Lifetime Video Game Exposure is Associated with Internalization of Sexist STEM Beliefs in Women and Men

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Abstract

Video gaming culture and careers in Science, Technology, Engineering, and Math (STEM) are both contexts in which women often experience gender-based harassment, sexualization, and exclusion. Cultivation theory posits that individuals with heavy exposure to mediated content develop a perceived reality that closely aligns with the media world. In the present research, we investigated cultivation effects in the context of video gaming and examined the relationship between sexist beliefs in gaming and beliefs about gender and STEM. We found across two studies (n=1,762 undergraduates and n=653 adults) that greater lifetime video game exposure was indeed associated with stronger STEM sexism. Interestingly, this effect was stronger for women, reflecting mainstreaming in cultivation. Specifically, women with less gaming exposure reported lower STEM sexism compared to men with less gaming exposure, but as video game exposure increased women's STEM sexism resembled men's STEM sexism. Overall, our results highlighted an important relationship between long-term exposure to sexist video game culture and women's acceptance and internalization of the gender status quo in gaming. This internalized gender prejudice may also be associated with prejudice against women in other masculine-dominated spaces such as STEM careers.

Keywords: gender, video gaming, women in STEM, cultivation theory, stereotypes

The video game industry is the fastest-growing entertainment industry in the United States, reporting $250 Billion in revenue globally in 2023 (*Video Games Worldwide*, 2024) – even more than Hollywood (Donnelly & Chakrabarti, 2023). It should therefore be considered a major driver of culture on par with other media industries such as television and social media, but it has not been studied as extensively in cultivation theory research as the other two media. Of particular interest in the video game space is its role in perpetuating individuals' stereotypical beliefs about gender. Video gaming is historically and culturally dominated by men, and girls and women often experience negative stereotyping, discrimination, and cultural exclusion (Fox & Tang, 2014; Paaßen et al., 2017; Yao, Ellithorpe, et al., 2022). Survey research has found that up to 77% of women who play video games report experiencing gender-based harassment and exclusion in gaming contexts (Fox & Tang, 2014; Paaßen et al., 2017; Reach3 Insights, 2021; Yao, Ellithorpe, et al., 2022). Additionally, in-game depictions of women characters tend to be highly stereotypical, often hypersexualized and objectified, relegated to non-playable characters, and women characters are generally portrayed as less important and are less prevalent compared to men characters (Downs & Smith, 2010; Gestos et al., 2018; Lynch et al., 2024; Lynch et al., 2016).

Importantly, while the gaming space is still culturally dominated by men, in truth almost half of players identify as women (46% in 2023; ESA, 2022). Playing video games is related to many positive outcomes such as social connection, skill acquisition, and tenacity (Wiederhold, 2021a, 2021b), and improved cognitive abilities (Large et al., 2019) such as attention and spatial performance (Bediou et al., 2018). Skills acquired in gaming are related to the skills required for success in careers in STEM (Granic et al., 2014). Furthermore, encouraging video game use has been suggested as a means for increasing women's participation in STEM careers (Ball et al.,

2020). Therefore, there are very real benefits that can be obtained when girls and women persist in playing video games, and their exclusion from gaming culture could harm their well-being. However, the prejudice and discrimination that they experience throughout the gaming experience may reduce their likelihood of getting these positive experiences and beneficial outcomes (Fox & Tang, 2017).

In addition to the possibility of missing out on positive outcomes of gaming, there are also risks to mental health and well-being associated with exposure to stereotyping, sexism, and harassment in the gaming culture for women. Research has found that exposure to sexualization and negative stereotyping of women game characters is associated with women's stereotype internalization, self-sexualization, lower self-efficacy, worse self-esteem, and more negative body image (Fox & Tang, 2014; Gestos et al., 2018; Yao, Ellithorpe, et al., 2022). Other research has found that women gamers also tend to hold stereotypes of other women gamers (Yao, Ellithorpe, et al., 2022) and justify the stereotypical culture (Fox & Tang, 2014). This suggests that when women play video games, they are at risk of internalizing the stereotypical gaming culture around gender.

Much research on discrimination against girls and women who play games focuses on the role that boys and men gamers play in perpetuating this culture. For example, studies have considered men gamers' stereotypical attitudes toward women gamers (Fox & Tang, 2014; Yao, Ellithorpe, et al., 2022), men gamers' harassment of women gamers (Kuznekoff & Rose, 2013; Tang & Fox, 2016; Tang et al., 2020), and men gamers' willingness to accept women gamers as playing partners (Yao, Ewoldsen, et al., 2022). Overall, the previous research examining men video game players found stereotypes of women gamers and sexist attitudes to be prevalent among men gamers, and this is exacerbated by individual difference variables such as masculine

norm conformity (Fox & Tang, 2014), social dominance orientation (Fox & Tang, 2014; Tang & Fox, 2016; Tang et al., 2020), and hostile sexism (Tang et al., 2020). Additionally, men gamers made three times as many negative comments toward a fellow player with a woman's voice compared to a man's voice or no voice (Kuznekoff & Rose, 2013), and this seems to be driven at least in part by lower-status men desiring to maintain a higher status over women in the gaming space (Kasumovic & Kuznekoff, 2015). In contrast, however, few studies have directly compared the stereotype internalization and perpetuation of women who play video games. Through two survey studies, we investigated how video game players (men and women) process and attribute stereotypes to women gamers, and how this gender stereotyping in gaming may be transmitted to stereotypical beliefs toward women in other masculine-dominant fields (e.g., women in STEM).

Cultivation Theory and Stereotypes

A theoretical mainstay since its inception in the 1960s, cultivation theory predicts that the more a person consumes mediated content, the more their worldview will resemble the mediated world (Gerbner, 1969; Morgan et al., 2015; Shanahan & Morgan, 1999). It is predicated on a view of media as hegemonic, viewing the system as a whole perpetuating a narrow worldview – generally one that benefits the elites who own the media (Gitlin, 1979, 2017). New media technology, such as video games with their interactivity, and social media with their lower barriers to entry, have offered additional options in media content (Duffy & Thorson, 2008). In particular, the increased choices available with ostensibly more options for content themes and worldviews were previously seen as the death knell for cultivation theory (Perse et al., 1994). That is, greater choice in content should reduce the impact of a single hegemonic worldview. However, although there is now greater choice in media content, evidence suggests that the

content still conveys a dominant worldview (Hermann et al., 2023; Morgan et al., 2015). For example, although there are many video games to choose from, game production is still controlled primarily by profit-driven corporate entities dominated by men (Bear, 2019). In addition, research from a grounded theory perspective suggests that the dominant worldview of hegemonic masculinity is perpetuated through processes enacted by the largely masculine and heteronormative identities of game developers, who naturally gravitate toward generating characters and narratives that fit that lens (Tompkins & Martins, 2022). Therefore, the previous prediction that increased choice in media would mean cultivation theory was no longer relevant has thus far not come to pass.

