10-2023

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Recommended Citation

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. Advance online publication. https://doi.org/10.1037/ppm0000430

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

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Abstract

Female gamers belong to a stereotyped social group. The stereotypes associated with female gamers may be associated with issues such as sexism and gender discrimination in the gaming community. However, few tools exist to properly assess the complex nature of the stereotypes held about this group. The present paper describes the development and validation of the Female Gamer Stereotypes Scale (FGSS), which offers a multifaceted measure of the stereotypical beliefs toward women who play video games. Five first-order FGSS factors have emerged and been consistent with data across three studies. The five dimensions target areas of stereotypes toward female gamers such as their lack of femininity, lack of sociability, weak gaming competence, reliance on men in gaming, and gaming preferences. A total of 1266 individuals from both a student sample and large national U.S. samples participated the studies. In the first study, a large pool of potential scale items was generated. In study 2 and 3, the five-factor, 20-item FGSS was developed and validated through five subsamples, including gamers, male gamers, female gamers, non-gamers, and the general population. Across all subsamples, the FGSS demonstrated excellent content and construct validity. Implications of results and recommendations for future studies are discussed.

Keywords: female, gaming, stereotypes, scale development, scale validation

Public Significance Statement: Three studies developed and validated the Female Gamer Stereotypes Scale (FGSS), which offers a multifaceted measure of the stereotypical beliefs toward women who play video games. FGSS, a five-factor, 20-item measurement scale, was validated through five populations including gamers, male gamers, female gamers, non-gamers, and the general population. FGSS can be broadly used in research areas related to stereotyping, prejudice, and discrimination within and beyond the context of gender and gaming.

Development and Validation of the Female Gamer Stereotypes Scale (FGSS)

Females constitute nearly half of the current gamer population and play a great variety of video games (2020 Essential Facts about the Video Game Industry). However, female players are still marginalized in video game culture (Paaßen et al., 2017). Female gamers are perceived as less competent than male gamers, as having slower game advancement than male gamers, and as preferring casual games more than competitive games (Kaye et al., 2018). In the game development industry, females are underrepresented as core game developers (Weststar & Legault, 2016). Maleness has been one of the key components of the gamer profile, and female gamers are in turn underprivileged in this setting (Shaw, 2012). Much empirical research has addressed gender dynamics in the gaming context, but there is a lack of tools which systematically measure people's perception about the female gamer category. In the present study, we developed and validated a multidimensional measurement instrument to capture stereotypical beliefs about female gamers.

The category "female gamers" is defined in this study as women of any age who play video games on any electronic devices (e.g., console, computer, mobile phone)[1]. Female gamer stereotypes refer to the perceived traits of the female gamer category without consideration for individuating information. In the context of gaming, stereotypes toward female gamers may arise, in part, because gender representation in video games has been unbalanced. Previous

[1] We understand that typically the term "woman" refers to gender identity and "female" is more related to biological sex (American Psychological Association, 2009). In the present study, female gamers are people who self-identify as a female video game player. To identify the scope of "female gamers" in the current study, we offered a definition that female gamers are "women of any age who play video games on any electronic devices (e.g., console, computer, mobile phone), which is equivalent to, for example, "women who play video games" (Fox & Tang, 2014) from previous research. Additionally, the term "female gamers" is commonly used in the literature (e.g., Paaßen et al., 2017; Vermeulen et al., 2016). Thus, the choice of female gamer would also be consistent with related research in the field.

research has found that women are severely underrepresented in video gaming environments (Behm-Morawitz, 2017). When they are represented as characters, female characters are often in secondary roles who appear to be either innocent or hypersexualized with revealing clothing (Lynch et al., 2016; Miller & Summers, 2007). Additionally, in the video game industry female professionals have reported being treated with gender stereotypes and only being assigned to workplace roles that align with stereotypical gender roles (Styhre et al., 2015). Past research has found that media portrayals of a social group affect people's stereotypical beliefs toward this group (for example, see Oliver et al., 2004). Thus the combination of underrepresentation with stereotypical and unidimensional roles when representation does occur may reinforce a biased perception of female gamers[2].

When stereotypes toward female gamers are made salient, female players believed less in their gaming skills (Vermeulen et al., 2016) and reported reduced self-efficacy (Behm-Morawitz & Mastro, 2009). Stereotypes may also be associated with direct discrimination against female players. For example, in a multiplayer game, male gamers used more negative comments when they heard a female voice than a male voice (Kuznekoff & Rose, 2013). Research on gender harassment in gaming has also found that women are disproportionately victims of harassment compared to men (Tang et al., 2019; Tang & Fox, 2016). Taken together, it is not surprising that some female gamers have reported increased intention to play alone, play anonymously, and frequently change gaming groups (McLean & Griffiths, 2018).

Prior Measurement of Female Gamer Stereotypes

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[2]There is a lack of longitudinal research testing the relationship between exposure to gender stereotypes and subsequent stereotypical perceptions of female gamers. Limited existing longitudinal research has found little support for this relationship (Breuer et al., 2015). However, cross-sectional studies have found support for the association between stereotypical representation of female gamers and biased beliefs toward this social group (e.g., Behm-Morawitz & Mastro, 2009).

Little work has systematically attempted to identify the attributes of female gamer stereotypes. One exception is the Video Game Sexism Scale (VGSS; Fox & Tang, 2014). The VGSS is a unidimensional scale designed to measure sexist attitudes in the gaming context. We believe that the VGSS and FGSS make distinctive contributions to research related to female gamers. Generally, video game sexism can be understood as a broader concept than stereotyping female gamers (Stangor, 2015; Swim & Hyers, 2009). Stereotypes toward female gamers represent people's "mental pictures" of the female gamer group (see Lippmann, 1922, also cited in Stangor, 2015) – the traits viewed as characteristic of female gamers as a social group. Sexism against female gamers, on the other hand, refers more to individual's attitudes and behaviors to maintain sex inequality in the gamer group (Swim & Hyers, 2009). Thus it is our understanding that FGSS aims to capture a more specific cognitive structure about female gamers than VGSS.

