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ORIGINAL ARTICLE

Virtual Virgins and Vamps: The Effects of Exposure to Female Characters' Sexualized Appearance and Gaze in an Immersive Virtual Environment

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Abstract This experiment exposed a sample of U.S. undergraduates (43 men, 40 women) to suggestively or conservatively clad virtual females who exhibited either responsive, high eye gaze or nonresponsive, low gaze in an immersive virtual environment. Outside the virtual world, men and women who encountered a highly stereotypical character—a suggestively clad, high gaze agent ("vamp") or conservatively clad, low gaze character ("virgin")—demonstrated more sexism and greater rape myth acceptance than participants who saw a suggestively clad nonresponsive or conservatively clad, responsive character. Results suggest that gender-stereotypical virtual females enhance negative attitudes toward women, whereas those that violate expectations and break stereotypes do not.

Keywords Sex role stereotypes · Media effects · Gender schema · Virtual reality · Video games

Introduction

Video games are quickly becoming one of the most popular forms of media entertainment across the globe. As of 2008, video games have grown into a $26.5 billion industry worldwide, nearly surpassing the global film industry ($26.7 billion; Brightman 2008). Although most of the market is concentrated in Asia, approximately 65% of American households play video games (Entertainment Software Association 2008). With such widespread usage, it is essential that we understand the psychological effects of video games and the representations therein. Gender schema theory suggests that the highly stereotypical portrayals of women in these games facilitate the development and activation of relevant schemata, which in turn may prime negative attitudes toward women. This study was designed to test the effects of sexualized and nonsexualized virtual representations of women that demonstrated high, responsive gaze behavior or low, nonresponsive gaze. A sample of U.S. undergraduates was exposed to one of these four types of female characters in a fully immersive virtual environment, after which participants' hostile and benevolent sexism and rape myth acceptance were assessed.

The abundance of sexualized and objectified representations of women and their deleterious effects have been well-documented for television shows, movies, music videos, magazines, and advertisements (American Psychological Association, Task Force on the Sexualization of Girls 2007). Similarly, content and critical analyses have revealed that video games and virtual worlds are perpetuating stereotypical portrayals of women (Beasley and Standley 2002; Dietz 1998). Unlike traditional media forms, however, video games and virtual worlds present a different context with a more engaging role for users (Anderson and Dill 2000). Rather than representations merely appearing on the screen for observation, female images in virtual spaces are behaviorally responsive. This dynamic creates a new and powerful experience beyond passive consumption, because as the user acts, the virtual woman reacts to the user, creating a behavioral dialogue that is much more analogous to real world social interactions. Because of this interactivity and enhanced realism, it is possible that these images will have more potent effects on users' beliefs, attitudes, and behaviors away from the screen (Anderson and Dill 2000; Sundar 2007; Williams 2006).

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Representations of people in online virtual worlds and video games vary, from photographs on social networking sites to emoticons in online chat to anthropomorphized animals in online role-playing games (see Nowak and Rauh 2006, for a review). This study focuses on *virtual humans*, or digital representations that resemble the human form. Virtual humans may be either *avatars*, which are controlled by a human user, or *agents*, which are controlled by an algorithm (Bailenson and Blascovich 2004). For example, in video games, the player at the controls is represented by an avatar, whereas the other characters on the screen are agents controlled by the computer. When a virtual human is controlled by an algorithm, typically it is referred to as an *embodied agent*.

Limited research has addressed the effects of interaction with a behaving virtual human in the context of a controlled experiment. This exploratory study was designed to delve into the potential effects of interacting with different types of virtual human representations typically featured in video games and other virtual worlds. Here we examine the effects of two different characteristics of female embodied agents, sexuality of dress and amount of eye gaze, on observers' behaviors in a virtual space and the impact on subsequent attitudes regarding women. The goals of this exploratory study were to determine 1) if sexualization of a female agent affected sexist and rape supportive attitudes and 2) if a female agent's eye gaze (a form of behavioral responsiveness) influenced these attitudes or interacted with sexualization to influence attitudes.

Gender-Stereotypical and Sexualized Representations of Women

The disparity in representation of men and women in traditional media has been well-documented for magazine advertisements (Soley and Reid 1988), television shows (Harwood and Anderson 2002), commercials (Stern and Mastro 2004), and music videos (Seidman 1992). Compared to men, women are relegated to secondary or subordinate roles (Ganahl et al. 2003) and are much more likely to appear in a sexualized or objectified manner, often solely for ornamental purposes (Lin 1998; Stankiewicz and Rosselli 2008). Recent research has determined that video games mirror traditional media: women are drastically underrepresented (Williams et al. 2009), and when they do appear, it is often a highly gender-stereotypical depiction (Miller and Summers 2007).