There has been robust scholarship through multiple decades regarding the cultivation of stereotype beliefs, across multiple target groups such as gender (Hermann et al., 2022), race and ethnicity (Gaur, 2020), and sexual and gender minorities (Żerebecki et al., 2021). Generally, findings suggest a small but consistent effect of media exposure, particularly television, on stereotype beliefs over time; these effects persist despite cultural changes to stereotype acceptability (Hermann et al., 2022). Previous research on cultivation theory and video games has mostly focused on exposure to violence in games (e.g., Shahghasemi, 2018; Van Mierlo & Van den Bulck, 2004; Williams, 2006). However, some studies have examined gender stereotyping, with mixed results. For example, one study found that lifetime exposure to video games was associated with increased hostile sexism and rape myth acceptance (Fox & Potocki, 2016). Similarly, another study looking at current video game play found that increased play was associated with increased adherence to masculine role norms, or the idea that masculinity should include aggression, dominance, toughness, and emotion suppression (Blackburn & Scharrer, 2019). In contrast, another study with a three-year longitudinal design found that general video

game exposure, as well as exposure to genres known to be worse for gender roles such as first-person shooters and role-playing games, found little to no association between exposure and stereotypical gender role beliefs (Breuer et al., 2015). Crucially, a consistent finding across these studies is that there are few differences by gender identity – women and men both appear to internalize and espouse sexism through video games (Blackburn & Scharrer, 2019; Fox & Potocki, 2016).

Mainstreaming and Resonance

Cultivation theory does not presume that there are no differences in personal life experience that might play a role in moderating the main cultivation effect. In particular, life experience can be associated with what is known as mainstreaming and resonance (Good, 2009; Morgan et al., 2015; Shrum & Bischak, 2001). In mainstreaming, it is the people without the most direct experience with the topic that is most affected by media exposure – the media exposure "fills in" the role of direct experience and essentially brings their perspectives more in line with those who do have direct experience. To take the original cultivation example of crime news exposure, those who experience more crime in daily life already perceive crime to be common; it is those who do not directly experience crime for whom crime news viewership increases their crime perceptions (Gerbner et al., 1980; Shrum & Bischak, 2001). More relevant to the present work, a study on television viewing and traditional gender role norms in Japan found a mainstreaming effect by participant gender (Saito, 2007). Specifically, Japanese television tended to portray traditional gender roles as ideal, and as television exposure increased the main effect of cultivation emerged, where heavier viewers espoused more traditional gender role attitudes compared to light viewers. However, this was moderated by gender, such that men reported more traditional gender role attitudes regardless of television exposure amount, while it

was women whose attitudes were associated with television exposure. Women who were light television users reported less traditional gender role attitudes compared to men, but as their television exposure increased their gender role attitudes became more traditional, to the point where they looked more similar to men's attitudes (Saito, 2007). It is possible that the sexism experienced in video games would have a similar mainstreaming relationship by gender in the present study, as well.

Resonance, on the other hand, is the idea that cultivation effects might be stronger in some cases for people with lived experience that mirrors the media world, as it gives them a "double dose" of influence (Morgan et al., 2014; Shrum & Bischak, 2001). While there has been some evidence for resonance in the context of crime news viewing, in which neighborhood crime rates were important moderators of the cultivation effect (Morgan et al., 2014), there has been less evidence for resonance in the context of social attitudes. For example, a study examining mainstreaming versus resonance in the context of attitudes toward homosexuality found support for mainstreaming from television exposure, not resonance (Calzo & Ward, 2009).

Stereotypes Related to Science, Technology, Engineering, and Math (STEM)

One important aspect of gender role beliefs is the disparity in expectations for women and men in the STEM fields. Women continue to lag behind men in STEM career achievement (Fry et al., 2021), and young women's interest in STEM careers remains more than 20 percentage points lower than young men's interest, driven mostly by women's lack of confidence in their abilities (Nicola, 2023). Recent research has drawn a connection between video gaming and interest in STEM careers, suggesting that increased interest in video gaming among women and girls might be leveraged to increase participation of women in STEM careers (Ball et al., 2020).

Much research from a cultivation perspective has considered gender and STEM as a context for belief cultivation, but most of this work was done with television exposure and in the specific area of increased portrayals of diversity in STEM (Aladé et al., 2022; Bond, 2016; Chen et al., 2023; Ward & Grower, 2020). Little cultivation research has been done in video games and STEM has generally focused on STEM-specific gameplay exposure (Chen et al., 2023), not on more general gender stereotype exposure.

The present work examines whether retrospectively reported lifetime exposure to video games in general is associated with the internalization of STEM stereotypes. It is well-known that the acceptance of broader cultural gender role norms is a driving factor behind STEM-specific stereotypes and disparities in STEM interest from women and men (Cheryan et al., 2015; Mack et al., 2024; Master & Meltzoff, 2020). Given what is already known about the internalization of sexism and gender role norms from video games from a cultivation theory perspective (Blackburn & Scharrer, 2019; Fox & Potocki, 2016), we predict that lifetime video game exposure will be associated with increased sexist beliefs about women in STEM, specifically.

H1: Lifetime video game exposure will be positively associated with sexist beliefs and negatively associated with egalitarian beliefs about women in STEM.

Given that previous research has not found much difference between women and men in terms of their likelihood of internalizing gender stereotypes from video games (Blackburn & Scharrer, 2019; Breuer et al., 2015; Fox & Potocki, 2016), we might expect no difference by gender identity. However, the relatively novel topic of generalizing from the masculine-dominated space of video games to another masculine-dominated space in the context of STEM stereotypes might mean there are gender differences, given that it is women’s beliefs about their

own STEM abilities that seem to be most affected by the broader cultural stereotypes of gender role norms (Cheryan et al., 2015; Mack et al., 2024; Master & Meltzoff, 2020). There is also evidence in favor of mainstreaming by gender identity in previous research conducted in Japan (Saito, 2007); however, that study was based on the television context and a different cultural context compared to this study. Therefore, we provide a non-directional research question:

RQ1: Will gender identity moderate the relationship between lifetime video game exposure and STEM sexism?

Study 1

Method[1]

Participants and Procedure

Participants were 1,762 undergraduate students recruited from two U.S. universities (one Midwestern, *n*=1,007, one mid-Atlantic, *n*=755). Demographics included an average age of 20.02 years (*SD*=1.66, min=18, max=53); gender identities of 1,095 (62.15%) women, 620 (35.19%) men, 26 (1.48%) non-binary or other, and 25 (1.19%) did not respond; and racial and ethnic identities of 1,250 (70.94%) White, 166 (9.42%) Asian or Asian American, 139 (7.89%) multiracial, 95 (5.39%) Black or African American, 50 (2.84%) Hispanic or Latino, 23 (1.31%) Arab or Middle Eastern, four (0.23%) Indigenous or Native American, two (0.11%) Pacific Islander, six (0.34%) other, and 27 (1.53%) did not respond. The study was conducted as an online survey hosted by Qualtrics.com. The procedures were determined exempt by the Institutional Review Boards at both universities. Participants received course credit or extra credit in the course through which they were recruited.

Measures

[1] Data and analysis syntax and output for both studies can be found on OSF: https://osf.io/b542s/?view_only=bcadc79fe0ed4cc8b51e0f94708e1812

Lifetime video game exposure. The lifetime exposure scale (Riddle, 2010) was developed as a retrospective measure of lifetime exposure for use in cultivation research, and thus used to measure exposure to video games in three life stages – elementary school, high school, and current. Participants were asked how often they used video games in different scenarios (e.g., in the morning on a weekday) in each life stage, on a scale from 0 (never) to 10 (always). The life stages are given weights in the creation of the measure, with elementary school given the suggested weight of 0.50 (6/12 years), high school 0.33 (4/12 years), and current 0.17 (2/12 years). The final measure was therefore a weighted combination of all three life stages (M=2.37, SD=2.31).

STEM-related stereotypes. Endorsement of gender role stereotypes that women do not belong in STEM fields was measured using the Women in Science Scale (Owen et al., 2007), which has two subscales, one for STEM sexism (e.g., "it is better for a woman to study home economics than chemistry") and one for STEM equality (e.g., "women can be as good in science careers as men can"). Participants responded to their agreement with a total of 14 items (six for sexism and 8 for equality), on a scale from (-5) strongly disagree to (+5) strongly agree, (sexism, M=-2.68, SD=2.50, Cronbach α=.95; equality, M=2.71, SD=1.51, Cronbach α=.77).