Additionally, FGSS is distinctive from VGSS because of dimensionality. VGSS is a unidimensional scale but we hypothesized that FGSS should be multidimensional. Previous scholarship has identified gender stereotypes in general as multidimensional (Deaux & Lewis, 1983). For example, Deaux & Lewis (1983) argue that gender stereotypes include components such as psychological traits and role behaviors (see also Behm-Morawitz & Mastro, 2009). Additionally, scale development work in male-dominant domains other than video gaming has also found gender stereotypes to be multidimensional (e.g., mathematics; Nurlu, 2017).

Gender stereotyping is an important issue in the gaming context and may be related with other issues such as sexism and discrimination (e.g., Yao et al., 2022). To reduce stereotyping toward female gamers and promote gender equity among video game players, we need to systematically understand the content and scope of stereotypical beliefs. In the present research, we developed and validated a measurement instrument aiming to capture the multifaceted nature of female gamer stereotypes. FGSS will provide a useful measurement tool for future research to better understand gender dynamics in the gaming context as well as enabling research to seek strategies to reduce stereotypes and gender prejudice among gamers.

The Present Research

Across three studies, we developed and validated the FGSS which is designed to evaluate the extent to which people hold stereotypical beliefs toward female gamers. In Study 1 we used established procedures from cognitive psychology and anthropology to identify a large pool of stereotypical beliefs toward female gamers. In Study 2[3], we developed the five-factor, 20-item FGSS which demonstrated excellent content and construct validity with a gamer sample. In the last study, we further validated FGSS with a non-gamer sample – indicating a broader cultural role for FGSS in addition to its application in the gamer community.

Study 1: Initial Development of FGSS

Previous scholarship has outlined two stages to validate measurement instruments (development stage and judgment-qualification stage; Lynn, 1986). In Study 1 we focused on developing FGSS and a few steps were taken to identify the dimensions and items of the scale. We first generated a large pool of potential items by thoroughly reviewing previous literature and other related materials. Then we identified FGSS' dimensionality based on the pool of initial items. Lastly, we sorted the pool of items into each identified FGSS dimension for scale specification in Study 2.

Method

[3] Between Study 1 and Study 2 we conducted a survey seeking to test a shorter version of the scale but failed. This survey used a student sample (n=302) and the reliability of the scale was too low to be acceptable. Because the survey was not part of the official research design and its results were not related to the validation of the 20-item FGSS, we omitted it from the present manuscript. The study methods and results are available on OSF, https://osf.io/96vbs/?view_only=111e3812185342dba0eaaaed66892184.

Initial Item Generation

Following procedures to identify the beliefs within a domain from cognitive psychology and cognitive anthropology (Roskos-Ewoldsen & Roskos-Ewoldsen, 2008), we adopted a triangulation method including a literature review of academic work, a review of online information, and interviews to generate a pool of potential items. In the literature review, keywords “female stereotype”, “gamer stereotype”, and “female gamer stereotype” were searched in the Communication & Mass Media Complete database[4]. This process yielded to 667 articles, including 9 articles drawing from the keywords “female gamer stereotype”, 21 articles from the keywords “gamer stereotype”, and 637 articles from the keywords “female stereotype”. The authors then sorted the articles by date published (from newest), reviewed the articles, and recorded statements about stereotypes toward female gamers. The review process stopped when there were no new stereotypes found. A total of 79 articles were reviewed. Online information was also used as a source to capture the nuances of female gamer stereotypes. The same three sets of keywords as in the literature review were searched on google.com[5], in addition to “women gamer stereotypes” and “stereotypes toward women who play video games”. We then reviewed the search results and stopped when female gamer stereotypes found by reviewing new webpages were all captured by previously generated stereotypes. Last, interviews were conducted with 10 gamers and 10 non-gamers who were identified through snowball sampling. The interviews were face-to-face or via phone calls, the length of which were typically 15 to 25 minutes. We were mainly interested in the interviewees’ opinions on the prevalent stereotypes

[4] https://www.ebsco.com/products/research-databases/communication-mass-media-complete
[5] An example of selected websites would be the GirlGamer subreddit from reddit.com. An example of selected popular press articles would be Eble’s (2015) article “25 Things Every Female Gamer is Tired of Hearing”.

about female gamers and how they evaluate the female gamer group. After these three processes, forty-one distinct stereotypes[6] about female gamers were generated. To capture potential female gamer stereotypes that may be missed from the literature review, online forums review, and interviews, an online survey was conducted with open questions for additional stereotypes. All studies in the present research were approved by the Institutional Review Board at Michigan State University.

Online Survey

Participants. Participants were 74 undergraduates at a large Midwestern university who participated for class credit (54% female; *M*age=18.96, *SD*age=3.83; 67%White, 9%Black, 17%Asian/Pacific Islander, 7%other; 53% reported playing video games during the past week). Standard IRB procedure was followed in all three studies. In all studies informed consent was obtained from the participants at the beginning of the survey.

Procedure and Measures. The online survey had two open questions. Participants were instructed to list the “characteristics of female gamers”, which was designed to detect participants’ own stereotypes about the female gamer group. Then, participants were asked to list the recurring female gamer stereotypes of which they are aware. This question was designed to detect female gamer stereotypes that are known by the participants but may or may not be endorsed by them. For each open question, participants were encouraged to write down as many answers as they could[7].

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[6] See supplemental material (p. 12) for items.

[7] We also measured perceived prevalence of the 41 stereotypes from initial item generation (plus recoded items and items with different wording but capture the same stereotype). We planned to remove items that are low in prevalence based on survey results, but were later convinced that perceived prevalence of a stereotype does not equal to the belief of a stereotype. For example, a participant may think “female gamers are nerdy” a prevalent stereotype but not personally believe it. Because the goal of the present scale was to capture people’s personal

Results

All analyses in all three studies were done in R (Version 1.1.463). All CFA was done in R with the Lavaan package (Version 06-3; Rosseel, 2012).

A total of 641 perceived characteristics and stereotypes of female gamers were generated. Of those, three stereotypes were not covered in the existing 41 statements (e.g., “Female gamers are quiet.”). After adding the three new stereotypes, we had a pool of 44 stereotype statements.