These representations of women are often dichotomized into extreme caricatures representing opposite ends of the good-bad spectrum. This naughty-versus-nice contrast suggests that women come in two varieties: the girl-next-door or the girl-who-gets-around, the *virgin* or the *vamp*. According to Benedict (1992), the virgin is innocent and pure, a docile girl who needs a man's protection from the danger of the outside world. The vamp, in contrast, is a highly sexualized, alluring temptress who incites a man to use her rather than care for her. The virgin confirms the stereotype that a woman should be submissive and subordinate to men, whereas the vamp represents the alternative stereotype of woman as a dominant, sexually controlling seductress. Benedict outlines the manner in which these two representations prevail in media portrayals of women. As a result, our interpretations of women are often relegated to one stereotype or the other, influencing our attitudes toward women and the willingness to accept *rape myths*, false beliefs about rape that blame the victim (Benedict 1992; Burt 1980). The virgin stereotype lends itself to benevolent sexism, or beliefs that women are weak and in need of male protection and leadership (Glick and Fiske 1996). The vamp stereotype may promote hostile sexism, which entails antagonistic beliefs that women are domineering and try to control men sexually (Glick and Fiske 1996).

Female representations in video games often fall within these virgin/vamp categories. Female roles are often limited to the damsel in distress awaiting male rescue or the alluring sex object (Dietz 1998). Gailey (1993) observed that passive, "good" women, in the form of handmaidens and princesses, are depicted as rewards for male characters' bravery and success, but "active women are portrayed as dangerous competitors that must be dealt with violently" (p. 87). These dichotomized representations explain why female characters are considered both more innocent (virgin characters) but also more sexy and provocative (vamp characters) than male characters (Miller and Summers 2007). Indeed, female characters are more likely than male characters to be portrayed in a sexualized manner in video game advertisements (Scharrer 2004), gaming magazines (Dill and Thill 2007; Miller and Summers 2007), online reviews (Ivory 2006), game covers (Burgess et al. 2007) and in the games themselves (Beasley and Standley 2002).

Although many people may argue that these stereotypical mediated representations are "mere entertainment" or "harmless fun," scientific evidence suggests that there are both short-term and long-term effects from exposure to stereotyped and sexualized representations of women. Herrett-Skjellum and Allen (1996) determined that television programming is rife with such portrayals, and that the more television people consume, the more they endorse gender-role stereotypes. Exposure to women featured in disempowered, submissive roles has been associated with a decrease in women's beliefs regarding their personal achievements (Geis et al. 1984) and less interest in political participation (Schwartz et al. 1987). Lanis and Covell (1995) found that after exposure to objectified images of women in advertisements, men were more accepting of rape

and violence against women. Sexually explicit representations, often characterized by the degradation and objectification of women, have been linked to rape myth acceptance (Allen et al. 1995b), acceptance of interpersonal violence (Mundorf et al. 2006), and aggression (Allen et al. 1995a; Malamuth et al. 2000).

Some recent work is also uncovering the effects of gender-stereotyped video game content on players. Dill et al. (2008) exposed participants to stills of gender-typed video game characters or photographs of professionals and then asked participants to evaluate a real-life sexual harassment case. Men exposed to the stereotyped characters expressed more tolerance of sexual harassment than men exposed to nonstereotyped portrayals or women in either group. Dill and colleagues also found that playing violent video games was correlated with rape supportive attitudes; those with more exposure to violent games expressed more tolerance of sexual harassment and greater rape myth acceptance. Considering that playing violent video games has also been shown to increase physiological arousal, aggressive feelings, and aggressive behaviors (Anderson and Bushman 2001; Anderson and Dill 2000), and that these games often feature sexualized portrayals of women (Haninger and Thompson 2004), it is important that the effects of these representations are examined more closely in the laboratory. Additionally, it is important to examine different factors, such as virtual human behavior, that may mitigate the effects of sexualized representations.

Gaze

Humans rely heavily upon nonverbal cues during social interaction. One of the most powerful nonverbal cues is eye contact or gaze. Gaze can be used to convey information, regulate interaction, express intimacy, control social interaction, or facilitate task goals (Kleinke 1986). Perhaps because of its multifunctionality in expression and control, gaze is often associated with perceptions of dominance (Dovidio and Ellyson 1985). Thayer (1969) found that extended as opposed to brief periods of gaze led recipients to judge the lookers as more dominant and also to feel as if the lookers judged the recipients as less dominant. Burgoon et al. (1984) examined several nonverbal behaviors and found that only close proximity and high eye contact were successful in conveying dominance and control.

Thus, it is likely that a gazing agent conveys dominance. Additionally, this gaze may interact with other nonverbal cues to influence the observer's interpretations of the agent. From a decoding standpoint, gaze is often interpreted differently by men and women, particularly in consideration of the gazer's gender. For example, men are much more likely than women to infer sexual intent when a woman gazes at a man (Koukonas and Letch 2001). If high gaze conveys dominance and sexuality, and this gaze is coming from a female in suggestive dress, it is possible that these cues may interact (Farris et al. 2008). Thus, a provocatively dressed female agent exhibiting dominant gaze behavior should serve as a virtual enactment of the sexually potent vamp stereotype.