Results

Analyses were conducted in Stata 18 using OLS regression and margins to probe the interaction. Because of the relatively small number of participants identifying as non-binary/other/no response, only men and women were included in the analyses. Scale variables were entered as mean scores. Full results are available in Table 1.

Results without the interaction suggested that lifetime video game exposure was significantly associated with greater STEM sexism, and lower STEM equality. Gender was also

significantly associated with attitudes, such that women were lower in STEM sexism and higher in STEM equality compared to men. There was a significant interaction between gender identity and lifetime exposure to video games for both STEM sexism and STEM equality. Probing the interaction for STEM sexism (Figure 1) indicated that lifetime exposure to video games was significantly associated with increased STEM sexism for both men and women, though the effect was stronger for women (men, *b*=0.38, 95% CI [0.29, 0.47); women, *b*=0.51, 95% CI [0.45, 0.58]). Probing the interaction for STEM equality (Figure 2) indicated that lifetime exposure to video games was significantly associated with decreased STEM equality for both men and women, and again the effect was stronger for women (men, *b*=-0.18, 95% CI [-0.24, -0.13]); women, *b*=-0.30, 95% CI [-0.34, -0.26]). In both cases, when video game exposure is near zero, women are significantly less sexist (*b*=-0.82, 95% CI [-1.22, -0.41]) and more egalitarian (*b*=0.46, 95% CI [0.21, 0.72]) compared to men, but as video game exposure increases women become equal (STEM sexism, *b*=0.50, 95% CI [-0.32, 1.31]) or more extreme (STEM equality, *b*=-0.67, 95% CI [-1.18, -0.16]) in stereotyping compared with men.

Study 1 Discussion

The results of Study 1 suggest that lifetime video game exposure is associated with increased STEM sexism beliefs and decreased STEM equality beliefs. While both men and women experienced this association in the same directions, the effects were significantly stronger for women. Specifically, women who played no or few video games were less sexist and more egalitarian compared to men who played no video games, but women who were highest in video game exposure were equal in STEM sexism and significantly less egalitarian compared to men. This reflects mainstreaming in previous cultivation research where people become more similar to one another with more media exposure, regardless of actual life experience (Calzo & Ward,

2009; Saito, 2007; Shrum & Bischak, 2001). According to gender role theories, men as the gender subgroup with higher status are more likely to have sexist beliefs than women (Eagly & Steffen, 1984). Therefore, sexist ideologies that are prevalent in video game culture would have been already held by more men than women. But women with their long-term experience in the video game culture might eventually internalize the prevalent sexist ideologies and hold similar levels of sexism as men.

Study 1 provided some initial evidence for cultivation of STEM and gender stereotypes as a result of lifetime video game exposure, although there were some limitations that could be addressed in a second study. Specifically, the sample in Study 1 was college students, which limits the ability to generalize the effects to a general population in terms of age. Additionally, Study 1 included non-gamers in addition to those who play video games. Previous research suggests that stereotypes related to gender in gaming are known and accepted by the non-gamer population (Fox & Tang, 2014; Yao, Ellithorpe, et al., 2022). However, it is possible that the inclusion of non-gamers in study 1 made the results more variable than if it had focused only on gamers. This is because the non-gamers in the sample could have dragged down the baseline point for stereotyping, because they might hold less extreme stereotypes of women gamers compared to those who do play games. Based on these two issues, Study 2 recruited a general population sample of U.S. adults who currently play video games at least a few hours per week.

In addition, the mechanism by which STEM sexism is cultivated through video game exposure remains less clear. One possibility is that an intervening variable is the internalization of stereotypes about women that are specific to video games, and this acceptance of women gamer stereotypes facilitates the generalization of those stereotypes to the STEM domain. Study

2 therefore includes acceptance of stereotypes of women gamers (Yao, Ellithorpe, et al., 2022) as a mediating variable between lifetime video game exposure and STEM sexism.

Study 2

Domain-specific gender bias has been studied extensively. For example, both men and women gamers were found to attribute sexist stereotypes to women who play video games (Yao, Ellithorpe, et al., 2022). In the field of STEM, the "default scientist" is usually assumed to be a man, and gender role norms and stereotypes play a role in this type of belief (Cheryan et al., 2015; Mack et al., 2024; Master & Meltzoff, 2020). Therefore, both the video gaming and STEM domains are dominated by men, and women are more likely to be stereotyped based on gender identity. What is understudied, however, is how biases against women in one of these domains may be generalized to biases against women in other domains. In Study 1, we did find a generalization relationship where participants who played a lot of video games were found to exhibit stronger sexism toward women in the STEM field. However, solely based on Study 1's results it is unclear what the mechanism of this relationship might be. As mentioned earlier, one possibility is that the exposure of sexist ideologies in the video game culture first influences the perception of women in the initial target domain (i.e., video gaming). Then, because both video gaming and STEM are domains historically dominated by men, the sexism against women who play video games is generalized to women in the STEM field as a similarly gendered domain. In the present study, we tested stereotypical beliefs toward women who play video games as a possible mediating mechanism between video game exposure and sexism against women in STEM.

Stereotypes of women who play video games are a combination of general cultural stereotypes about femininity and masculinity, as well as some stereotypes that are specific to the

gaming context. The Female Gamer Stereotype Scale (FGSS) includes five components, and can be treated as five subscales or as a single dimension (Yao, Ellithorpe, et al., 2022; Yao, Ewoldsen, et al., 2022). The five components are: lack of gaming competence, reliance on men in gaming, lack of sociability, lack of femininity, and preference for casual games (Yao, Ellithorpe, et al., 2022). We expect that lifetime exposure to video games will be associated with increased acceptance of stereotypes of women gamers, and this will mediate the relationship between lifetime exposure to video games and STEM sexism. This is because we would expect that the stereotypes relevant to the specific context at hand – video gaming – would be activated first, followed by a generalization effect to stereotypes in other domains. This is similar to findings in extant research on stereotyping in other contexts; for example that priming racial stereotypes of criminality influences downstream beliefs about affirmative action (Ramasubramanian, 2010). Therefore, we hypothesize:

H2: Increased lifetime exposure to video games will be associated with increased acceptance of stereotypes of women gamers, which will then be associated with an increase in STEM sexism in a mediation model.

We also ask whether the finding for gender will replicate Study 1 using a non-directional research question:

RQ2: Will gender identity moderate the relationship between lifetime video game exposure and a) stereotypes of women gamers or b) STEM sexism?

In addition, the previous study did not examine potential confounds as covariates that could interfere with the results. To rectify this, we include two potentially important covariates in Study 2. First, previous research finds that video game experience and skill among women players is an important differentiator in terms of how women gamers view other women. For

example, there is evidence that skilled women gamers bifurcate their identity, separating out their identity as women from their identity as gamers, and this influences their stereotyping of other women gamers (Yao & Rhodes, 2023). Therefore, the present study will also include perceived skill in gaming as a covariate in the analysis. Second, while the Study 1 sample was undergraduates in social science (i.e., non-STEM) research pools, Study 2 recruited a general population adult panel sample. With a general adult sample, it is conceivable that some participants might themselves be employed in a STEM field and this could affect their beliefs about women in STEM. Thus, STEM employment is also included as a covariate.

