are violently or sexually attacked or being the victim to be saved by the player (Dietz, 1998). In light of these

findings, the current research aims to clarify whether female character sexualization is associated with these other character attributes.

Representations of Female Characters in VR Games

VR games may present novel forms of player engagement through immersive technologies, potentially transforming the traditional player-character relationships. User avatars and virtual agents in immersive VR games share some characteristics with those in traditional games, but the way players perceive and interact with characters are qualitatively different between these platforms. Immersion in VR allows players to engage with people and virtual objects in a more naturalistic way with less interface interference (Cummings & Bailenson, 2016). These immersive experiences lead to a heightened sense of social presence, defined as the feeling of being *with* others in the virtual space, which tend to amplify cognitive, emotional, and behavioral reactions to virtual experiences (e.g., empathy; Pimentel et al., 2021).

Previous research in the context of VR has largely focused on the psychological and behavioral outcomes related to representations or customization of human avatars and virtual agents. Findings have consistently shown that sexualized avatars within VR not only influence self-perception but also have the potential to perpetuate and reinforce gender stereotypes and biases, affecting real-world attitudes and behaviors toward women (Fox & Bailenson, 2009). Moreover, many VR games increasingly involve the multiplayer context and social interactions among players, and these interactions can be particularly naturalistic due to the heightened sense of presence and embodiment that VR offers. However, these naturalistic interactions can also exacerbate the negative effects of sexualized representations in VR. A qualitative study suggested that experiencing harassment in social VR can be intensified by features like synchronous voice chat and avatar movements that may be misused to intrude into one's

personal boundaries (e.g., touching or grabbing through avatar; Blackwell et al., 2019). Given the potential of immersive VR to enhance these negative experiences, a thorough understanding of female character representation in VR gaming is imperative.

Despite recognizing the impact of immersion and embodiment in VR, less attention has been given to the representation of female characters in VR games. Although customizable avatars provide a degree of control over players' self-representation, developer-defined characters can still reflect industry trends and norms. Discourses about the industry of traditional video games and design suggest a predominant focus on heterosexual male players as the target audience, resulting in the underrepresentation and misrepresentation (e.g., sexualization, victimization) of female characters in video games (Lynch et al., 2016). To the best of our knowledge, however, a comprehensive content analysis of gender representation in video games within the VR context has not been conducted, leaving a notable gap in the understanding of gender portrayals in VR games. Therefore, to expand the current understanding of women's representation in video games and address the distinct characteristics of VR gaming, we ask the following research questions:

RQ1: Are female characters underrepresented compared to male characters in VR games?

RQ2: Does underrepresentation of female characters in VR games, if present, differ between (a) type of game, (b) genre, and (c) ESRB rating?

RQ3: Are female characters overall sexualized in VR games?

RQ4: Does sexualization of female characters in VR games, if present, differ between (a) type of game, (b) genre, and (c) ESRB rating?

RQ5: Is sexualization of female characters related to (a) whether they are physically capable, (b) whether they are violently portrayed, and (c) whether they are a victim?

Method

Sampling

Video Game Sampling

Three popular VR game platforms (i.e., steamVR, Oculus VR, PlayStation VR) were selected for video game sampling. These three platforms were selected due to their popularity among VR users. Though many VR games are cross listed on all three platforms, some games were available on only one platform. On each VR game platform's official website, we first sorted all available video games by popularity, then the top 100 video games were selected as the initial sample. On the steamVR website, we clicked on "POPULAR" to sort the video games. On the Oculus VR website, we searched "most popular games" and then selected the top 100 games. On the PlayStation VR website, we sorted all available games by the "best-selling" feature. Seventy-seven duplicate video games were removed from the initial 300 video games. Of the remaining games, 111 featuring non-anthropomorphized characters (e.g., *Gorilla Tag*) were removed because previous research found media figures that look very different from humans (e.g., a snake) are perceived as less socially relevant (Hoffner & Cantor, 1991). However, video games featuring anthropomorphic non-human characters (e.g., zombies) were included in the sample because reactions to these characters can be similar to those elicited by human media characters (Yao, Ellithorpe, et al., 2022). Two research assistants worked on the video game sampling task. All video games removed from the sample were evaluated and agreed by both research assistants and the first author.