Alternatively, gaze aversion is viewed as an act of submission (Dovidio and Ellyson 1985). Those of lesser status are less likely to make eye contact, perhaps to avoid challenging the other's position. Rather than conveying power, low gaze conveys weakness and vulnerability. In conjunction with nonsexualized, conservative dress, these nonverbal cues may prime the virgin stereotype.

It is expected that the same schema people use to judge other people will be activated when examining these agents, particularly those related to sex and gender. Because these virtual vamps and virgins are realistic renderings of women, it is possible that encountering them in a virtual environment might lead to effects that carry over into the real world.

IVET and Psychological Research

Immersive virtual environment technology (IVET) allows a researcher to create novel experimental simulations. IVET is largely defined by two characteristics: the replacement of natural sensory information with digital information and the ability to track and respond to users' movements in order to tailor that digital information (Loomis et al. 1999; Blascovich et al. 2002). One of the most commonly implemented devices is a *head-mounted display* (HMD). This is a helmet or headpiece with LCD screens fitted in front of the eyes. This helps provide a wide, stereoscopic view of the computer-generated environment. The image drawn inside the HMD depends on the information given by the *tracking* apparatus. Various devices can capture simple head movements, such as turning the head in different directions; the position of the body in three-dimensional space (e.g., walking around a room); or body movements, such as waving a hand. Figure 1 illustrates the components of IVET.

Indeed, in this study, tracking the participants' movements was necessary in order to create a realistic rendering of eye contact from a virtual human. In the high gaze condition, the algorithm determining the agent's movements used trigonometry to assess where the participant was in the room and appropriately orient the agent's head and eyes toward the participant. This function demonstrates how IVET reacts in a naturalistic way to the user's actions. This responsiveness enhances the experience of *presence*, the user's feelings that the virtual environment is real and that the user's sensations and actions are responsive to the virtual world as opposed to the real, physical one (Biocca et al. 2003; Heeter 1992).

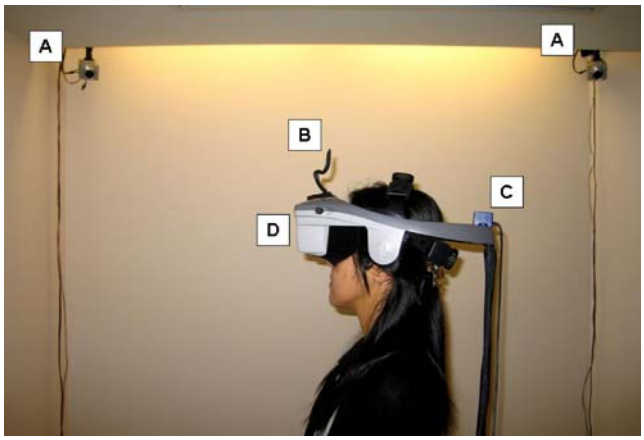

Fig. 1 The setup of the immersive virtual environment. Cameras at the corners of the room (*A*) track the position of an infrared light (*B*) on the HMD to determine where the participant is located in X, Y, Z space while the Intersense orientation device (*C*) assesses the rotation of the participant's head. These data are then transmitted to the rendering computer, which recreates the image of the room based on the tracking data stereoscopically on the HMD's screens (*D*).

Theoretical Explanations and Hypotheses

Bem's (1981) gender schema theory suggests that the nature of our socialization through learning, interpersonal interaction, and media lead humans to develop schemata about men and women. Schemata are cognitive structures that help the brain organize and store information relevant to a particular subject (e.g., women) and are activated when an individual is faced with a cognitive decision about that subject. Because humans are cognitive misers who try to expend as little cognitive effort as possible, our schemata tend to reflect stereotypes. Thus, gender stereotypes such as the virgin and the vamp often prevail when processing information about women. For example, previous research indicates that people judge a suggestively dressed woman as responsible for her rape because of the stereotype that women who dress in that fashion are promiscuous (Edmonds and Cahoon 1986).

These schemata include stereotypes about how the sexes "should" and "should not" behave. According to expectation states theory, diffuse status characteristics such as gender help people anticipate how others will behave in a social interaction (Berger et al. 1977; Dovidio and Ellyson 1985). Because of sociocultural stereotypes, men are seen as more competent and of higher status than women, leading to expectations of dominance and leadership. Women are considered lower status and thus are expected to behave in a submissive manner. Indeed, men are more likely to exhibit nonverbal dominance than women, and women are more likely to demonstrate submission (Henley and Harmon 1985). When women violate this expectation and behave assertively, others question whether this behavior is acceptable because of women's low status (Ridgeway 2001; Ridgeway and Bourg 2004). Thus, women are often penalized for being assertive or expressing dominance.