The content similarity of the 44 statements were then analyzed. First, we analyzed the content of each item and the theme that the item may be about within the context of gender and gaming (e.g., “female gamers like casual games” is about preference of game types). Then, we reviewed the newly generated themes to see if any of them are similar enough to map onto the same latent concept. If two themes appeared to be capturing the same latent concept (e.g., preference of game type and preference of in-game modifiability are both about gaming preference), we consolidated them into one common theme. Five distinct themes emerged, including lack of femininity in everyday life, lack of sociability in everyday life, lack of competence in gaming, reliance on men in gaming, and gaming preference. After identifying the five dimensions, we sorted the pool of 44 items into the five categories. The five stereotype dimensions and the items selected for each dimension were then corroborated with a number of experts in this research field. Because the goal of Study 1 was to develop a pool of items which sufficiently capture the construct of female gamer stereotypes, we prompted the experts to think of potential female gamer stereotypes that might have been missed from the initial item

beliefs about female gamers, we were hesitant to use prevalence measures to remove any stereotype items. This part of the results is thus not reported here.

generation. Six new stereotypes were added to the item pool after this process, which left a total of 50 items for scale specification in Study 2.

Specifically, we used sorting technique to determine FGSS' dimensionality instead of an exploratory factor analysis (EFA) with the survey data from Study 1. We avoided EFA to determine FGSS's dimensionality because EFA classifies items incorrectly under certain conditions. First, EFA classifies items as measures of the same factor based on the magnitude of their intercorrelations. But when factors are correlated highly[8], as are ours, that leads frequently to under factoring even with oblique rotation (Hunter et al., 1982). Thus, we miss finding important dimensions of the construct because two or more of them may be combined in the EFA output. Second, EFA may misclassify an item when there is a gradient (items have different factor loadings) in the factor structure[9]. It may classify two strong items (those with high factor loadings) as measures of the same factor when they are not, or it may fail to find a weaker item loading on the factor of which it is an indicator. In our data item loadings indeed had gradients.

Study 2: Development and Validation of FGSS

According to previous literature, after the development of scale items the next stage of scale validation is to judge the quality of the scale items (Lynn, 1986). Thus, the goals of Study 2 were to finalize scale items and examine the quality of these items. Model fit, convergent validity, and discriminant validity were triangulated to examine item quality (Anderson & Gerbing, 1988; Campbell & Fiske, 1959).

[8] See supplemental material (p.5 - p.10) for zero-order correlations.
[9] See supplemental material (p. 15) for an example.

Because stereotypes toward female gamers are most salient in the gaming community (Taylor, 2009), we focused on the gamer population in this study. We also validated FGSS across all gamers, male gamers, and female gamers.

Specification of FGSS

CFA was employed to assess fit of the model. A centroid algorithm was used to estimate factor loadings. Internal consistency and parallelism analyses were also conducted to test the model fit (Hunter & Hamilton, 1992). The difference between each predicted correlation from the internal consistency and parallelism analyses and its respective observed correlation (i.e., residuals) was calculated. The adequacy of the model can be judged by its factor loadings and the residuals. Specifically, we can infer an excellent fit of the model through large factor loadings and small residuals. During internal consistency and parallelism analyses of the FGSS, an item was kept or deleted based on how it affected the factor loadings, residuals, and reliability. Items with the weakest factor loadings and the ones that produced the largest residuals were removed from each subscale. This analysis was repeated until a set of internally consistent and parallel items were identified.

The 50 items generated from Study 1 were all included in the CFA. As mentioned earlier, sexism is a broad concept which includes gender stereotyping as well as gender-based prejudice and discrimination (Swim & Hyers, 2009). Thus it is possible that some VGSS items, which are meant to capture video game sexism, may cover the concept of female gamer stereotype. To test whether some items from the VGSS (Fox & Tang, 2014) map onto the five-dimensional FGSS, we included all items from the VGSS in the survey and included them in the CFA.

Convergent Validity

The Employment Skepticism Subscale (ESS) in the multidimensional Aversion to Women Who Work Scale measures doubts and negative attitudes toward women at workplace (Valentine, 2001). Both FGSS and ESS capture stereotypical beliefs about women in traditionally male-dominant roles (i.e., working environment, gaming). Therefore, we predicted that participants' scores on FGSS and ESS would be correlated positively and substantially – demonstrating convergent validity.

Discriminant Validity

To demonstrate FGSS' discriminant validity, we adopted the approach recommended by Anderson and Gerbing (1988; also see Joreskog, 1971; Kim & Kim, 2010). The correlation between a pair of FGSS factors (e.g., lack of femininity and lack of sociability) was constrained to be 1.00. Then, a chi-square difference test was performed to compare the constrained model with the freely estimated model. A significantly lower χ^2 value of the freely estimated model than the constrained model would indicate that the two factors are not supposed to be perfectly correlated and that discriminant validity is demonstrated (Anderson & Gerbing, 1988; Bagozzi & Phillips, 1982). To rigorously test discriminant validity of the scale, Anderson & Gerbing (1988) recommend that "this test should be performed for one pair of factors at a time, rather than as a simultaneous test of all pairs of interest". Thus, we performed model comparison tests between the constrained and freely estimated models for all possible pairs of the FGSS factors.

Method

Participants & Procedure

One guideline for a minimum sample size for CFA is around 300 subjects (Worthington & Whittaker, 2006)[10]. In this study we planned to analyze two subsamples (i.e., female gamers and male gamers), therefore a minimum of 600 participants were needed.

Participants in Study 2 were recruited through Amazon's Mechanical Turk (MTurk) and paid $2.50 USD. Previous research has found MTurk subjects to be more demographically diverse and representative compared to typical undergraduate student samples (Buhrmester et al., 2011). The survey on MTurk was only visible to individuals who resided in the U.S. and aged 18 years or older. To reduce social desirability bias the true purpose of the study was masked, and it was emphasized at the beginning of each subsection of the survey that participants' honest answers would be appreciated.