Method

Participants and Procedure

Participants were 653 adults living in the United States recruited through survey panel Prolific. A participant was qualified to take the 10-minute online survey if they on average play at least three hours of video games per week. The average age was 36.73 years (*SD*=10.95, min=18, max=78), gender identities included 321 (49.16%) men, 307 (47.01%) women, 21 (3.21%) non-binary/other, and 4 (0.61%) did not respond, and racial and ethnic identities included 390 (59.72%) White, 91 (13.94%) Black or African American, 68 (10.41%) Asian or Asian American, 50 (7.66%) multiracial, 38 (5.82%) Hispanic or Latino, two (0.31%) Indigenous or Native American, one (0.15%) Arab or Middle Eastern, six (0.92%) other, and seven (1.07%) did not respond. As in Study 1, participants who identified as a gender identity other than man or woman was not included in analysis. The study was again conducted as an online survey hosted by Qualtrics.com, and the procedures were determined exempt by the Institutional Review Boards at [UNIVERSITY].

Measures

Lifetime video game exposure. The lifetime video game exposure measure (Riddle, 2010) was the same as in Study 1 (*M*=3.75, *SD*=2.06).

Stereotypes of women gamers. The FGSS (Yao, Ellithorpe, et al., 2022) was 20 items measured on a 1 (strongly disagree) to 7 (strongly agree) scale, treated as a single factor for stereotype acceptance of women in gaming (*M*=2.55, *SD*=0.99, Cronbach α=.94).

STEM sexism. The STEM sexism and STEM equality subscales of the WISS were again used to measure STEM sexism (Owen et al., 2007), this time on a 1 (strongly disagree) to 7 (strongly agree) scale to match the FGSS (STEM sexism, *M*=1.96, *SD*=1.16, Cronbach α=.93; STEM equality, *M*=5.85, *SD*=0.64, Cronbach α=.73).

Covariates. Perceived skill in gaming was measured with a single item, "please rate your overall ability level in gaming" on a 1 (rookie) to 7 (expert) scale (*M*=5.01, *SD*=1.13). STEM employment was measured by asking participants to indicate whether their current employment could be categorized as science, technology, engineering, or math (*n*=186, 28.48%), or none of the above (*n*=467, 71.52%). Both measures were included as covariates in the analysis.

Results

Analyses were conducted using Stata 18, as well as moderated mediation analysis with OLS regression in SPSS 28 using the PROCESS macro v. 4.2 Model 8, with indirect effects estimated using 5,000 bootstrapped samples. Scale variables were again entered as mean scores. Full statistical results can be found in Table 2, and a graphical depiction of the results is in Figure 3. There was a significant interaction between lifetime video game exposure and participant gender in the stereotyping of women gamers. The index of moderated mediation was significant, *b*=0.06, 95% CI (0.001, 0.13). Probing the interaction (Figure 4) revealed that the relationship between lifetime video game exposure and stereotyping of women in gaming was significant and

positive for women, *b*=0.10, 95% CI [0.04, 0.16], but not significant for men, *b*=0.02, 95% CI [-0.03, 0.07]. Similar to Study 1, women who had the lowest exposure to video games were significantly lower in stereotyping of women gamers compared to men who have had zero video game exposure, *b*=-0.74, 95% CI [-1.07, -0.42]. However, at the highest lifetime exposure levels there is no significant difference by gender, *b*=0.07, 95% CI [-0.44, 0.58]. This again reflects mainstreaming in cultivation.

There was then a significant positive relationship between stereotyping of women gamers and STEM sexism, and a significant negative relationship between stereotyping of women gamers and STEM equality. The conditional indirect effect of lifetime video game exposure on STEM sexism was therefore significant and positive for women, *b*=0.08, 95% CI [0.04, 0.13], but not for men, *b*=0.02, 95% CI [-0.03, 0.06]. Additionally, the conditional indirect effect of lifetime video game exposure on STEM equality was significant and negative for women, *b*=-0.03, 95% CI [-0.05, -0.02], but not for men, *b*=-0.01, 95% CI [-0.03, 0.01].

There was also a significant interaction between lifetime video game exposure and gender on STEM sexism, but not on STEM equality. Probing this interaction for STEM sexism (Figure 5) indicated that, despite the significant overall interaction, neither conditional direct effect was significant; women, *b*=0.04, 95% CI [-0.01, 0.09], men, *b*=-0.04, 95% CI [-0.08, 0.01]. However, there was again a similar difference between men and women for those who have had the lowest lifetime video game exposure, such that women were significantly lower in STEM sexism compared to men, b=-0.56, 95% CI [-0.85, -0.27], but at the highest levels of video game exposure there was no significant difference by gender, b=0.25, 95% CI [-0.19, 0.69].

The covariates of gaming skill and STEM career were both significantly associated with stereotypes of women gamers, but not with STEM sexism or equality beliefs. Specifically, more skilled gamers were less likely to stereotype women gamers, while those working in a STEM field were more likely to stereotype women gamers.

Study 2 Discussion

The results of Study 2 largely replicate the results of Study 1, reflecting mainstreaming in lifetime video game exposure regarding STEM beliefs for women and men, with the addition of acceptance of stereotypes of women gamers as one potential mediating mechanism. Again, the relationship between video game exposure and internalization of stereotypes and sexism regarding women in the masculine-dominated spaces of video games and STEM was strongest for women gamers. Stereotypes of women gamers are likely to therefore generalize beyond the gaming context in which they were formed.

General Discussion

The results of both studies found that lifetime video game exposure is associated with sexism toward women in STEM. Study 1, with an undergraduate sample, found that lifetime video game exposure for both women and men was associated with higher sexism and lower equality beliefs regarding women in STEM. However, the effect was stronger among women, such that women who played the least amount of video games in their lifetime were lower in STEM sexism and higher in STEM equality compared to men, but as lifetime video game exposure increased women and men both exhibited an increase in sexism and decreased in equality. At the highest levels of lifetime video game exposure women’s sexist beliefs toward women in STEM were statistically the same as men’s beliefs, and their equality beliefs were even lower than men’s beliefs – reflecting mainstreaming in cultivation theory.

In Study 2, with a general population adult sample, this relationship was replicated and extended with the inclusion of internalization of stereotypes toward women gamers as a mediating mechanism. In this sample, the effect of lifetime video game exposure was significant only for women, but again reflected mainstreaming – men with little gameplay experience were significantly higher than women with little gameplay experience in stereotypes of women gamers, but while increased gameplay experience had little relationship with men's stereotyping of women, as women's lifetime exposure increased so did their acceptance of stereotypes. Acceptance of stereotypes was then associated with increased STEM sexism and decreased STEM equality. A significant interaction between lifetime video game exposure and gender on the direct effect of game exposure remained significant for STEM sexism only, again demonstrating that women resembled men in terms of sexism the more their lifetime exposure to games.

The results of both studies combined support cultivation theory, and in particular the idea of mainstreaming in cultivation research (Morgan et al., 2015; Shrum & Bischak, 2001). Lifetime video game exposure, likely to expose women gamers to sexualization, stereotyping, and harassment (Downs & Smith, 2010; Fox & Tang, 2014; Gestos et al., 2018; Lynch et al., 2024; Lynch et al., 2016; Paaßen et al., 2017; Reach3 Insights, 2021; Yao, Ellithorpe, et al., 2022), was associated with more sexism and less egalitarianism toward women in STEM. Internalization of stereotypes of women gamers (Yao, Ellithorpe, et al., 2022) appears to be a potential mediating mechanism, which then generalize to contexts outside of gaming. These findings align with other research on cultivation and video games that does find significant associations between game exposure and sexism and/or gender role norms (Blackburn & Scharrer, 2019; Fox & Potocki, 2016). It also aligns with previous research on mainstreaming

and gender role attitudes that was conducted in Japan, in which a mainstreaming relationship was found for women only as they increased their television exposure and became more similar to men in their gender role beliefs (Saito, 2007).