Glick and Fiske's (1996) ambivalent sexism theory argues that attitudes toward women are often mixed. Sexism is characterized by both benevolent and hostile components. Benevolent sexism entails confining women to stereotypical attitudes and roles, supposedly to their benefit. The construct is comprised of protective paternalism, in which women are cast as fragile, weak creatures in need of male protection; complementary gender differentiation, which suggests that men and women have distinct qualities (e.g., purity and sensitivity) that make women naturally subordinate; and heterosexual intimacy, which suggests men and women are dependent on each other for closeness. Hostile sexism is defined as prejudicial feelings or antipathy toward women. Not coincidentally, these forms of sexism map onto the virgin/vamp dichotomy of female representations. The virgin is in need of men's protection from a world she cannot manage on her own (benevolent sexism) and the vamp is deserving of men's anger and punishment for trying to control men sexually (hostile sexism).

According to Hansen and Hansen (1988), gender role stereotypes are activated when the contextual cues are consistent within the stereotype rather than contradictory. It is possible that dress may serve as one nonverbal cue that impacts the observer's expectations for how the agent should behave, but that gaze may serve as an alternative nonverbal cue. Gaze may impact observer's attitudes depending if it complements or contradicts the way the agent is dressed: the style of dress may send one message or connote one stereotype whereas the agent's behavior may invoke another. An observer may expect a suggestively dressed vamp to exhibit sexually aggressive, dominant cues such as direct eye contact, whereas a conservatively dressed virgin should demonstrate submissive cues like avoiding eye contact. Confirmation of either stereotype may elicit more sexist attitudes than an agent who dresses one way, but violates behavior expectations and acts another way.

Based on previous research and these theoretical perspectives, the following hypotheses are proposed:

> H_1: Suggestively dressed agents will promote more benevolent sexism, hostile sexism, and rape myth acceptance than conservatively dressed agents, independent of gaze.
>
> H_{2a}: Exposure to agents that match dress and gaze consistent to a stereotype (the conservatively dressed, low gaze "virgin" or the suggestively dressed, high gaze "vamp") will elicit more rape myth acceptance than exposure to agents that break stereotypes and behave contrary to expectations.

H_{2b}: Exposure to the conservatively dressed, low gaze agent (the "virgin") will elicit more benevolent sexism than other agents.

H_{2c}: Exposure to the suggestively dressed, high gaze agent (the "vamp") will elicit more hostile sexism than other agents.

Method

Sample

A convenience sample was recruited from a medium-sized West Coast university. Participants received course credit or $10 for their participation. Five participants were dropped from the initial sample (N=88) due to technical failure during the experiment. The final sample (N=83) consisted of 43 men and 40 women who ranged in age from 18 to 34 (M=20.82, SD=3.17) and was racially diverse (38.6% White (n=32); 24.1% Asian/Asian-American (n=20); 13.3% Black/African/African-American (n=11); 10.8% Latino/Latina/Hispanic (n=9); 13.3% multiracial (n=11)).

Design

A 2×2×2 (Dress × Gaze × Gender) between-subjects design was employed. Participants were randomly assigned to one of four Conditions: Suggestively Dressed High Gaze Agent (n=21; 9 women, 12 men), Suggestively Dressed Low Gaze Agent (n=19; 9 women, 10 men), Conservatively Dressed High Gaze Agent (n=23; 14 women, 9 men), and Conservatively Dressed Low Gaze Agent (n=20; 8 women, 12 men). There were no significant differences in gender or race/ethnicity by condition.

Apparatus

Participants were placed in a fully immersive virtual environment. Figure 1 illustrates the room set up. They donned a head-mounted display (HMD) through which they were able to view the stimulus. The HMD was an nVisor SX with dual 1280 horizontal by 1024 vertical pixel resolution panels. The display presented a visual field subtending approximately 50 degrees horizontally by 38 degrees vertically. Stereoscopic images were rendered by a 1900 MHz Pentium computer with an NVIDIA GeForce 6600 graphics card and were updated at an average frame rate of 60 Hz.

Sensing equipment tracked users' motions (e.g., walking, turning their heads) so that a realistic visual depiction of the environment could be updated constantly based on their movements and the direction of the participant's view could be recorded at all times. Participants' head movements were tracked by a three-axis orientation sensing system (Intersense IS250 with an update rate of 150 Hz) and used to continuously update the simulated viewpoint. The position of the participant along the X, Y, and Z planes was tracked via an optical tracking system (WorldViz PPT with an update rate of 60 Hz). The system latency, or delay between the participant's movement and the resulting update in the HMD was no greater than 45 ms. Vizard 3.0 software was used to assimilate tracking and rendering.

Pretest

The agents used as stimuli were selected based on a pretest. All of the adult female representations from the agent database were coded independently by one male and one female research assistant. From this data, 16 agents that coders agreed were similar in age (20's) and race (White) were then chosen for pretesting. Thirty participants from a separate pool from the main experiment viewed the agents and rated them on several qualities derived from previous content analyses of mediated representations (Stern and Mastro 2004). The variables of interest analyzed for this study were "How sexy is this agent?" (1=*Not sexy at all*; 5=*Very sexy*) and "How is this agent dressed?" (1=*Conservatively clad*; 5=*Suggestively clad*). Two agents that demonstrated extreme scores as sexy (M=3.52; SD=.94) and suggestively dressed (M=4.12; SD=.47) and two that ranked as not sexy (M=2.08; SD=.93) and conservatively dressed (M=2.20; SD=.77) were selected. The sexualized, suggestively clad agents were ranked as significantly more sexy, $t(29)=6.53$, $p<.0005$, Cohen's d=1.54, and suggestively clad, $t(29)=11.78$, $p<.0005$, Cohen's d=3.01, than the nonsexualized, conservatively clad agents.