YouTube Segments Sampling

To understand sexualized representation of female characters in actual gameplay, we followed a procedure outlined by Hartmann et al. (2014) and Lynch et al. (2016), where videos

of gameplay recordings on YouTube were sampled and analyzed. As argued by Lynch et al. (2016), compared to recording gameplays of researchers who are aware of the study purpose, this approach avoids possible researcher biases that may arise when capturing the gameplay content. For each of the sampled 112 video games, four trained research assistants sampled the YouTube video segments. The research assistants first searched the video game name and "VR playthrough" (e.g., "Blade and Sorcery VR playthrough") on youtube.com, who then filtered results by the "view count" from the highest. Then the first two videos that met the following two conditions were selected: (1) The video must feature an unmodified version of the original game; (2) The video must have at least 5-minute of footage of actual gameplay, excluding content such as initial menu, loading screen, or basic tutorial. The 5-minute cutoff of video length matches the standards of previous content analyses in the video game context (Hartmann et al., 2014; Lynch et al., 2016). In line with the argument made by Lynch et al. (2016), we believe that the level of character sexualization is unlikely to change dramatically throughout the video. If there was no female character in either of the selected videos, the research assistants reviewed up to an additional four videos using the same procedure. If no female characters were present in all six reviewed videos, then the video game is marked as missing for character-level coding as there were no female characters to be coded. During this process, 44 video games were coded as missing for character-level variables for two possible reasons. First, the gender of all characters in the videos were unidentifiable due to face masks or heavy armors. Second, the video game may feature humans, but no female characters were found in the videos (e.g., an all-male football game). The final sample for character-level coding included 68 video games and 136 YouTube videos (length range: 9-361 minutes).

Several manifest variables were recorded during the sampling process. *Video game genre* was coded as one of the six categories: action, adventure, simulation, strategy, sport & racing, and other/indeterminable. Trained coders were instructed to use information provided on the listing website of the video game for this variable (e.g., oculus.com). Occasionally there were several genres listed on the website with the most relevant genre as the first one. If there are two or more genres listed on the website, the first one was used to code the genre variable. *ESRB rating* was coded as early childhood (EC), everyone (E), Everyone 10+ (E10+), teen (T), Mature (M), Adults Only (AO), rating pending (RP), or not rated/interminable, which was coded based on information provided on www.esrb.org. Because of the objective nature of these variables, intercoder reliability was not computed.

Coding

Game-Level Coding

To understand whether women are overall underrepresented in VR games than men, the first 60 minutes of each of the two selected videos of all 112 sampled video games were coded for the number of female and male characters. If the video is shorter than 60 minutes, the whole video was coded for these variables. The first appearance of the first human character was used as the timestamp of the beginning of the video, then each 5-minute segment was used as a coding unit. The final sample of underrepresentation coding included 758 video segments. Four research assistants worked as coders for these variables. Several rounds of reliability training were conducted until the percent agreement reached 100%. During each round of reliability training, each coder coded the same 5-minute video segment that fits the sampling criteria but outside of the final sample, then all four coders and the first author watched the 5-minute segment together

and checked all coding results. All disagreements were resolved among the four coders and the first author through discussion.

In each 5-minute segment of the video, *number of male characters* and *the number of female characters* were coded as (1) zero, (1) 1-2, (3) 3-5, (4) 6-10, and (5) more than 10. If the character's gender is impossible to determine due to low resolution (e.g., a blurry, background character) or lack of clear gender cues, then the character was not coded as either a male or a female character. An index of the number of male characters for each video game was formed by adding the number of male characters of all 5-minute segments in both videos (M = 24.72; SD = 17.28). The same procedure was used to form an index of the number of female characters (M = 5.96; SD = 4.54).

Additionally, *Game type* was coded as competitive (i.e., video games that feature player-vs-player competitions or require high level of involvement) or casual (i.e., video games that are not competitive in nature, such as light puzzles, trivia, or match-3 games; percent agreement: 93.8%; Krippendorf's α = .87).

Character-Level Coding

The video segment selection for sexualization variables was slightly different than the video segment selection for underrepresentation variables. In the initial sampling, we found 68 of the sampled video games had at least one appearance of female characters, which means the rest 44 video games had no female characters to be analyzed. Thus, we coded sexualization of female characters using the videos from the 68 video games that had female character appearances. We used the first 5-minute segment of each selected video and the beginning timestamp was the first female character's first appearance in the video. The final sample includes the first 5-minute segment of the 136 selected videos from all sampled 68 video games, and a total of 460 female

characters were coded. Screenshots of all coded characters are available upon request. Two research assistants worked as coders and reliability training involved two steps. First, each coder counted the number of female characters for a 5-minute segment that fits the sampling criteria but not included in the final sample. If there was a disagreement between the coders, the two coders and the first author watched the 5-minute segment together and checked the coding results. Whenever there was a disagreement between the coders, they repeated the procedure and coded another 5-minute segment. This iterative process took several rounds of training until the percent agreement reached 100%. Second, reliability training for the sexualization variables and the game type variable took two rounds and lasted roughly four weeks.