Subjective group identification is reported to be a better predictor of stereotype beliefs than objective measures (e.g., gaming frequency; Turner, 1984). Of the original 743 participants who took the survey, 648 were self-identified gamers. That is, participants were included for data analysis if they chose "female gamer" or "male gamer" to the question "Which of the following category would you identify yourself with?" (other options included "female non-gamer", "male

[10] There are currently three general approaches to determine sample sizes for CFA. Early CFA scholars proposed absolute numbers, which typically ranged from 100 to 200 (e.g., Anderson & Gerbing, 1984; Boomsma, 1982). With the increasing complexity of CFA models, researchers started to recommend determining sample sizes based on model parameters (e.g., Gorsuch, 1983; MacCallum et al., 1999; Tanaka, 1987; Bentler & Chou, 1987). This approach tends to propose a minimum ratio of participants to indicator (e.g., 5:1 or 10:1). More recently, using Monte Carlo simulations to determine sample size has become more common. Despite the different approaches to determine sample sizes for CFA, there is a general agreement on how large a sample size is *enough*, that "larger sample sizes seemed to provide more confidence in CFA results" (Gagne & Hancock, 2006, p. 66). In our research, although Monte Carlo simulation is considered the most accurate method to plan sample sizes, it is impossible for us to utilize as we do not have the necessary information to implement in the simulation models (e.g., between-indicator covariances; factor loading of each indicator on its factor). However, previous research using Monte Carlo simulations has found that regardless of focal contexts important model fit indices such as RMSEA showed significant reduction in bias when sample size reaches 200 to 400 participants (Jackson, 2001). There is also a widely used guideline for factor analysis to have at least 300 subjects (Worthington & Whittaker, 2006). Thus we chose to use 300 participants for Study 2's CFA.

non-gamer", and "none of the above", n=83). Then, twelve gamer participants were removed due to low survey completion rate (<70%). Of the final 648 participants (M_{age}=33.09; *SD*=8.54), 45% were female (79%White, 13%Black/African American; 5%Asian/Pacific Islander; 3%other).

Measures

For the potential FGSS items, VGSS, and ESS[11] (Valentine, 2001), participants were asked to rate their level of agreement to each item on a 11-point Likert-scale ranging from (0) strongly disagree to (10) strongly agree[12]. All items were randomized within scales.

Results

The Gamer Sample

This sample included all self-identified female and male gamers in the online survey (*n*=648). After CFA, a 20-item, five-factor scale that is consistent with data was produced (see Figure 1 for scale items and Table 1 for local and global fit). Of the 20 final items in the FGSS, three came from the VGSS. These three items loaded on the factors of lack of competence in gaming and reliance on men in gaming.

[Insert Figure 1 here]

[Insert Table 1 here]

Factor loadings for the five-factor model ranged from .57 to .94 (Table 2). The one-factor model was tested to examine whether there is a general female gamer stereotype construct that can be captured by one dimension. As predicted, data did not fit the model well (see Table 1). Additionally, the possibility of second-order unidimensionality was also tested and failed.

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[11] For descriptive statistics and CFA model fit of VGSS and ESS, see supplemental material.
[12] We treated Likert scales as interval variables in our data analysis. Empirical research as well as simulation research has found that an 11-point Likert scale is more desirable than scales with fewer points (e.g., 4- or 7-point Likert scales) when treating ordinal variables as interval variables (Wu & Leung, 2017; Xu & Leung, 2018).

The five dimensions of FGSS were averaged to form five indices, including femininity, sociability, competence, reliance-on-men, and gaming-preference (see Table 3). The distributions of the five indices were all platykurtic. The sociability and gaming indices were distributed with approximate symmetry, whereas distributions of the remaining three indices were moderately and positively skewed. The reliabilities of all five indices were reasonable.

Data were used to test construct validity of FGSS in the form of convergent and discriminant validity (see Table 4). Scores on ESS and each of the five FGSS indices correlated substantially[13]. The hypothesized convergent effects were all ample, suggesting that the measures exhibited convergent validity (Campbell & Fiske, 1959). FGSS exhibited discriminant validity because all model comparisons between the constrained and freely estimated models showed significant difference (see Table 5).

[Insert Table 2 here]

[Insert Table 3 here]

[Insert Table 4 here]

[Insert Table 5 here]

Measurement invariance was tested to see whether FGSS operates in the same way between the female and male gamer subsamples. (Dimitrov, 2010). Configural invariance was demonstrated by fitting a multigroup (female and male gamers) CFA (Model 1; χ^2=859.05, p<.05 $RMSEA$=.07(90%CI=[.07, .08]), CFI =.96, TLI=.95, $SRMR$=.03). To test weak invariance (i.e., metric invariance), factor loadings were constrained to be equal across the female and male gamer subsamples (Model 2; χ^2=881.77, p<.05, $RMSEA$=.07(90%CI=[.07, .08]), CFI=.96,

[13] The correlations in Table 4 were observed correlations. For correlations corrected for attenuation due to error of measurement, see supplemental materials (p. 11).

TLI=.95, *SRMR*=.03). Weak invariance was demonstrated by a chi-square difference test for the two nested models (Model 1, Model 2; χ^2_{diff}=22.72; *p*=.09), indicating invariance of the factor loadings across the female and male gamer groups. There was no strong or strict measurement invariance between the two groups in the current sample. The presence of weak invariance allows us the compare the factor structure between female and male gamer subsamples.

The Female Gamer Subsample

In the female gamer subsample (*n*=318), the one-factor and second-order single-factor models did not fit the data well (see Table 1). The five-factor model exhibited reasonable model fit with ample factor loadings (Table 2).

The distribution of each index was platykurtic (see Table 3). Moderately positive skewness was observed in the distribution of reliance-on-men, whereas the other four indices had approximately symmetric distributions. Cronbach's alpha was at least .86 across indices. Convergent and discriminant validity were both present in the sample (see Table 4&5).

The Male Gamer Subsample

In the male gamer subsample (*n*=330), the first- and second-order one-factor models were both inconsistent with data (see Table 1). The five-factor model fits well and the factor loadings were ample (see Table 2).

The distribution of each index was platykurtic (see Table 3). Moderately positive skewness was spotted in three indices (femininity, gaming competence, reliance-on-men), whereas the distributions for the remaining two indices were approximately symmetric. Reliability scores of the FGSS ranged from .77 to .92. The FGSS' convergent and discriminant validity were suggested in these measures (see Table 4).