Stimuli

Dress

Figure 2 shows the four agents that were selected for use in the study based on the pretest described above.

Gaze

In the high gaze condition, the algorithm determining the agent's head movements assessed where the participant was in the room and appropriately oriented the agent's head toward the participant. Head orientation has been demonstrated to be a sufficient proxy for eye contact in virtual humans (Bailenson et al. 2005). In the low gaze condition, a different algorithm was used. Data about the agent's movement from a previous participant was randomly chosen and "played back." Thus, in the low gaze condition,

Fig. 2 The female agents used as stimuli. *Top row*: Suggestively dressed agents; *bottom row*: Conservatively dressed agents.

although the agent demonstrated the same quantity and type of movements as in the high gaze condition (turning the head, shifting weight), they were not contingent on the participant's movement and so the agent did not appear responsive. For example, in the high gaze condition, the agent would turn her head as the participant approached and appeared to make eye contact. In the low gaze condition, it would not matter that the participant was approaching; the agent would turn her head in accordance to the playback rather than the participant's movement. As a result, the agent's movements in the low gaze condition seemed random, and she would only occasionally appear to look at the participant.

Procedure

Participants were told they would be providing feedback on some recent virtual creations, including an agent and a cube-finding task, that might be used in future studies. Participants were immersed in the virtual environment and then instructed as follows:

> When the agent appears, please walk towards it and examine the agent from head to toe so that you feel prepared to answer questions about the agent's appearance and behavior later. Try looking at it from the right, from the left, from eye level, and from below.
>
> Please tell me when you feel you have finished examining the agent.

At one end of the room, a female agent appeared. Although they could approach the agent from either side, participants were prevented from walking behind her; this insured that those in the high gaze condition would continue to experience the agent's gaze during the evaluation process. Figure 3 illustrates the position of the agent and a participant's possible path during the evaluation period. Participants were next asked to engage in a 5-min

task wherein they walked around the virtual space in search of red cubes that disappeared after they approached. During this task, the agent remained in the virtual room; thus, the dress and gaze manipulations were observable during the task. After completing this task, participants were led to a computer to complete the questionnaire items.

Measurement

Time

Using keypresses, research assistants recorded the amount of time participants spent inspecting the agent. Timing started after instructions were provided and the participant began to approach the agent and ended when the participant verbally indicated the inspection was complete (M=48.63 seconds; SD=18.56).

Manipulation Checks

To assess if the sexualized dress manipulation was successful, participants were asked to indicate on a 5-point scale (1=*Not at all*; 5=*Extremely*) how sexy and how suggestively dressed the agent was. To assess the gaze manipulation, participants were also asked to indicate their agreement on a 5-point scale (1=*Strongly disagree*; 5=*Strongly agree*) with the following statements: "The agent seemed to see me" and "The agent appeared to acknowledge my presence." In keeping with the cover story that participants were immersed in order to evaluate the agent, several filler items regarding the agent's appearance and responsiveness were also included.

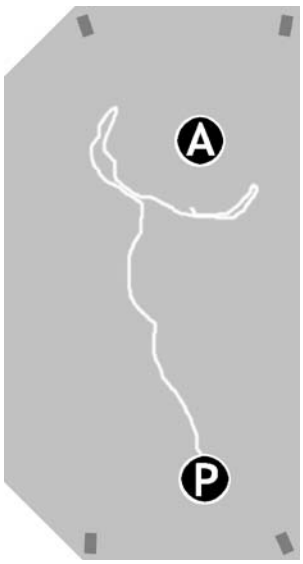

Fig. 3 A bird's eye diagram of the experimental setup. Cameras at the corners of the room track the participant's (*P*) walking path as s/he approaches the agent (*A*).

Ambivalent Sexism Inventory

The Ambivalent Sexism Inventory (ASI; Glick and Fiske 1996) is comprised of subscales that measure two aspects of sexism against women. Hostile sexism scale items include "Women seek to gain power by getting control over men" and "Women are too easily offended." Benevolent sexism items include "Women should be cherished and protected by men," "Many women have a quality of purity that men do not possess," and "Every man ought to have a woman whom he adores." Participants indicated their agreement with these items on a 5-point scale (1=*Strongly disagree*; 5=*Strongly agree*.) Previous reliabilities for the ASI have been reported ranging from α=.83 to α=.92; alphas for the Hostile Sexism (HS) subscale have ranged from α=.80 to α=.92, and the Benevolent Sexism (BS) subscale has ranged from α=.73 to α=.85 (Glick and Fiske 1996). For this study, Cronbach's alpha for the ASI was α=.83, for HS α=.82, and for BS α=.71.