In the first round, each coder coded twelve 5-minute segments (a total of 56 female characters) that fit the sampling criteria but were not part of the sample, then the first author computed percent agreement and Krippendorf's α between coders. For variables with low agreement, the first author and the coders discussed up to two coded characters where the two coders coded the variable differently. After reaching an agreement for the example characters, the coders went back and revised their coding results based on the prior discussion. The first author then computed percent agreement and α again for the revised coding results, and met with the coders to discuss disagreement. The same procedure was repeated several times until the coding results reached 90% agreement and an average α of .80. In the second round of reliability training, the coders coded another twelve 5-minute segments (a total of 48 female characters) that fit the sampling criteria but were not part of the final sample. Reliability training was concluded because both percent agreement (range: 87.5% to 100%) and α (range: .74 to 1.00) were acceptable.

The coding structure of the character sexualization was based on Lynch et al. as well as Downs and Smith, encompassing twelve character-level variables. We adapted our coding protocol as closely consistent with Lynch et al. as possible. We followed Lynch et al.'s approach and coded five areas of character sexualization—chest, buttock, waist, leg, and movement—were coded as either present (1) or absent (0). Coding protocol with detailed instruction and supplemental images demonstrating each coded level is available upon request from the first author.

Following Lynch et al., character's *chest* was considered sexualized if the coding indicated the presence of one of the following: the breasts were disproportionate to the body size (percent agreement: 97.9%; $\alpha = .79$), the breasts were accentuated by garments or artistic styling (percent agreement: 97.9%; $\alpha = .90$), or bare skin was visible between armpits and the bottom of the breasts (percent agreement: 95.8%; $\alpha = .74$).

Character's *buttocks* were considered sexualized if the coding identified the presence of visible bare skin between the top of hips and the bottom of the buttocks (percent agreement: 100%; $\alpha = 1.00$), or the buttocks accentuated by clothes or artistic styling (percent agreement: 97.9%; $\alpha = .95$).

Character's *waist* was marked as sexualized if bare skin is visible in the midriff area (percent agreement: 95.8%; $\alpha = .90$) or the shape of the waist and hip were exaggerated (percent agreement: 100%; $\alpha = 1.00$).

Character's *legs* were noted as sexualized if bare skin is visible between the bottom of buttocks/hip area and the top of the knees (percent agreement: 97.9%; $\alpha = .96$).

Character's *movement* was considered sexualized if the movement emphasized the body in a sexually suggestive manner (e.g., unnecessary jiggling; percent agreement: 100%; $\alpha = 1.00$).

Finally, we calculated a *character-level sexualization index* by adding all five coded areas, ranging from 0, representing the least sexualized, to 5, indicating the most sexualized, consistent with Lynch et al.'s formula. Additionally, the *game-level sexualization index* was also formulated by averaging the total sexualization score of all coded characters in a particular game (M = .47, SD = .66).

Characters' overall competence was coded across three variables. A character was coded as *physically capable* (percent agreement: 93.8%; α = .87) if she exhibited physical strength such as engaging in a combat (e.g., hitting, kicking, using a weapon) or intense physical activities (e.g., climbing, jumping around, using physical strength in an athletic manner) beyond basic actions such as walking or picking up an item. A character's *violent portrayal* was inferred if she used or intended to use physical force to harm another in the game (percent agreement: 87.5%; α = .75). Conversely, a character's *victim portrayal* was coded if she was subjected to physical force from another entity (e.g., being killed, pushed, or knocked down; percent agreement: 93.8%; α = .88). See Table 1 for descriptive statistics.

Results

All analyses were done in R (version 4.3.1). RQ1 asks whether female characters are underrepresented in VR games compared to male characters. In the sampled VR games, male characters (M = 24.72; SD = 17.28) were more represented than female characters (M = 5.96; SD = 4.54) by more than four times, on average. This difference was significant, φ = .21, df = 1, p<.001. To answer RQ2, we tested whether the underrepresentation of female characters varied based on game genre, type, and ESRB rating (see Table 2). ANOVA results showed that the underrepresentation of female characters did not significantly vary based on game genre, $F(5,106) = 0.71$, p = .616, or ESRB rating, $F(4,107) = 1.79$, p = .136; however, female character

underrepresentation was significantly more severe in competitive games compared to casual games, $F(1,110) = 5.12$, $p = .026$. Further investigation of the underrepresentation of female characters by game type indicated that female characters were less represented than male characters for both casual and competitive games (Table 2). When testing gender representation by game genre, female characters were underrepresented in action, adventure, simulation, and other/interminable games (Table 2). When testing gender representation by ESRB rating, female characters were underrepresented in Teen (T), Mature (M), and not rated/interminable games (Table 2).