Discussion

Excellent model fit across the main sample (i.e., all gamers) and two subsamples (i.e., female gamer; male gamer) expands the applicability of FGSS. The same structure of female gamer stereotypes held by female and male gamers suggested that the processes of stereotyping and self-stereotyping are currently congruent. Past research has argued that, to maintain positive esteem, in- and out-groups with status differences tend to hold different stereotypes toward the outgroup membership (Hogg & Abrams, 1988). The male category is typically valued with higher social status compared to female (Swan & Wyer, 1997), and gaming is traditionally viewed as a male-dominated field (Fox & Tang, 2014). Thus, female gamer stereotypes held by male and female gamers were expected to be different. However, in the current study the structure of female gamer stereotypes is the same between these two groups. One interpretation of this result is that male gamers as the ingroup members may have contributed to form a set of stereotypes toward female gamers, but this set of stereotypical beliefs are acknowledged within the female gamer group as well. Past research has demonstrated that, even when individuals disagree with the stereotypes, they are aware of the stereotype content (Devine, 1989). Thus, female gamers may not necessarily endorse the stereotypes, but they are aware of the stereotypes regardless of whether the stereotypes are consistent with their personal beliefs. As a result, when female gamer participants were presented with the prevalent stereotypes, even the stereotypes may not completely overlap with their own beliefs, female gamers are likely to recognize these stereotypes and connect them with their group.

Study 3: Validating FGSS with Non-Gamers

Study 2 demonstrated excellent content and construct validity of FGSS in the gamer population. In study 3, we sought to further validate FGSS in people who do not play video games (i.e., non-gamers). This population was examined for three reasons. First, if the structure of FGSS is distinct in a non-gamer sample, it would suggest that the current stereotypes of female gamers exclusively reflect gender dynamics within video game culture. However, if the structure is similar, it suggests that these stereotypes have expanded beyond the gaming community to the larger culture. Testing whether FGSS fits well with the non-gamer population could provide important insights into both combatting stereotypes and understanding how stereotypes spread through a culture. Second, discrimination against female gamers is not likely limited to the gaming population; there may be ways that female gamers are marginalized and discriminated against by the non-gamer populations as well – making their beliefs important to understand. Finally, merging the gamer sample from study 2 and the non-gamer sample from study 3 permitted us to analyze model fit of FGSS in the general population which includes gamers and non-gamers. Thus we combined all participants from Study 2 (n=648) and Study 3 (n=618) and reported FGSS model fit of the total sample (n=1266).

Method

Participants & Procedure

Study 3 used MTurk to obtain participants who are U.S. adults and self-identified non-gamers, and paid them $2.50. Based on the general principle that larger samples provide more confidence in CFA (DeVellis, 2017)[14], a total of 618 participants were collected.

Of the 2046 participants who took the survey, those who categorized themselves as a “female non-gamer” or “male non-gamer” on the same screening question as in Study 2 were selected (n=633). Fifteen non-gamer participants were removed due to low survey completion

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[14] Results from simulation studies have also supported the principle that larger sample sizes produce better results for CFA (Jackson, 2001; Gagne & Hancock, 2006).

rate (<70%). Of the final 618 participants (*M*age=35.43, *SD*age=10.85), 64% were female (77%White, 11%Black/African American, 6%Asian, 6%other).

Measures

The measures in this study were identical to the measures used in Study 2.

Results

The Non-gamer Sample

The one-factor and second-order single-factor models of FGSS did not fit well with data but the five-factor model did fit the data (see Table 1&2). As seen in Table 3, all distributions were platykurtic. Distributions of four indices were roughly symmetric and one had slightly positive skewness (reliance-on-men). FGSS was a highly reliable measure across all five dimensions. Additionally, data were consistent with the construct validity hypotheses (see Table 4&5).

The Total Sample

This sample includes all participants from Study 2 and Study 3 ($n = 1266$; for dataset, see Yao, 2021). The unidimensional and second-order unidimensional models did not fit well, but the five-factor model demonstrated close fit with data (see Table 1). As seen in Table 3, the distributions of the indices were all moderately platykurtic and three indices were skewed. The reliability scores of were all reasonable. Convergent and discriminant validity were present in the total sample (Table 4&5).

Measurement invariance testing was conducted for the gamer and non-gamer subsamples. First, configural invariance was demonstrated by fitting a multigroup (gamer, non-gamer) CFA model with the total sample (Model 1; χ^2=890.91, p<.05, *RMSEA*=.06(90%CI=[.06, .06]), *CFI*=.97, *TLI*=.96, *SRMR*=.02). Weak invariance was not supported as Model 1 showed significantly better fit (χ^2_{diff}=68.21; p<.05) than the model with equal factor loadings across groups (χ^2=1215.67, p<.05, *RMSEA*=.06(90%CI=[.06, .07]), *CFI*=.96, *TLI*=.96, *SRMR*=.04). Partial weak invariance was then demonstrated by releasing the constraint of equal factor loadings across groups for two items (item 19 and 20; χ^2_{diff}=9.71; p=.72)[15]. Previous literature has suggested that less than 20% freed parameters (10% freed parameters in our analysis) can be considered acceptable in practice (Dimitrov, 2001), thus we conclude that this partial weak invariance allows us to compare the factor structures between the gamer and non-gamer subsamples.

Discussion

The five-factor FGSS was found to be a highly reliable measurement instrument in all three subsamples in Study 3 with close model fit and large factor loadings. Validation of the scale with non-gamers and the general population indicates that female gamer stereotypes' structure is now the same in the general culture as it is in the gamer culture. These stereotypes may have been originally derived from the subculture of gaming, where male gamers attribute stereotypes to female gamers through intergroup interactions, but now even people who do not have regular exposure to video game culture appear to have the same structure of the stereotypes. These findings provide further evidence that female gamer stereotypes no longer circulate exclusively within the gamer community but have become part of the mainstream culture.

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[15] It is worth noting that the constraint of equal factor loadings across groups was released for these two items one by one. We first ran a univariate score test and found that releasing the constraint for item 19 would have led to most χ^2 improvement for the CFA model (Model 2). We then ran a chi-squared difference test to compare Model 1 and Model 2. We failed to demonstrate partial weak invariance at this point as the two models were still significantly different. We then ran a univariate score test again with the remaining 19 items and released the factor loading constraint for item 20 as this action would have led to the most χ^2 improvement for Model 2. The model with items 19 and 20's factor loadings free to vary is named as Model 3. A model comparison test was then done between Model 1 and Model 3. These two models were not significantly different (χ^2diff=9.71; p=.72), indicating partial weak invariance.