Rape Myth Acceptance Scale

Burt's (1980) Rape Myth Acceptance Scale (RMAS) is used to determine the degree to which one endorses false beliefs about rape and rape victims. Following the recommendations of Lonsway and Fitzgerald (1994), 11 items from the scale were employed. Participants responded to items on a 5-point scale (1=*Strongly disagree*; =*Strongly agree*) including "Women who get raped while hitchhiking get what they deserve" and "In the majority of rapes, the victim is promiscuous or has a bad reputation." Previous reliability for the entire 14-item scale has been reported as α=.88 (Burt 1980). In this study, a Cronbach's alpha of α=.76 was achieved.

Results

Manipulation Checks

The Dress manipulation was successful. A 2×2 ANOVA (Dress × Gender) revealed that participants in the sexualized conditions indicated that the agent was more sexy (M=3.22, SD=1.19) and suggestively dressed (M=3.78, SD=1.21) than participants in the nonsexualized conditions (sexy, M=2.00, SD=.99; suggestively dressed, M=1.37, SD=.79), sexy: $F(1, 78)=29.38$, $p<.0005$, partial $\eta^2=.27$; suggestively dressed: $F(1, 79)=120.43$, $p<.0005$, partial $\eta^2=.60$. The interaction effect of Dress by Gender for perceived sexiness was also significant, $F(1, 78)=8.65$, $p<.005$, partial $\eta^2=.10$, whereas the interaction effect for suggestive dress bordered on significance, $F(1, 79)=3.33$, $p=.07$, partial $\eta^2=.04$. For perceived sexiness, within-condition pairwise t-tests revealed

the only significant difference to be that men in the nonsexualized conditions (M=2.48, SD=.93) considered the agent to be more sexy than women (M=1.52, SD=.81) did, $t(40)$=3.54, p=.001, Cohen's d=1.10.

The Gaze manipulation was also successful. A 2×2 (Gaze × Gender) ANOVA revealed that participants in the high gaze condition indicated that the agent saw them (M=3.86, SD=.96) and acknowledged them (M=4.00, SD=.94) more than participants in the low gaze condition (saw, M=2.72, SD=1.00; acknowledged, M=2.74, SD=.99) felt that the agent saw them, $F(1, 79)=27.61$, $p<.0005$, partial $\eta^2=.26$, or acknowledged them, $F(1, 79)=33.83$, $p<.0005$, partial $\eta^2=.30$. No other effects were significant.

Hypotheses

The hypotheses examined the effects of Dress and Gaze on attitudes. Means and standard deviations for all conditions can be found in Table 1, and results from the second set of hypotheses are illustrated in Fig. 4.

Hypothesis 1 considered whether Dress alone would have an effect on attitudes. There was no main effect for Dress on rape myth acceptance, $F(1, 72)=.49$, $p>.05$, partial $\eta^2=.01$, benevolent sexism, $F(1, 74)=2.08$, $p>.05$, partial $\eta^2=.03$, or hostile sexism, $F(1, 72)=.47$, $p>.05$, partial $\eta^2=.01$. Hypothesis 1 was not supported.

Hypothesis 2a suggested an interaction between Dress and Gaze such that exposure to a suggestively dressed, high gaze agent or a conservatively dressed, low gaze agent would result greater rape myth acceptance. Because gender of the participant may influence attitudes, a 2×2×2 (Gender × Dress × Gaze) ANOVA was performed. The hypothesis was supported. For RMA, the Dress by Gaze

Table 1 Means and standard deviations for dependent variables, by gender and condition.

	Suggestive dress				Conservative dress			
	High gaze		Low gaze		High gaze		Low gaze	
	M	SD	*M*	SD	*M*	SD	*M*	SD
Male participants								
BS	3.17	.57	2.80	.63	3.27	.49	3.32	.48
HS	3.01	.61	2.72	.59	2.67	.55	2.85	.42
RMA	2.06	.39	1.60	.37	1.73	.48	2.10	.46
Female participants								
BS	3.02	.35	3.02	.27	2.79	.38	3.25	.55
HS	2.88	.72	2.58	.47	2.57	.48	2.76	.56
RMA	1.99	.52	1.74	.31	1.72	.36	2.13	.70

Note: Benevolent sexism (BS), hostile sexism (HS), and rape myth acceptance (RMA) are all measured on 5-point scales; 1 indicates strong disagreement with sexism and RMA and 5 indicates strong agreement.