In testing the overall sexualization of female characters in VR games (RQ3), we found that roughly 30% of the female characters were sexualized. Additionally, there were more characters with no sexualized representation (n = 320) than those who had at least one incidence of sexualized representation (n = 140), $\chi = 335.65$, $df = 1$, $p < .001$. RQ4 asked whether the degree of female characters' sexualization in VR games may differ based on the (a) type of game, (b) genre, and (c) ESRB rating (see Table 3 for a summary of results). Results of a one-way analysis of variance (ANOVA) between competitive and casual games indicated no significant difference between the level of female character sexualization, $F(1, 110) = 0.16$, $p = .687$. Another one-way ANOVA showed that female characters' sexualization was not significantly different based on game genre, $F(5, 106) = 1.08$, $p = .376$. Additionally, one-way ANOVA results indicated that female characters' sexualization in a game was not significantly different based on the game's ESRB rating, $F(4, 107) = 0.61$, $p = .654$.

RQ5 explored the relationship between female characters' attributes—specifically, being (a) physically capable, (b) violently portrayed, or (c) depicted as a victim—and their degree of sexualization. Relevant descriptive statistics are provided in Table 4. As seen in Table 5, an

ordinary least square (OLS) regression with physical capability as the predictor revealed that physically capable female characters were more likely to be sexualized, compared to those that were not physically capable ($\beta = 0.37$, $p = .017$), answering RQ5(a). Female characters' physical capability explained 1.23% of the sexualization variance, $F(1,458) = 5.56$, $p = .017$. Addressing RQ5(b), an OLS regression found that female characters that are portrayed as violent had higher likelihood of being sexualized than those that were not ($\beta = 0.21$, $p = .011$), explaining 1.40% of the variance in sexualization, $F(1,458) = 6.52$, $p = .011$. Regarding RQ5(c), OLS regression showed that female characters depicted as victims were more likely to be sexualized than those that were not ($\beta = 0.27$, $p = .001$), accounting for 2.38% of the sexualization variance, $F(1,458) = 11.16$, $p = .001$.

Discussion

In the present content analysis, we analyzed the representation and sexualization of female characters in video games listed on three popular VR platforms. Results clearly showed that female characters continue to be underrepresented in video games within new VR platforms. Results suggest that men are represented roughly four times as frequently as women. Additionally, female characters are more severely underrepresented in competitive VR games than in casual VR games, however levels of representation did not differ significantly by game genres or ESRB rating. In analyzing the possible sexualized representation of female characters, roughly 30% of the coded female characters were found to be sexualized to some extent. Although no significant variation in the sexualized representation of women by game type, genre, or ESRB ratings emerged, results found that female characters were more frequently sexualized if they were portrayed as physically competent, involved in violent acts, or depicted as victims in VR games.

The underrepresentation of female characters in VR video games resonates with prior findings in the context of traditional video games. Indeed, a recent systematic review of content analyses in the past three decades confirmed the trend of female underrepresentation in video games (Waddell et al., 2022). Both console and PC video games have shown similar disparities in gender representations (Downs & Smith, 2010; Williams et al., 2009). This implies that the issue of underrepresentation of women in traditional video games has permeated the immersive VR gaming context. Because many popular VR video games are directly ported from PC or console games (e.g., *Half-Life 2*, *Fallout 4 VR*), it is conceivable that VR video games inherited existing gender biases in representations from traditional video games.

However, findings from earlier content analyses on traditional video games present a mixed picture regarding female character representation based on game types. Although women are often overrepresented in casual video games than men (Lomanowska & Guitton, 2014; Wohn, 2011), they are notably underrepresented in competitive games, such as massively multiplayer online games (Waddell et al., 2014). In the current content analysis, we found that women are underrepresented in both casual and competitive VR games, signifying a potentially more severe issue of underrepresentation of women in VR games compared to traditional video games.

A possible consideration when comparing players of traditional and VR video games is the demographic of their primary users. Recent research has found that VR head-mounted display (HMD) owners are predominantly male, and that men are less prone to motion sickness in VR and spend more time playing VR games than women (Kelly et al., 2021). A literature review of manuscripts published in the IEEE Virtual Reality Conference found a significant underrepresentation of women both as human subjects and authors of VR experimental research

(Peck et al., 2020). These gender disparities in HMD ownership and experiences suggest that VR content design, mainly targeting male consumers, might be less accommodating to female users. This design bias could have influenced the gender dynamics in VR game development, reinforcing existing biases in gender representations.

For sexualization of female characters in VR games by game-level metrics, we did not find any significant difference in terms of sexualization of women by game type, game genre, or ESRB rating. Our finding is inconsistent with a recent content analysis on female character's sexualization in traditional video games with a female protagonist, where Lynch et al. (2016) found significant differences of sexualization between game genre and ESRB rating. They found fighting video games feature more sexualized female characters than any other genre, and video games rated as *M* (*Mature*) and *T* (*Teen*) feature more sexualized female characters than video games rated as *E* (*Everyone*). In our research neither omnibus test nor pairwise comparison showed any significant sexualization difference between game types, genres, and ESRB ratings. However, our findings are more consistent with an earlier content analysis (Downs & Smith, 2010) on traditional video games, where most sexualization variables (e.g., sexually revealing clothing, body proportion, waist size) did not significantly differ across ESRB ratings. We speculate that our findings may lie in the nascency of VR gaming and consequently an inevitable small sample of VR games. Although it has been decades since the release of the first VR video game, VR games did not begin to gain mass popularity until the first Oculus Rift was commercially released in 2016. Therefore, compared to millions of existing traditional video games, the current corpus of VR games may not yet systematically represent the unique VR game culture. It is also possible that, because of this nascency, VR game culture is still highly

dynamic. As VR gaming industry becomes more mainstream and competitive, content may increasingly reflect stereotypes and sexualization of female characters.