Practical Implications

Crucially, the present research demonstrated that women may be even more vulnerable than men to being affected by exposure to sexism in gaming culture. Long-term exposure to video games not only appears to be associated with the internalization of gender biases and the attribution of negative stereotypes to their own ingroup members (i.e., other women who play video games), but also is associated with the generalization of this gender prejudice to women in other fields that are historically dominated by men (e.g., STEM). Our findings suggest a complex relationship between video gaming and STEM. Prior work that has been encouraging engaging women and girls in video games to leverage the skills and interest gained in gaming to increase women's participation in STEM careers (e.g., Ball et al., 2020) has not considered the possible negative effects of exposure to and internalization of stereotypes of women in those careers. Therefore, we advocate for more research to continue deciphering the potential long-term effects of women playing video games, particularly with a focus on their internalization of gender bias and the projection of this bias to other women. We also encourage practitioners in the video gaming industry to participate actively and creatively to develop potential solutions for this issue.

Additionally, the current findings implied that the video game culture can indeed be toxic, and video game players pick up these prevalent sexist ideologies with time. Across two studies, results showed that greater long-term exposure to video games is associated with stronger sexist beliefs toward women in STEM. However, it is less clear what specific aspects of the video game culture communicate the most sexist norms (e.g., video game content, player-to-

player interaction). Therefore, we advise policymakers to work closely with researchers and content creators to pinpoint the components of the video game culture that promote sexism against women and to take action to address gender discrimination in these spaces.

Limitations and Future Research

The present studies are not without limitations. Primarily, they are cross-sectional surveys that rely on retrospective reports to measure lifetime exposure to video games, rather than longitudinal data. As previous researchers have pointed out (Breuer et al., 2015), cultivation research in the area of video games is lagging behind research on other media in terms of truly longitudinal works that have the best methodology for establishing causal direction over a long period of time. While this study provides an expansion on previous research in terms of topic areas such as the inclusion of gaming-specific stereotypes and STEM sexism as outcomes of video game exposure, we did not measure these things longitudinally. Therefore, causal direction cannot necessarily be established despite the theoretical directionality provided by cultivation theory. It is entirely possible, and possibly likely, that the process we have detected in these studies was instead the one outlined by the reinforcing spirals model (Slater, 2007, 2015). Unlike cultivation theory, which assumes a relatively unidirectional relationship from media exposure to worldview outcomes, a reinforcing spirals view treats media users as selectively and actively engaging in media content with purpose and motivation. Thus, worldview would also act upon media exposure, in a mutually reinforcing process (Slater, 2015). While this is different from the cultivation process, it is not entirely in opposition to it, as it does still include space for media exposure to outcomes to be a causal process. Additionally, it should be noted that reinforcement of existing beliefs is still an important media effect in its own right (Lang & Ewoldsen, 2010), and cultivation theory does not require beliefs to be generated in a vacuum separated from

broader culture and personal experience (Gerbner, 1969; Gerbner et al., 1994). That said, the cross-sectional nature of the present studies means that the cultivation process versus the reinforcing spiral process cannot be disentangled, and future research should consider longitudinal methods to explore this issue further.

One issue with video games and cultivation that has yet to be empirically addressed is the role of interactivity in the affordances of the medium. Unlike television, video games and other newer media technologies like social media include the possibility for users to directly influence the media messages in various ways. Previous researchers have considered this issue as it relates to cultivation processes and have come to differing conclusions about what interactivity might mean for cultivation theory. Some researchers surmise that interactivity should strengthen cultivation effects, because realism and more intensive processing should both be associated with greater internalization of the worldview (Behm-Morawitz & Ta, 2014; Fox & Potocki, 2016). However, Breuer et al. (2015) suggest that interactivity means more varied experiences for players, which should therefore mean weaker effects as the cultivation effect assumes a hegemonic worldview that might not exist to the same extent in games. The issue of interactivity also might map on to previous work regarding whether media and judgment processing is heuristic or systematic in the cultivation effect (Shrum et al., 2011; Shrum, 2001, 2004). While the initial research on processing strategy and cultivation effects focused on the processing during recall and judgments (Shrum, 2001, 2004), later work tested processing during media exposure as well. For example, Shrum et al. (2011) found that first-order cultivation effects only emerged for participants who were highly transported into the television narrative, indicating they were processing more heuristically. To the extent that interactivity and realism in video games are associated with greater transportation (Busselle & Bilandzic, 2012; Green & Jenkins,

2014; Oh et al., 2020), we might expect interactivity to also enhance heuristic processing and thus the cultivation effect. Future research should consider the role of interactivity of the medium more overtly in applying cultivation processes to newer media technologies.

Finally, while our samples were large and we did have a sample in Study 2 that was a general population U.S. adult sample, the results are still limited in generalizability to the U.S. context. Other research should examine these processes in different global regions and cultures.

Conclusion

Cultivation theory predicts that the more a person is exposed to the media worldview, the more their view of the real world comes to look like the media world (Gerbner, 1969). This has continued to be an influential theory that finds support in a variety of contexts, despite the proliferation of media and channels in the time since the theory's inception (Morgan et al., 2015). The results of two studies further support cultivation's tenets, finding that lifetime video game exposure is associated with the internalization of gender stereotypes and sexism toward women in STEM. According to previous research, such internalization of sexism in women is associated with lower self-esteem, lower self-efficacy, and negative body image (Fox & Tang, 2014; Gestos et al., 2018; Yao, Ellithorpe, et al., 2022). The results of the present study suggest that it can also mean greater sexism toward women across domains. Crucially, the relationship between lifetime game exposure and sexism was strongest among women, indicating that playing video games, while potentially helpful in many arenas (Wiederhold, 2021a, 2021b), could also be a negative influence on women to the extent that they internalize self-stereotyping and sexism.

References

Aladé, F., Lauricella, A. R., Kumar, Y., & Wartella, E. (2022). Impact of exposure to a counter-stereotypical STEM television program on children's gender-and race-based STEM occupational schema. *Sustainability*, *14*(9), 5631.

Ball, C., Huang, K.-T., Cotten, S. R., & Rikard, R. (2020). Gaming the SySTEM: The relationship between video games and the digital and STEM divides. *Games and Culture*, *15*(5), 501-528.

Bediou, B., Adams, D. M., Mayer, R. E., Tipton, E., Green, C. S., & Bavelier, D. (2018). Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. *Psychological Bulletin*, *144*(1), 77.

Behm-Morawitz, E., & Ta, D. (2014). Cultivating virtual stereotypes?: The impact of video game play on racial/ethnic stereotypes. *Howard Journal of Communications*, *25*(1), 1-15.

Blackburn, G., & Scharrer, E. (2019). Video game playing and beliefs about masculinity among male and female emerging adults. *Sex Roles*, *80*(5), 310-324.

Bond, B. J. (2016). Fairy godmothers> robots: The influence of televised gender stereotypes and counter-stereotypes on girls' perceptions of STEM. *Bulletin of science, technology & society*, *36*(2), 91-97.

Breuer, J., Kowert, R., Festl, R., & Quandt, T. (2015). Sexist games= sexist gamers? A longitudinal study on the relationship between video game use and sexist attitudes. *Cyberpsychology, Behavior, and Social Networking*, *18*(4), 197-202.

Busselle, R. W., & Bilandzic, H. (2012). *Cultivation and the perceived realism of stories*. Universität Augsburg.

Calzo, J. P., & Ward, L. M. (2009). Media exposure and viewers' attitudes toward homosexuality: Evidence for mainstreaming or resonance? *Journal of Broadcasting & Electronic Media, 53*(2), 280-299.