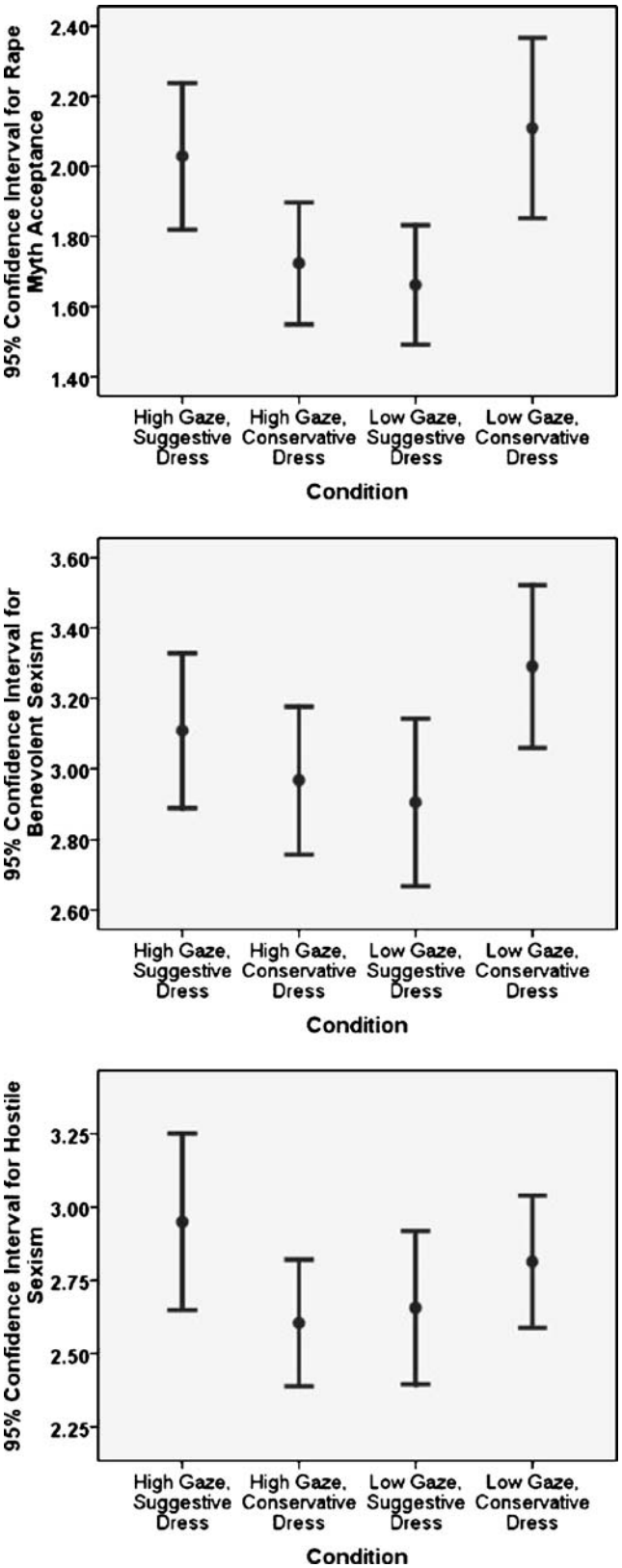

Fig. 4 Rape myth acceptance, benevolent sexism, and hostile sexism by condition. Higher values on the Y axis indicate more extreme attitudes.

interaction effect was significant, $F(1, 76)=14.55$, $p<.0005$, partial $\eta^2=.16$. Planned contrasts between the stereotypical groups ("virgins" and "vamps") and nonstereotypical groups revealed that those in the suggestively dressed high gaze condition ("vamp"; $M=2.03$, $SD=.43$) and the conservatively dressed low gaze condition ("virgin"; $M=2.11$, $SD=.55$) exhibited significantly higher rape myth acceptance than those in the suggestively dressed low gaze ($M=1.66$, $SD=.34$) and conservatively dressed high gaze conditions ($M=1.77$, $SD=.40$). See Fig. 4. No other effects were significant; notably, no differences were found between men and women, as can be seen in Table 1.

Hypothesis 2b predicted that the conservatively dressed, low gaze agent would evoke more benevolent sexism than the other agents. Because gender of the participant may influence attitudes, a 2×2×2 (Gender × Dress × Gaze) ANOVA was performed. The hypothesis received some support. The Dress by Gaze interaction effect was significant, $F(1, 74)=4.18$, $p<.05$, partial $\eta^2=.05$. Planned pairwise comparisons between the conservatively dressed low gaze condition and the three other conditions revealed that this group ("virgin"; $M=3.29$, $SD=.50$) exhibited significantly higher benevolent sexism than those in the suggestively dressed low gaze ($M=2.90$, $SD=.49$) and conservatively dressed high gaze conditions ($M=2.97$, $SD=.47$). Additionally, there was also a borderline significant interaction effect for Gaze by Gender, $F(1, 74)=3.36$, $p=.07$, partial $\eta^2=.04$. Females in the high gaze condition ($M=2.88$, $SD=.38$) expressed significantly less benevolent sexism than females in the low gaze condition ($M=3.21$, $SD=.53$). See Fig. 4. No other effects were significant.