The five-factor FGSS was validated in Study 2 & 3. In addition to the excellent model fit across five subsamples (all gamers, female gamers, male gamers, non-gamers, total sample; see Table 1 for model fit indices), the five-factor structure can be understood through theory. Consistent with intersectionality theory (Crenshaw, 1990), the five FGSS dimensions can be understood as derived from gamer stereotypes, female stereotypes, and stereotypes that uniquely target the intersectional female gamer identity. The scale items from lack of femininity dimension are congruent with stereotypical gamer traits, such that gamers can be so occupied with gaming that they do not have time to be romantically involved with someone or clean their living environment. Similarly, the lack of sociability dimension implies that, just like a stereotypical gamer, a stereotypical female gamer may lack ability in social interactions. Indeed, the dimensions of lack of femininity and lack of sociability map well onto the prevalent gamer stereotype that they are lazy, single, socially inept, and spend way too much time on video gaming (Grohol, 2018). The lack of gaming competence dimension compares female gamers with male gamers and highlights females' presumed low competence in video gaming. The content of these items is consistent with gender stereotypes that men are more agentic and competitive than women (Eagly et al., 2000). Similarly, the content of reliance-on-men in gaming captures a toxic aspect of gender dynamics among gamers that female gamers are thought to be constantly in need of male gamers' help, just as a woman stereotypically is less competent than men and therefore needs men's help (Barreto & Ellemers, 2005). The gaming preference dimension directly targets the uniqueness of the female gamer identity. Items such as female gamers' preferences of simulation games and video games that they can modify cannot be fully explained by either stereotypical female traits or stereotypical gamer traits. Instead, we feel that these stereotypes were developed to specifically target the intersectional female gamer identity.

General Discussion

The present findings suggest that female gamers are stereotypically perceived as less feminine than other women, socially awkward, incompetent in gaming and thus constantly in need of men’s help, and as only liking casual games. Not only do these stereotypes negatively impact the female players’ gaming experience (e.g., Vermeulen et al., 2016), it may also relate to gender-based prejudice and discrimination in the video game community (e.g., Yao et al., 2022). To combat gender stereotyping in gaming, we need to first understand the content and scope of the female gamer stereotypes. The present research developed and validated a measurement instrument which systematically captures perceived stereotypes about female video game players. FGSS has the potential for use in theory and research that examines message effects on stereotypical beliefs, cognitive processes between stereotypical beliefs and prejudicial attitudes toward female gamers, and strategies to reduce gender discrimination in the gaming context.

FGSS showed consistency with data across five subsamples. The studies culminated in a scale with excellent fit, which should provide confidence to identify stereotypical beliefs toward female gamers in terms of femininity, sociability, gaming competence, reliance on men in gaming, and gaming preference. Future research is recommended to use FGSS as a first-order, five-factor measurement tool. Additionally, because of the strong internal consistency of each FGSS dimension, future studies that examine specific areas of female gamer stereotypes are not constrained to measure all FGSS dimensions, but only the ones that are of particular interest. For example, for research that focuses how the current video game culture influences stereotypical beliefs about female gamers' gaming competence, researchers may use only the lack of competence dimension of FGSS instead of the whole five-factor scale.

Despite FGSS' excellent model fit, data analysis results from the studies raised questions that need to be addressed in subsequent research. One limitation of the current study is lack of longitudinal data. Future FGSS validation research is encouraged to conduct experiments in which the measures of the scale are associated with predictions of behavior at a future time. Additionally, in our research "female gamer" is a term for self-identification regardless of biological sex. However, it is possible that "female" may be more associated with the cognitive representation of someone who is biologically female than someone who self-identifies as being female. Thus, future research is recommended to further validate FGSS with pronouns that represent gamers who self-identify as women such as "women gamers" or "women who play video games".

Another limitation lies in using MTurk as the data collection platform to validate the FGSS. Although MTurk is said to be more representative of the general population than a typical student sample, there are concerns about MTurk workers' misrepresentation of desired populations (MacInnis et al., 2019). For example, we still cannot exclude the possibility that some participants may have misrepresented their identity to qualify for the study. We recommend further research to cross-validate FGSS with other survey platforms. Additionally, in our research we used U.S. samples but it would be beneficial to test whether the same stereotype structure is valid in other regions and countries.

FGSS provides a highly valid, multidimensional measure of female gamer stereotypes. The development of FGSS not only allows researchers to measure the magnitude of stereotypical beliefs about female gamers, but also signals the severity of a sexist ideology in the gaming community. Thus, it is our hope that FGSS will also assist video game developers and other professionals in the video game industry to have a more nuanced understanding of the current scope and severity of sexism in gaming. By utilizing FGSS in research conducted by academic researchers as well as video game professionals, it is hopeful that we will have a more thorough understanding of stereotyping and prejudice toward female gamers, as well as patterns that may contribute to more positive gender dynamics in the gaming context.

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Table 1

Model Fit of Five-Factor FGSS, Unidimentional FGSS, Second-Order Unidimensional FGSS, and VGSS across Five Samples in Studies 2 and 3

	All Gamers (n = 648)	Female Gamers (n = 318)	Male Gamers (n = 330)	Non-Gamers (n = 618)	Total Sample (n = 1266)
5-Factor FGSS					
χ^2	584.57*	483.97*	375.08*	562.90*	890.91*
CFI	.97	.96	.96	.96	.97
TLI	.96	.95	.95	.95	.96
RMSEA	.06	.08	.06	.06	.06
90% CI	[.06, .07]	[.07, .09]	[.06, .07]	[.06, .07]	[.06, .06]
SRMR	.02	.02	.04	.03	.02
Single-Factor FGSS					
χ^2	1513.78*	866.79*	865.82*	1692.15*	3018.90*
CFI	.89	.90	.84	.82	.86
TLI	.87	.89	.81	.79	.84
RMSEA	.13	.13	.13	.14	.13
90% CI	[.12, .13]	[.12, .14]	[.12, .14]	[.13, .14]	[.13, .13]
SRMR	.05	.05	.07	.08	.06
Second-order Single-Factor FGSS					
χ2	192.35*	66.76*	121.38*	254.99*	465.95*
CFI	.94	.97	.91	.89	.92
TLI	.88	.94	.82	.78	.83
RMSEA	.24	.20	.26	.28	.27
90% CI	[.21, .27]	[.16, .24]	[.22, .30]	[.26, .32]	[.25, .29]
SRMR	.03	.01	.05	.05	.04

Note. The models being tested are in boldface. 90% CI = 90% confidence interval of RMSEA.
*$p < .01$