Chen, C., Hardjo, S., Sonnert, G., Hui, J., & Sadler, P. M. (2023). The role of media in influencing students' STEM career interest. *International Journal of STEM Education, 10*(1), 56.

Cheryan, S., Master, A., & Meltzoff, A. N. (2015). Cultural stereotypes as gatekeepers: Increasing girls' interest in computer science and engineering by diversifying stereotypes. *Frontiers in Psychology,* 49.

Donnelly, C., & Chakrabarti, M. (2023). Power, profits and labor practices in the video game industry. *WBUR*. https://www.wbur.org/onpoint/2023/12/01/power-profits-and-labor-practices-in-the-video-game-industry

Downs, E., & Smith, S. L. (2010). Keeping abreast of hypersexuality: A video game character content analysis. *Sex Roles*, *62*, 721-733.

Eagly, A. H., & Steffen, V. J. (1984). Gender stereotypes stem from the distribution of women and men into social roles. *Journal of Personality and Social Psychology, 46*(4), 735.

Fox, J., & Potocki, B. (2016). Lifetime video game consumption, interpersonal aggression, hostile sexism, and rape myth acceptance: A cultivation perspective. *Journal of Interpersonal Violence*, *31*(10), 1912-1931.

Fox, J., & Tang, W. Y. (2014). Sexism in online video games: The role of conformity to masculine norms and social dominance orientation. *Computers in Human Behavior, 33*, 314-320.

Fry, R., Kennedy, B., & Funk, C. (2021). *STEM Jobs See Uneven Progress in Increasing Gender, Racial and Ethnic Diversity.* https://www.pewresearch.org/science/2021/04/01/stem-jobs-see-uneven-progress-in-increasing-gender-racial-and-ethnic-diversity/

Gaur, R. (2020). A multilevel meta-analysis of effects of negative stereotypes of blacks in media on consumers' attitudes. *Media Psychology*, *23*(5), 711-732.

Gerbner, G. (1969). Toward "cultural indicators": The analysis of mass mediated public message systems. *Educational Technology Research and Development*, *17*(2), 137-148.

Gerbner, G., Gross, L., Morgan, M., & Signorielli, N. (1980). The "mainstreaming" of America: Violence Profile no. 11. *Journal of communication*, *30*(3), 10-29.

Gerbner, G., Gross, L., Morgan, M., & Signorielli, N. (1994). Growing up with television: The cultivation perspective.

Gestos, M., Smith-Merry, J., & Campbell, A. (2018). Representation of women in video games: A systematic review of literature in consideration of adult female wellbeing. *Cyberpsychology, Behavior, and Social Networking*, *21*(9), 535-541.

Gitlin, T. (1979). Prime time ideology: The hegemonic process in television entertainment. *Social Problems*, *26*(3), 251-266.

Gitlin, T. (2017). Television's screens:: hegemony in transition. In *Cultural and economic reproduction in education* (pp. 202-246). Routledge.

Good, J. E. (2009). The cultivation, mainstreaming, and cognitive processing of environmentalists watching television. *Environmental Communication*, *3*(3), 279-297.

Green, M. C., & Jenkins, K. M. (2014). Interactive narratives: Processes and outcomes in user-directed stories. *Journal of Communication*, *64*(3), 479-500.

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (3rd edition ed.). Guilford Press.

Hermann, E., Morgan, M., & Shanahan, J. (2022). Social change, cultural resistance: A meta-analysis of the influence of television viewing on gender role attitudes. *Communication Monographs*, *89*(3), 396-418.

Hermann, E., Morgan, M., & Shanahan, J. (2023). Cultivation and social media: A meta-analysis. *New Media & Society*, *25*(9), 2492-2511.

Kasumovic, M. M., & Kuznekoff, J. H. (2015). Insights into sexism: Male status and performance moderates female-directed hostile and amicable behaviour. *PLoS ONE*, *10*(7), e0131613.

Kuznekoff, J. H., & Rose, L. M. (2013). Communication in multiplayer gaming: Examining player responses to gender cues. *New Media & Society*, *15*(4), 541-556.

Lang, A., & Ewoldsen, D. (2010). Beyond effects: Conceptualizing communication as dynamic, complex, nonlinear, and fundamental. *Rethinking communication: Keywords in communication research*, 111-122.

Large, A. M., Bediou, B., Cekic, S., Hart, Y., Bavelier, D., & Green, C. S. (2019). Cognitive and behavioral correlates of achievement in a complex multi-player video game. *Media and Communication*, *7*(4), 198-212.

Lynch, T., Tompkins, J. E., Gilbert, M., & Burridge, S. (2024). Evidence of ambivalent sexism in female video game character designs. *Mass Communication and Society*, 1-26.

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.

Mack, N. A., Adeleke, M. B., Ballou, E., Davis, D., Ingram, V., & Cox, K. (2024). Breaking Stereotypes and Feeding the STEM Pipeline. Proceedings of the 55th ACM Technical Symposium on Computer Science Education V. 1,

Master, A. H., & Meltzoff, A. N. (2020). Cultural stereotypes and sense of belonging contribute to gender gaps in STEM. *Grantee Submission*, *12*(1), 152-198.

Morgan, M., Shanahan, J., & Signorielli, N. (2014). Cultivation theory in the twenty-first century. *The Handbook of media and mass communication theory*, 480-497.

Morgan, M., Shanahan, J., & Signorielli, N. (2015). Yesterday's new cultivation, tomorrow. *Mass Communication and Society*, *18*(5), 674-699.

Nicola, T. P. (2023). *STEM gender gaps significant among Gen Z.* https://news.gallup.com/opinion/gallup/544772/stem-gender-gaps-significant-among-gen.aspx

Oh, J., Lim, H. S., & Hwang, A. H.-C. (2020). How interactive storytelling persuades: The mediating role of website contingency and narrative transportation. *Journal of Broadcasting & Electronic Media*, *64*(5), 714-735.

Owen, S. V., Toepperwein, M. A., Pruski, L. A., Blalock, C. L., Liu, Y., Marshall, C. E., & Lichtenstein, M. J. (2007). Psychometric reevaluation of the women in science scale (WISS). *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *44*(10), 1461-1478.

Paaßen, B., Morgenroth, T., & Stratemeyer, M. (2017). What is a true gamer? The male gamer stereotype and the marginalization of women in video game culture. *Sex Roles*, *76*, 421-435.

Potter, W. J. (1991). The relationships between first-and second-order measures of cultivation. *Human Communication Research*, *18*(1), 92-113.

Ramasubramanian, S. (2010). Television viewing, racial attitudes, and policy preferences: Exploring the role of social identity and intergroup emotions in influencing support for affirmative action. *Communication Monographs*, *77*(1), 102-120.

Reach3 Insights. (2021). *Women in gaming: The future of gaming is her.* https://www.reach3insightstop3.com/women-in-gaming

Riddle, K. (2010). Remembering past media use: Toward the development of a lifetime television exposure scale. *Communication Methods and Measures*, *4*(3), 241-255.

Saito, S. (2007). Television and the cultivation of gender-role attitudes in Japan: Does television contribute to the maintenance of the status quo? *Journal of communication*, *57*(3), 511-531.

Schnauber, A., & Meltzer, C. E. (2016). On the distinction and interrelation between first-and second-order judgments in cultivation research. *Communications*, *41*(2), 121-143.

Shanahan, J., & Morgan, M. (1999). *Television and its viewers: Cultivation theory and research*. Cambridge University Press.