For sexualization of female characters in VR games by character-level metrics, we found that female characters are more likely to be sexualized if they demonstrate physical competence or engage in violent actions, replicating the prior content analysis on traditional videogames (Lynch et al., 2016). Additionally, our results expand upon these prior findings, indicating that sexualization was more likely to be part of a female character's features if she was a victim in the video, although the effect size was relatively small (2.38% of the sexualization variance was explained by whether the female character was a victim). This finding warrants more investigation as previous research has found a relationship between sexualized female video game characters and the rape myth acceptance of women in real-life as victims (Noël et al., 2021). Future research should utilize theories such as cultivation theory (Gerbner, 1998) and social cognitive theory (Bandura, 2009) to further understand the link between in-game sexualization and victimization of women in and outside of the video game environment. For example, utilizing cultivation theory, research may investigate the long-term effects of exposure to sexualized female characters on video game players' gender role expectations and sexist attitudes toward women. Social cognitive theory may help deepen our understanding of various factors (e.g., personal, behavioral, environmental) for the relationship between exposure to victimized female characters in video games and players' behavioral tendencies toward women in everyday life.

Limitations and Future Research

Despite the interesting findings, our content analysis has limitations. First, to code the level of representation between female and male characters, we used a scale instead of counting

the number of characters for each gender per coded video. This decision was made because of the limitation in human coder capability and the complexity of the video game content. For some videos, there can be hundreds of characters in the background in one scene (e.g., the arena of a sports game), which makes it extremely time-consuming and difficult to count all characters by gender. Because we did not count the exact number of female and male characters in each video, it is possible that our result does not reflect the exact ratio of gender representation in VR games. However, given that there is no ceiling effect (on a scale from 1 to 5, the number of female characters per 5-minute segment was 0.88 and the number of male characters per 5-minute segment was 3.65), we feel confident about our conclusion that women are indeed less represented than men in VR video games. To more accurately account for the underrepresentation of female characters in VR games, though, future research should count the number of characters by gender.

Additionally, we used 5-minute segments of YouTube videos as the unit of analysis. The approach of segmenting has been widely utilized by previous content analysis works (e.g., Lynch et al., 2016; Smith et al., 2003). However, as pointed out by Schmierbach (2009), by artificially dividing the playthrough video into smaller pieces, this approach may omit important "contextual information" or "developing content elements" of the game (p. 152). Moreover, using YouTube playthrough videos may limit the present sample to fully represent all the content of a given video game. For example, by doing so we inevitably neglected any possible character customization and game environment modification. We also did not separate customizable avatars and non-customizable characters, which may potentially serve as a factor in the sexualization of women in these games. Although our design is common practice among content

analyses in the video game context, these limitations should be addressed by future research which may sample video game content that reflects the interactive aspect of the media platform.

There is a discrepancy between video lengths coded for the underrepresentation of female characters and female characters' sexualization. We coded the entire video (or the first 60 minutes of content for longer videos) for gender representation and 5-minute segments for sexualization. This decision was made based on the nature of the coded variables. Based on previous content analyses on female characters' sexualized representation (e.g., Lynch et al., 2016), we believe the level of sexualized representation of women characters in a video game should be stable enough to capture in two 5-minute video segments. Based on the large ratio between the number of male and female characters (roughly 4:1) in the current 60-minute videos, we feel that 60-minute may be long enough to detect gender underrepresentation in the current context. However, future research is encouraged to investigate this question again with more innovative and sophisticated methods that allow for a more accurate account of gender representation in VR games.

In the present content analysis, we included anthropomorphic non-human characters (e.g., zombies) as part of the sample. However, it is uncertain whether players would react to the sexualized human characters and sexualized anthropomorphic non-human characters the same way. Additionally, by including anthropomorphic non-human characters but not non-anthropomorphic non-human characters, we may have oversampled some genres (e.g., shooting games) over others (e.g., match-3 games). Given all this, it is important that future research further investigates the representation of female characters among various species such as humans, anthropomorphic non-humans, and non-anthropomorphic non-humans. Lastly, evaluating immersive gaming scenes via YouTube videos could have constrained the coders'

ability to fully grasp the in-game events and characters' features. Although VR games facilitate 360-degree observation, enabling characters to be viewed from all angles, our analysis was restricted to what visibility was presented on screen, potentially overlooking certain nuances of character sexualization or other portrayals. We encourage future research to refine our design to explicitly reflect the technological affordances of VR games.