Table 2

Factor Loadings for the Five Factors of the FGSS in Studies 2 and 3

	Samples				
Scale Item	All Gamer	Female Gamer	Male Gamer	Non-Gamer	Total Sample
Lack of Femininity					
(1)	.91 (.91)	.94 (.94)	.84 (.86)	.86 (.85)	.89 (.84)
(2)	.93 (.93)	.95 (.95)	.89 (.88)	.87 (.86)	.90 (.90)
(3)	.84 (.84)	.88 (.87)	.79 (.79)	.77 (.78)	.81 (.81)
(4)	.91 (.90)	.94 (.94)	.84 (.83)	.81 (.83)	.87 (.87)
Lack of Sociability					
(5)	.57 (.58)	.63 (.64)	.49 (.49)	.58 (.57)	.57 (.58)
(6)	.90 (.89)	.92 (.92)	.88 (.86)	.88 (.84)	.90 (.87)
(7)	.89 (.90)	.91 (.91)	.84 (.86)	.80 (.85)	.85 (.88)
Lack of Gaming Competence					
(8)	.94 (.93)	.96 (.95)	.90 (.89)	.90 (.89)	.92 (.91)
(9)	.90 (.90)	.92 (.92)	.86 (.85)	.89 (.89)	.89 (.89)
(10)	.90 (.89)	.93 (.93)	.87 (.85)	.87 (.87)	.89 (.88)
(11)	.86 (.88)	.89 (.90)	.82 (.86)	.82 (.84)	.84 (.86)
Reliance on Men in Gaming					
(12)	.89 (.91)	.93 (.94)	.82 (.85)	.81 (.85)	.86 (.89)
(13)	.92 (.91)	.94 (.93)	.90 (.87)	.86 (.84)	.90 (.88)
(14)	.89 (.88)	.90 (.90)	.88 (.86)	.86 (.84)	.87 (.86)
(15)	.86 (.87)	.90 (.90)	.80 (.81)	.82 (.82)	.85 (.85)
(16)	.87 (.87)	.90 (.90)	.80 (.81)	.79 (.78)	.83 (.83)
Gaming Preference					
(17)	.78 (.82)	.81 (.86)	.77 (.80)	.74 (.75)	.77 (.79)
(18)	.81 (.80)	.91 (.90)	.66 (.65)	.70 (.69)	.75 (.75)
(19)	.71 (.69)	.79 (.74)	.59 (.60)	.79 (.77)	.74 (.73)
(20)	.59 (.58)	.62 (.60)	.55 (.53)	.74 (.74)	.65 (.64)

Note. Factor loadings reported are calculated by centroid algorithm. Maximum likelihood factor loadings are in the parentheses. Dimension names are in boldface. See Figure for scale items.

Table 3

Descriptive Statistics of the FGSS in Studies 2 and 3

	Mean	Standard Deviation	Range	Cronbach's Alpha	Kurtosis	Skewness
All Gamers						
femininity	3.05	3.01	(0, 10)	.94	2.23	.73
sociability	4.08	2.72	(0, 10)	.83	2.03	.30
competence	3.30	3.12	(0, 10)	.95	1.92	.54
reliance on men	3.05	3.06	(0, 10)	.95	2.15	.73
gaming preference	5.33	2.26	(0, 10)	.81	2.37	-.02
Female Gamers						
femininity	3.55	3.41	(0, 10)	.96	1.65	.46
sociability	4.53	2.97	(0, 10)	.86	1.74	.12
competence	3.51	3.46	(0, 10)	.96	1.64	.46
reliance on men	3.40	3.44	(0, 10)	.96	1.67	.55
gaming preference	5.57	2.50	(0, 10)	.86	2.14	-.22
Male Gamers						
femininity	2.57	2.48	(0, 10)	.91	2.93	.90
sociability	3.65	2.38	(0, 10)	.77	2.34	.37
competence	3.09	2.76	(0, 10)	.92	2.13	.54
reliance on men	2.72	2.61	(0, 10)	.92	2.64	.82
gaming preference	5.08	1.98	(0, 10)	.74	2.75	.17
Non-Gamers						
femininity	3.72	2.69	(0, 10)	.90	2.10	.36
sociability	4.66	2.48	(0, 10)	.79	2.15	-.06
competence	3.28	2.80	(0, 10)	.93	2.00	.44
reliance on men	3.18	2.69	(0, 9.80)	.92	2.23	.56
gaming preference	5.46	2.02	(0, 10)	.83	2.96	-.23
Total Sample						
femininity	3.38	2.88	(0, 10)	.92	2.10	.54
sociability	4.36	2.62	(0, 10)	.81	2.04	.12
competence	3.29	2.97	(0, 10)	.94	1.98	.50
reliance on men	3.12	2.89	(0, 10)	.94	2.20	.66
gaming preference	5.39	2.15	(0, 10)	.82	2.61	-.11

Note. Femininity = lack of femininity. Sociability = lack of sociability. Competence = lack of gaming competence. Reliance on men = reliance on men in gaming.

Table 4.

Convergent Validity Test for the FGSS in Study 2 and Study 3

	Lack of Femininity		Lack of Sociability		Lack of Gaming Competence		Reliance on Men in Gaming		Gaming Preference	
	r	95% CI	*r*	95% CI	*r*	95% CI	*r*	95% CI	*r*	95% CI
The ESS										
All Gamers	.87	[.85, .89]	.73	[.69, .76]	.84	[.82, .86]	.89	[.87, .90]	.61	[.55, .65]
Female Gamers	.91	[.89, .93]	.79	[.75, .83]	.93	[.91, .94]	.94	[.93, .96]	.71	[.65, .76]
Male Gamers	.78	[.74, .82]	.61	[.53, .67]	.71	[.65, .76]	.79	[.74, .83]	.42	[.32, .50]
Non-Gamers	.66	[.62, .71]	.44	[.37, .50]	.76	[.72, .79]	.80	[.77, .83]	.41	[.34, .48]
Total Sample	.77	[.75, .79]	.59	[.56, .63]	.80	[.78, .82]	.85	[.83, .86]	.52	[.48, .56]

Note: *r* = observed correlations.