Shrum, J., & Bischak, D. (2001). Mainstreaming, resonance, and impersonal impact. Testing moderators of the cultivation effect for estimates of crime risk. *Human Communication Research*, *27*(2), 187-215.

Shrum, L., Lee, J., Burroughs, J. E., & Rindfleisch, A. (2011). An online process model of second-order cultivation effects: How television cultivates materialism and its consequences for life satisfaction. *Human Communication Research*, *37*(1), 34-57.

Shrum, L. J. (2001). Processing strategy moderates the cultivation effect. *Human Communication Research, 27*(1), 94-120.

Shrum, L. J. (2004). The cognitive processes underlying cultivation effects are a function of whether the judgments are on-line or memory-based.

Slater, M. D. (2007). Reinforcing spirals: The mutual influence of media selectivity and media effects and their impact on individual behavior and social identity. *Communication Theory, 17*, 281-303.

Slater, M. D. (2015). Reinforcing spirals model: Conceptualizing the relationship between media content exposure and the development and maintenance of attitudes. *Media Psychology, 18*(3), 370-395. https://doi.org/10.1080/15213269.2014.897236

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.

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.

Tompkins, J. E., & Martins, N. (2022). Masculine pleasures as normalized practices: Character design in the video game industry. *Games and Culture, 17*(3), 399-420.

Video Games Worldwide. (2024). https://www.statista.com/outlook/dmo/digital-media/video-games/worldwide

Ward, L. M., & Grower, P. (2020). Media and the development of gender role stereotypes. *Annual Review of Developmental Psychology, 2*, 177-199.

Wiederhold, B. K. (2021a). Kids will find a way: The benefits of social video games. In (Vol. 24, pp. 213-214): Mary Ann Liebert, Inc., publishers 140 Huguenot Street, 3rd Floor New ….

Wiederhold, B. K. (2021b). Violent Video Games: Harmful trigger or harmless diversion? In (Vol. 24, pp. 1-2): Mary Ann Liebert, Inc., publishers 140 Huguenot Street, 3rd Floor New ….

Yao, S. X., Ellithorpe, M. E., Ewoldsen, D. R., & Boster, F. J. (2022). Development and validation of the Female Gamer Stereotypes Scale. *Psychology of Popular Media*.

Yao, S. X., Ewoldsen, D. R., Ellithorpe, M. E., Van Der Heide, B., & Rhodes, N. (2022). Gamer girl vs. girl gamer: Stereotypical gamer traits increase men's play intention. *Computers in Human Behavior*, *131*, 107217.

Yao, S. X., & Rhodes, N. (2023). Protecting a Positive View of the Self: Female Gamers' Strategic Self-Attribution of Stereotypes. *Sex Roles*, *88*(3-4), 155-168.

Żerebecki, B. G., Opree, S. J., Hofhuis, J., & Janssen, S. (2021). Can TV shows promote acceptance of sexual and ethnic minorities? A literature review of television effects on diversity attitudes. *Sociology Compass*, *15*(8), e12906.

Table 1

Study 1 Regression Results

	STEM Sexism			STEM Equality		
	b	β	95% CI	*b*	β	95% CI
Model 1: Main effects						
Lifetime video game exposure	**0.46**	**0.43**	**0.41, 0.52**	**-0.26**	**-0.39**	**-0.29, -0.22**
Gender (1=man, 2=woman)	**-0.44**	**-0.08**	**-0.69, -0.18**	0.14	0.04	-0.02, 0.29
R^2		.22			.17	
Model 2: Interaction effects						
Lifetime Video Game Exposure	**0.38**	**0.40**	**0.29, 0.47**	**-0.18**	**-0.28**	**-0.24, -0.13**
Gender (1=man, 2=woman)	**-0.82**	**-0.16**	**-1.22, -0.41**	**0.46**	**0.15**	**0.21, 0.72**
Video Games*Gender	**0.13**	**0.10**	**0.02, 0.24**	**-0.11**	**-0.14**	**-0.18, -0.05**
R^2		.22			.17	

Note: *b*=unstandardized coefficient, β=standardized coefficient, and coefficients that are statistically significant at $p<.05$ are **bolded** for ease of interpretation.

Table 2.

Study 2 regression results. Note: Stereotypes of women gamers was the mediator in the moderated mediation model, while STEM sexism and STEM equality were the separate outcome variables in each model. All are reported here for conciseness.

	Stereotypes of Women Gamers			STEM Sexism			STEM Equality		
	b	β	95% CI	*b*	β	95% CI	*b*	β	95% CI
Lifetime Video Game Exposure	-0.06	-0.12	-0.18, 0.06	**-0.12**	**-0.21**	**-0.22, -0.02**	0.04	0.12	-0.03, 0.10
Gender (1=man, 2=woman)	**-0.74**	**-0.44**	**-1.07, -0.42**	**-0.56**	**-0.22**	**-0.85, -0.27**	**0.26**	**0.26**	**0.07, 0.45**
Video Games*Gender	**0.08**	**0.17**	**0.00, 0.16**	**0.08**	**0.14**	**0.01, 0.15**	-0.02	-0.08	-0.07, 0.02
Perceived Gaming Ability	**-0.07**	**-0.08**	**-0.14, -0.00**	-0.01	-0.01	-0.07, 0.05	0.01	0.02	-0.03, 0.05
STEM Career (0=no, 1=yes)	**0.28**	**0.28**	**0.11, 0.45**	-0.00	-0.00	-0.15, 0.15	-0.04	-0.07	-0.14, 0.05
FGSS	--	--	--	**0.78**	**0.67**	**0.71, 0.85**	**-0.32**	**-0.50**	**-0.37, -0.28**
R^2	.11			.51			.32		

Note: *b*=unstandardized coefficient, β=standardized coefficient, and coefficients that are statistically significant at $p<.05$ are **bolded** for ease of interpretation. To achieve standardized coefficients in PROCESS the continuous variables were first standardized before being entered into the model; standardized coefficients should be interpreted with caution in moderated mediation, and those involving dichotomous variables should be interpreted as partially standardized (Hayes, 2022).

Figure 1. Study 1 interaction between lifetime video game exposure and participant gender with STEM sexism as the outcome.

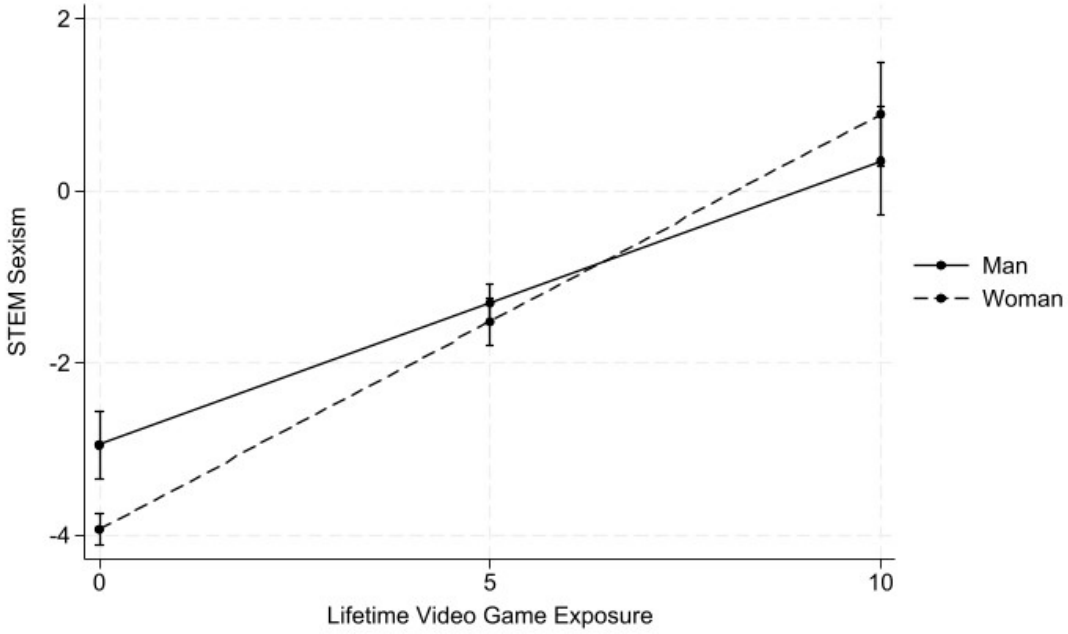

Figure 2. Study 1 interaction between lifetime video game exposure and participant gender with STEM equality as the outcome.