Practice Implications

From a practical standpoint, the severe underrepresentation of female characters in VR video games signals to video game developers the need for more female characters in video games of this emerging technology. Our finding on sexualization of female characters also calls for a more systematic shift where women are not only more represented in VR games in quantity but are also represented in a more balanced way. Currently, there are more male users than female users in the VR space (Kelly et al., 2021). Increasing the number of female characters with balanced representation in VR games may help women feel better represented in the VR experience, in VR culture, and consequently increase the number of female VR users. Additionally, as many VR games are ported adaptations from traditional titles, developers need to be especially cautious about any pre-existing gender biases in their source games. A conscious effort to reexamine and rebalance these biases during the adaptation for VR can mitigate the persistence of women's underrepresentation and misrepresentation. For example, this study demonstrates a concerning trend where female characters with physical competence were more frequently sexualized. Game developers are strongly encouraged to consider our finding and place boundaries between empowering female characters and merely objectifying them.

Conclusion

This study provides evidence that female characters are significantly underrepresented within VR video games. Furthermore, results showed that the sexualization of female characters tends to coincide with their portrayal as physically capable, violent, or as victims. Overall, the representation of women in immersive VR games showed patterns that are comparable but distinct from traditional video games. Sexualization of female characters was prevalent in approximately 30% of VR games, and was consistent across game types, game genres, and ESRB ratings. This represents a departure from recent research on traditional video games. These findings call for attention of VR video game developers to create more balanced female characters in terms of sexualization and capability. In research on traditional video games, sexiness and capability tend to be inseparable for female characters (Jansz & Martis, 2007). Exposure to such representation may reinforce gender stereotypes and unrealistic expectations of women. Because the popularity of VR games is still relatively new and VR game culture is still developing, this study reveals the current state of representation of women in this emerging context. We also hope our results may provide insight to policymakers and opinion leaders in the VR game culture to promote a more inviting space for all genders.

References

Bandura, A. (2009). Social cognitive theory of mass communication. In *Media effects* (pp. 110-140). Routledge.

Barlett, C. P., & Harris, R. J. (2008). The Impact of Body Emphasizing Video Games on Body Image Concerns in Men and Women. *Sex Roles, 59*(7), 586-601. https://doi.org/10.1007/s11199-008-9457-8

Behm-Morawitz, E. (2017). Examining the intersection of race and gender in video game advertising. *Journal of Marketing Communications, 23*(3), 220-239. https://doi.org/10.1080/13527266.2014.914562

Blackwell, L., Ellison, N., Elliott-Deflo, N., & Schwartz, R. (2019). Harassment in social virtual reality: Challenges for platform governance. *Proceedings of the ACM on Human-Computer Interaction, 3*(CSCW), 1-25. https://doi.org/10.1145/3359202

Cummings, J. J., & Bailenson, J. N. (2016). How Immersive Is Enough? A Meta-Analysis of the Effect of Immersive Technology on User Presence. *Media Psychology, 19*(2), 272-309. https://doi.org/10.1080/15213269.2015.1015740

Dietz, T. L. (1998). An Examination of Violence and Gender Role Portrayals in Video Games: Implications for Gender Socialization and Aggressive Behavior. *Sex Roles, 38*(5), 425-442. https://doi.org/10.1023/A:1018709905920

Downs, E., & Smith, S. L. (2010). Keeping Abreast of Hypersexuality: A Video Game Character Content Analysis. *Sex Roles, 62*(11), 721-733. https://doi.org/10.1007/s11199-009-9637-1

Fox, J., & Bailenson, J. N. (2009). Virtual Virgins and Vamps: The Effects of Exposure to Female Characters' Sexualized Appearance and Gaze in an Immersive Virtual Environment. *Sex Roles, 61*(3), 147-157. https://doi.org/10.1007/s11199-009-9599-3

Gerbner, G. (1998). Cultivation Analysis: An Overview. *Mass Communication and Society, 1*(3-4), 175-194. https://doi.org/10.1080/15205436.1998.9677855

Haninger, K., & Thompson, K. M. (2004). Content and Ratings of Teen-Rated Video Games. *JAMA, 291*(7), 856-865. https://doi.org/10.1001/jama.291.7.856

Hartmann, T., Krakowiak, K. M., & Tsay-Vogel, M. (2014). How Violent Video Games Communicate Violence: A Literature Review and Content Analysis of Moral Disengagement Factors. *Communication Monographs, 81*(3), 310-332. https://doi.org/10.1080/03637751.2014.922206