Table 5

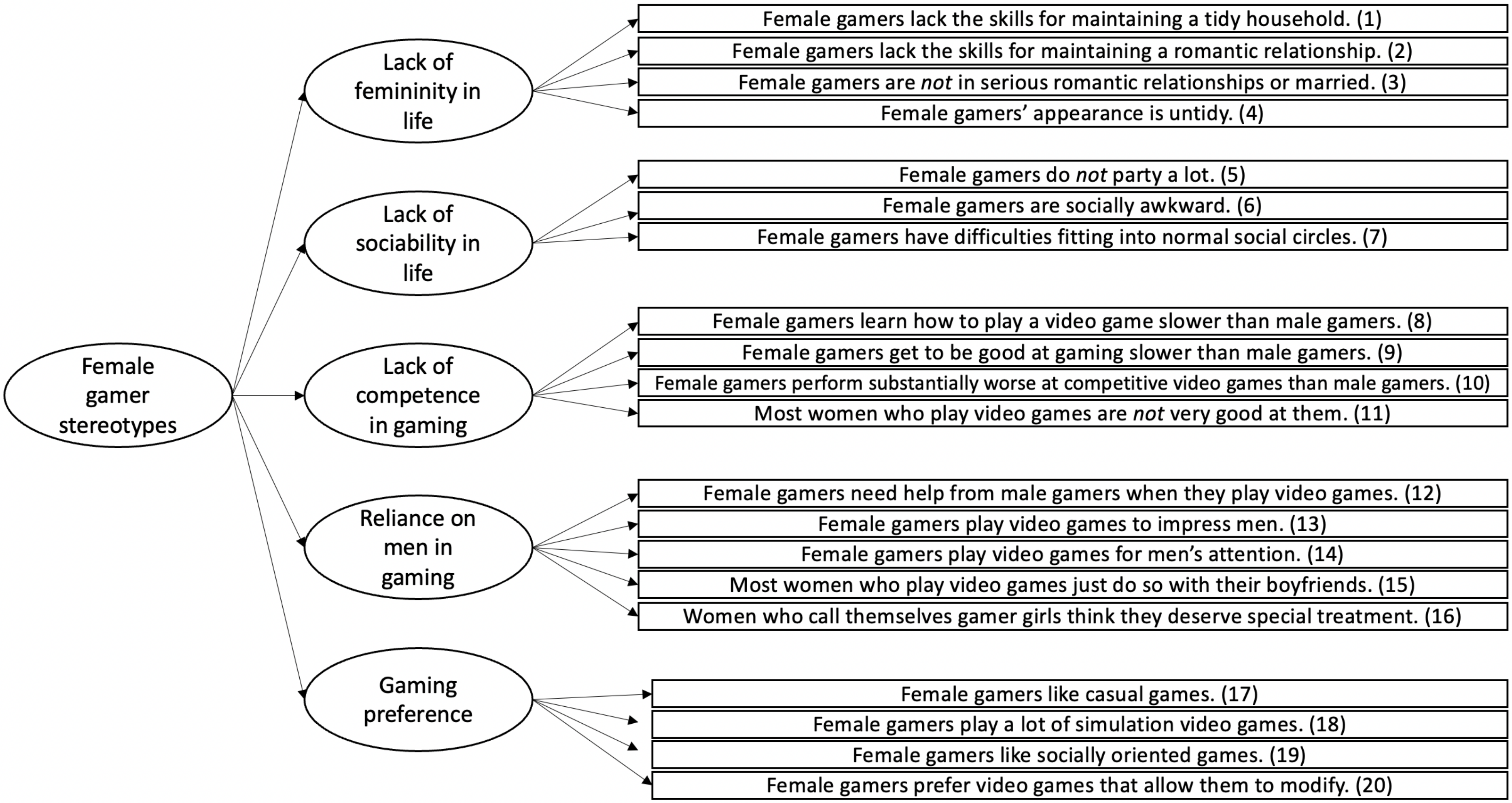
Discriminant Validity Test for the FGSS in Study 2 and Study 3

		All Gamers		Female Gamers		Male Gamers		Non-Gamers		Total Sample	
		χ^2	χ^2_{diff}	χ^2	χ^2_{diff}	χ^2	χ^2_{diff}	χ^2	χ^2_{diff}	χ^2	χ^2_{diff}
Freely estimated model	5-factor FGSS	584.56	-	483.97	-	375.08	-	562.89	-	890.91	-
Constrained model	femininity & sociability	1231.84	647.27*	892.64	408.64*	558.02	182.94*	952.49	389.60*	2121.48	1230.60*
	femininity & competence	1241.00	656.44*	996.54	512.57*	538.05	162.98*	949.15	386.25*	1906.32	1015.40*
	femininity & reliance on men	1366.27	781.71*	1.64.42	580.45*	557.07	182.00*	953.77	390.88*	2033.51	1142.6*
	femininity & gaming preference	776.69	192.13*	635.98	152.01*	403.87	28.79*	630.35	67.46*	1153.02	262.11*
	sociability & competence	977.07	392.5*	794.48	310.51*	466.39	91.32*	713.31	150.41*	1406.99	516.08*
	sociability & reliance on men	991.30	406.74*	791.07	307.1*	464.51	89.44*	703.13	140.23*	1412.53	521.62*
	sociability & gaming preference	738.89	154.33*	610.52	126.55*	399.29	24.22*	614.31	51.42*	1097.56	206.65*
	competence & reliance	1550.47	965.91*	1099.21	615.24*	658.79	283.71*	1107.42	544.53*	2561.73	1670.80*
	competence & gaming	872.19	287.63*	673.01	189.04*	465.40	90.32*	660.67	97.78*	1270.30	379.39*
	reliance on men & gaming competence	833.49	248.93*	651.51	167.54*	441.59	66.52*	643.84	80.94*	1222.55	331.64*

Note. Femininity = lack of femininity. Sociability = lack of sociability. Competence = lack of gaming competence. Reliance on men = reliance on men in gaming. In the freely estimated models, all parameters were estimated freely in CFA. In the constrained models, the correlation of the pair of factors (second column from the left) was constrained to be 1.00 in CFA. χ^2_{diff} = the difference between the freely estimated model and the constrained model. $p < .001$*

Figure 1

Conceptual Model of the Female Gamer Stereotype Scale (FGSS)



Note. Items 11, 15, and 16 were adopted from the VGSS, which is a measurement instrument developed to capture sexism toward female gamers (Fox & Tang, 2014).