Hypothesis 2c predicted that suggestively dressed, high gaze agent would evoke more hostile sexism than the other agents. Because gender of the participant may influence attitudes, a 2×2×2 (Gender × Dress × Gaze) ANOVA was performed. The hypothesis received some support. The Dress by Gaze interaction effect was significant, $F(1, 72)=3.78$, $p=.056$, partial $\eta^2=.05$. Planned pairwise comparisons between the suggestively dressed high gaze condition and the three other conditions revealed that this group ("vamp"; $M=2.95$, $SD=.64$) exhibited significantly higher hostile sexism than those in the conservatively dressed high gaze condition ($M=2.60$, $SD=.50$). See Fig. 4. No other effects were significant.

Discussion

This study is the first to our knowledge to examine the effects of interacting with sexualized, behaving agents in an immersive virtual environment. Our results demonstrate that both appearance and behavior must be considered to understand attitudes following exposure to virtual representations of women. For highly sexualized, suggestively dressed women, sexist attitudes are maximized with agents that maintain eye contact. For more conservatively dressed women, sexist attitudes are maximized towards agents that are demure and avoid looking at the subjects. These representations may be more potent in affecting sexism and RMA because they activate existing schemata, meet expectations (Ridgeway and Bourg 2004) and confirm existing stereotypes, the virgin and the vamp, that are prevalent across media (Benedict 1992).

The interactions regarding the effects of gaze and dress on sexism and rape myth acceptance are noteworthy. Contrary to what previous research with traditional forms of media has shown, we did not find main effects for sexualized dress on sexism or RMA; rather, the manner of dress needed to be considered in conjunction with agents' behaviors. Exposure to the conservatively dressed low gaze agent, the virgin, led to greater rape myth acceptance and some support was found that she promoted feelings of benevolent sexism. Because this agent dressed and behaved in a demure manner, participants may have categorized her as a weak, submissive woman and thus expressed the desire to protect her via benevolent sexism. Because she is submissive and sexually innocent, however, the virgin also simultaneously evoked the acceptance of rape myths (e.g., that "many women have an unconscious desire to be raped").

The suggestively dressed high gaze agent also led to greater rape myth acceptance and some support was found that she evoked feelings of hostile sexism. Eye contact from a suggestively dressed female agent may have been interpreted as sexually dominant or aggressive. In conjunction with suggestive dress, these nonverbal cues may have primed the vamp stereotype. Participants may have felt threatened by the sexual dominance this representation conveyed and reacted by expressing hostile sexism. Because of this agent's suggestive clothing and behavior, participants may have been compelled to "punish" this bad woman or put her in her place by expressing acceptance of rape myths (e.g., that provocatively dressed women are "asking for it"). Another explanation is that the high gaze agent in suggestive dress may have in some way been 'blamed' for her sexualized appearance—if she appeared to act responsively and by her own volition, then participants might have perceived her manner of dress as something she "chose" or as an expression of her true self. In these cases, participants may have felt that the agent's appearance merited a negative response and she "deserved" to be treated badly (McCoy and Major 2007). Thus, participants may have reacted to such brazenness by expressing more RMA.

In the case of the suggestively dressed low gaze agent, it is possible that these two cues counteracted each other:

although the style of dress conveyed sexual aggression, the agent's avoidance of eye contact may have indicated submissiveness. The same effect may have occurred with the conservatively dressed high gaze agent: although her gaze behavior may have seemed dominant, her manner of dress was casual and nonthreatening. Rather than exhibiting stereotypical behavior and priming sexist attitudes, these agents may have violated participants' expectations (Ridgeway and Bourg 2004). In effect, the behavioral disconfirmation may have humanized these agents somewhat and forced participants to evaluate them beyond a simple stereotype. Our findings indicate that it is important to consider both appearance and behavior in order to understand the effects of virtual representations in interactive environments on users.

Because this study was exploratory, it was necessarily limited in its scope. An interesting replication of this work should address reactions to male agents with similar gaze and dress manipulations. Also, other measures of women's reactions to sexualized female agents should be considered, for example whether these images cause women to self-objectify (Fredrickson and Roberts 1997). Although this study only examined one virtual behavior, gaze, future research should address other behaviors, such as facial expressions and gestures that may convey different emotions. Other extensions of this work should consider the effects of increasingly interactive agents or those with higher behavioral realism (Bailenson et al. 2006). Perhaps if the agents interact more with users through action or speech, users will perceive them as more "human" and be less likely to demonstrate sexism or rape myth acceptance. Another important consideration is context. This study implemented a neutral setting; it is possible that effects may be greater in a violent or aggressive context like those commonly featured in video games.

People are spending more and more time in virtual spaces, from video games to online social worlds. This study demonstrates the need to study the effects of virtual human representations on users. Both men and women demonstrated significant changes in their sexist attitudes and rape myth acceptance after a brief encounter with gender-stereotypical virtual females. Many conclusions about media effects are made based on content analyses of static images or based on experiments with noninteractive media. New media necessitate the study of representations and social interactions in more dynamic and interactive environments. It is possible that in these contexts, the effects of sexualized and stereotypical representations are even greater than those in traditional media. And as this study has demonstrated, it is possible these effects linger and can seep into our real world interactions, reinforcing negative stereotypes, promoting objectification, and hindering women's pursuit of equality.

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