Jansz, J., & Martis, R. G. (2007). The Lara Phenomenon: Powerful Female Characters in Video Games. *Sex Roles, 56*(3), 141-148. https://doi.org/10.1007/s11199-006-9158-0

Kelly, J. W., Cherep, L. A., Lim, A. F., Doty, T., & Gilbert, S. B. (2021). Who Are Virtual Reality Headset Owners? A Survey and Comparison of Headset Owners and Non-Owners. 2021 IEEE Virtual Reality and 3D User Interfaces (VR),

Lomanowska, A. M., & Guitton, M. J. (2014). My avatar is pregnant! Representation of pregnancy, birth, and maternity in a virtual world. *Computers in Human Behavior, 31*, 322-331. https://doi.org/https://doi.org/10.1016/j.chb.2013.10.058

Lombard, M., & Ditton, T. (1997). At the Heart of It All: The Concept of Presence. *Journal of computer-mediated communication, 3*(2), JCMC321. https://doi.org/10.1111/j.1083-6101.1997.tb00072.x

Lynch, T., Tompkins, J. E., Van Driel, I. I., & Fritz, N. (2016). Sexy, strong, and secondary: A content analysis of female characters in video games across 31 years. *Journal of Communication, 66*(4), 564-584. https://doi.org/10.1111/jcom.12237

Noël, T., Larøi, F., & Burnay, J. (2021). The Impact of Sexualized Video Game Content and Cognitive Load on State Rape Myth Acceptance. *Frontiers in Psychology, 12*. https://doi.org/10.3389/fpsyg.2021.614502

Peck, T. C., Sockol, L. E., & Hancock, S. M. (2020). Mind the Gap: The Underrepresentation of Female Participants and Authors in Virtual Reality Research. *IEEE Transactions on Visualization and Computer Graphics, 26*(5), 1945-1954. https://doi.org/10.1109/TVCG.2020.2973498

Pimentel, D., Kalyanaraman, S., Lee, Y.-H., & Halan, S. (2021). Voices of the unsung: The role of social presence and interactivity in building empathy in 360 video. *New Media & Society, 23*(8), 2230-2254. https://doi.org/10.1177/1461444821993124

Schmierbach, M. (2009). Content Analysis of Video Games: Challenges and Potential Solutions. *Communication Methods and Measures, 3*(3), 147-172. https://doi.org/10.1080/19312450802458950

Smith, S. L., Lachlan, K., & Tamborini, R. (2003). Popular Video Games: Quantifying the Presentation of Violence and Its Context. *Journal of Broadcasting & Electronic Media, 47*(1), 58-76. https://doi.org/10.1207/s15506878jobem4701_4

Tang, W. Y., & Fox, J. (2016). Men's harassment behavior in online video games: Personality traits and game factors. *Aggressive Behavior, 42*(6), 513-521. https://doi.org/https://doi.org/10.1002/ab.21646

Tang, W. Y., Reer, F., & Quandt, T. (2020). Investigating sexual harassment in online video games: How personality and context factors are related to toxic sexual behaviors against fellow players. *Aggressive Behavior, 46*(1), 127-135.

Thompson, K. M., Tepichin, K., & Haninger, K. (2006). Content and Ratings of Mature-Rated Video Games. *Archives of Pediatrics & Adolescent Medicine, 160*(4), 402-410. https://doi.org/10.1001/archpedi.160.4.402

Waddell, T. F., Elizabeth Moss, C., Holz, A., & Ivory, J. D. (2022). Character Portrayals in Digital Games: A Systematic Review of More than Three Decades of Existing Research. *Journal of Broadcasting & Electronic Media, 66*(4), 647-673. https://doi.org/10.1080/08838151.2022.2100376

Waddell, T. F., Ivory, J. D., Conde, R., Long, C., & McDonnell, R. (2014). White man's virtual world: A systematic content analysis of gender and race in massively multiplayer online games. *Journal For Virtual Worlds Research, 7*(2).

Williams, D., Martins, N., Consalvo, M., & Ivory, J. D. (2009). The virtual census: representations of gender, race and age in video games. *New Media & Society, 11*(5), 815-834. https://doi.org/10.1177/1461444809105354

Wirth, W., Hartmann, T., Böcking, S., Vorderer, P., Klimmt, C., Schramm, H., Saari, T., Laarni, J., Ravaja, N., Gouveia, F. R., Biocca, F., Sacau, A., Jäncke, L., Baumgartner, T., & Jäncke, P. (2007, 2007/05/15). A Process Model of the Formation of Spatial Presence Experiences. *Media Psychology*, *9*(3), 493-525. https://doi.org/10.1080/15213260701283079

Wohn, D. Y. (2011). Gender and Race Representation in Casual Games. *Sex Roles, 65*(3), 198-207. https://doi.org/10.1007/s11199-011-0007-4

Yao, S. X., Ellithorpe, M., & Ewoldsen, D. (2022). *Supernatural genre reduces negative outgroup attitudes through strength of human identity: A replication and extension* International Communication Association,

Yao, S. X., Ellithorpe, M. E., Ewoldsen, D. R., & Boster, F. J. - Development and validation of the Female Gamer Stereotypes Scale.