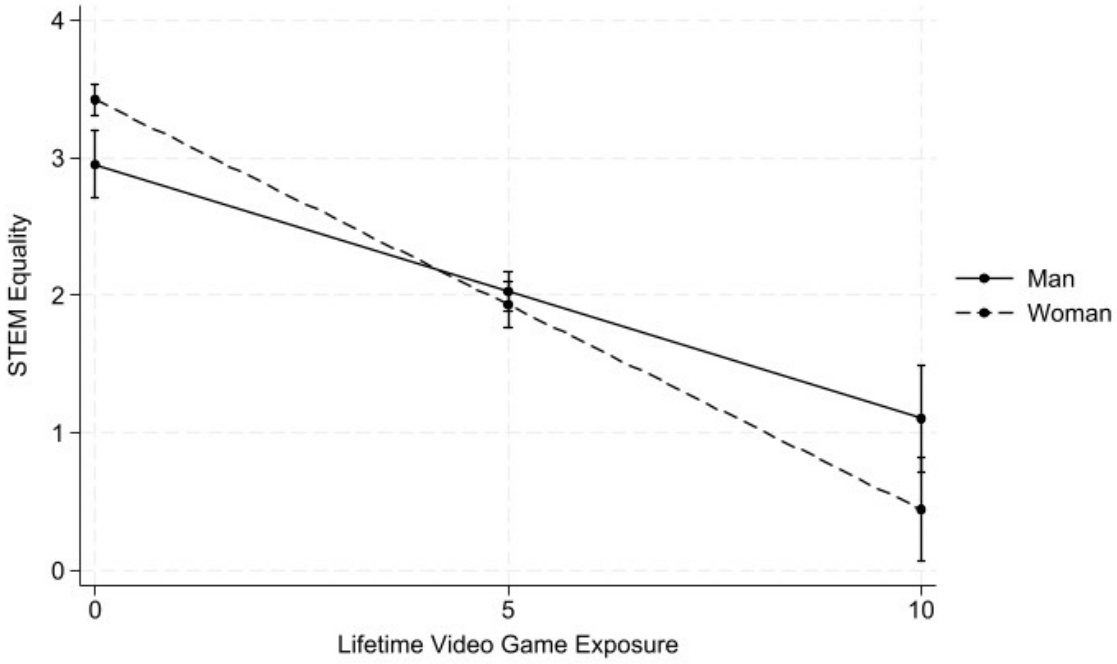

Figure 3. Study 2 moderated mediation model with coefficients. Note: *p<.05, XX/XX denotes differing results for STEM sexism/STEM equality, respectively. Coefficients for the relationship between lifetime video game exposure and outcomes reflect the simple main effect in the presence of the interaction (interpretable as the relationship for men only, as men=0, women=1).

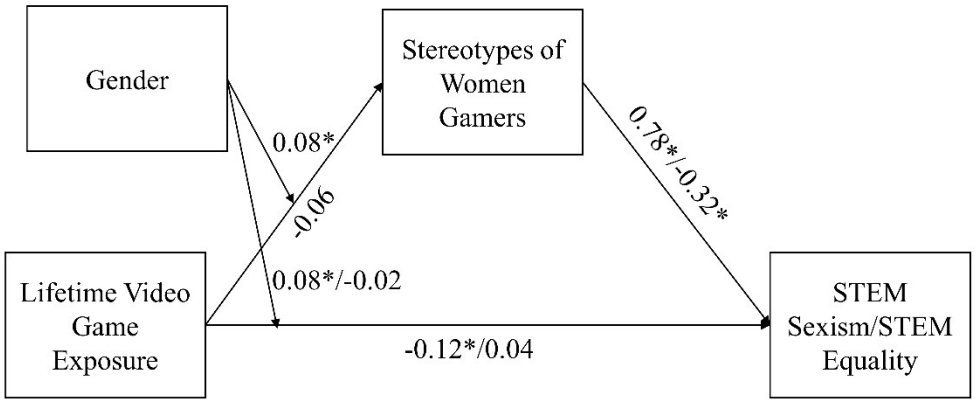

Figure 4. Study 2 interaction between lifetime video game exposure and participant gender with stereotypes of women gamers (FGSS) as the outcome.

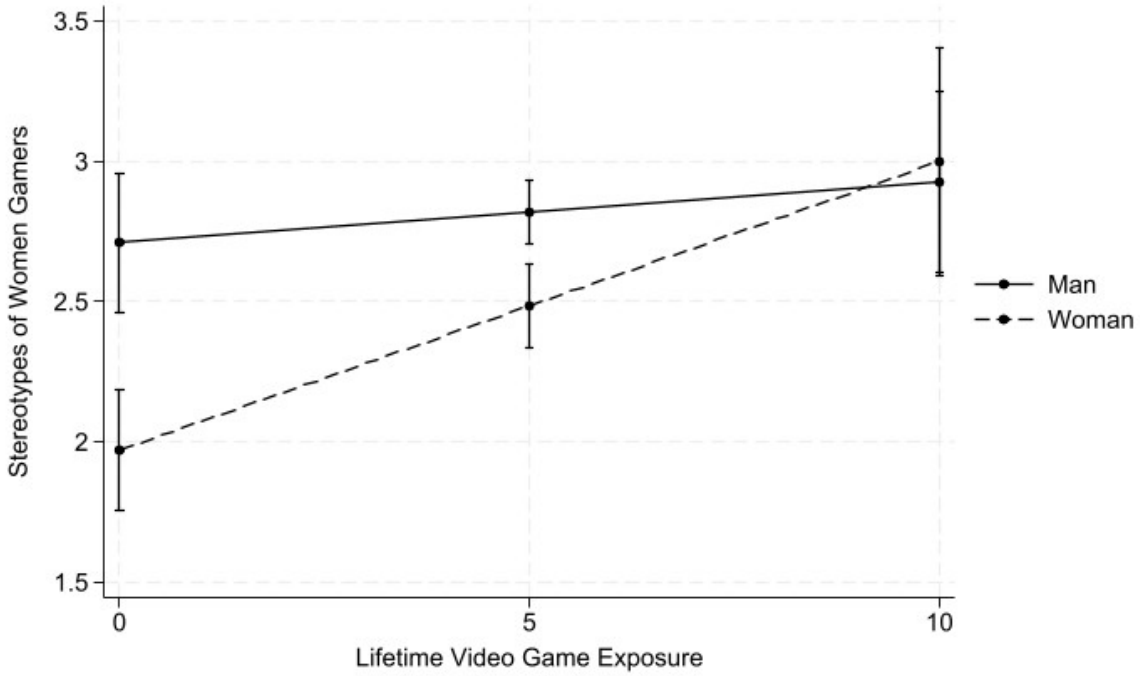

Figure 5. Study 2 interaction between lifetime video game exposure and participant gender with STEM sexism as the outcome.