Yao, S. X., Ewoldsen, D., Ellithorpe, M., Van Der Heide, B., & Rhodes, N. (2022, 2022/01/31/). Gamer Girl vs. Girl Gamer: Stereotypical gamer traits increase Men's play intention. *Computers in Human Behavior*, 107217. https://doi.org/https://doi.org/10.1016/j.chb.2022.107217

Table 1

Descriptive Statistics at the Character Level

	No (zero incidence)	Yes (one incidence or more)	Chi-squared	Range	*M*	*SD*
Chest Sexualization	429	31	746.53*	0-3	0.09	0.34
Waist Sexualization	412	48	1031.1*	0-2	0.12	0.37
Buttock Sexualization	447	13	844.20*	0-2	0.03	0.17
Leg Sexualization	343	117	396.55*	0-1	.25	.44
Movement Sexualization	457	3	902.12*	0-1	.01	.08
Total Sexualization	320	140	335.65*	0-5	0.46	0.84
Physically Capable	429	31	746.53*	0-1	.07	.25
Violently Portrayed	307	153	307.33*	0-1	.33	.47
Victim	306	154	305.34*	0-1	.33	.47

Note. $p < .001$ was marked with an asterisk.

Table 2

Underrepresentation of Female Characters by Game Type, Genre, and ESRB rating

	N	Male Character *M (SD)*	Female Character *M (SD)*	*t-statistic*	*p*	ANOVA
Game Type						
Casual	39	20.33 (15.00)	6.00 (4.32)	5.73	< .001	$F(1,110) = 5.12$ $p=.026$
Competitive	73	27.07 (18.05)	5.95 (4.70)	9.68	< .001	
Game Genre						
Action	71	26.80 (16.76)	6.21 (4.57)	9.99	< .001	
Adventure	12	19.42 (17.11)	6.42 (4.38)	2.55	.024	
Simulation	7	23.14 (16.31)	4.14 (2.91)	3.03	.021	$F(5,106) = 0.71$ $p = .616$
Strategy	1	29.00 (-)	8.00 (-)	-	-	
Sport & Racing	4	21.25 (15.73)	7.25 (4.72)	1.71	.172	
Other/Indeterminable	17	21.00 (20.87)	4.94 (5.30)	3.07	.007	
ESRB Rating						
Everyone	3	15.00 (10.54)	5.67 (2.08)	1.51	.262	
Everyone 10+ (E 10+)	4	14.00 (17.19)	2.50 (3.32)	1.31	.275	
Teen (T)	12	22.00 (14.54)	7.17 (7.15)	3.17	.006	$F(4,107) = 1.79$ $p = .136$
Mature (M)	24	32.21 (21.38)	7.13 (4.45)	5.63	< .001	
Not Rated or Indeterminable	69	23.64 (15.79)	5.57 (4.07)	9.21	< .001	

Table 3

Sexualization Differences by Game Type, Genre, and ESRB rating

	N	*M*	*SD*	ANOVA	
Game Type					
Casual	39	0.26	0.48	$F(1,110) = 0.16$	$p = .687$
Competitive	73	0.30	0.61		
Game Genre					
Action	71	0.24	0.54		
Adventure	12	0.28	0.45		
Simulation	7	0.12	0.21	$F(5,106) = 1.08$	$p = .376$
Strategy	1	0.00	0.00		
Sport & Racing	4	0.67	0.94		
Other/Indeterminable	17	0.49	0.71		
ESRB Rating					
Everyone (E)	3	0.22	0.39		
Everyone 10+ (E 10+)	4	0.00	0.00	$F(4,107) = 0.61$	$p = .654$
Teen (T)	12	0.42	0.73		
Mature (M)	24	0.37	0.58		
Not Rated or Interminable	69	0.25	0.55		

Table 4

Sexualization Differences by Character Capability

	N	*M*	*SD*
Physically Capable			
Yes	31	0.81	1.08
No	429	0.44	0.81
Violently Portrayed			
Yes	153	0.60	0.99
No	307	0.39	0.74
Victim			
Yes	154	0.64	1.05
No	306	0.37	0.69

Table 5

OLS Regression Results of Character Capability on Sexualization

	B	*SE*	*t*	*p*
Physically capable → Sexualization	0.37	0.16	2.39	.017
Violently portrayed → Sexualization	0.21	0.08	2.55	.011
Victim → Sexualization	0.27	0.08	3.34	.001