EXPLORING THE IMPACT OF STEREOTYPE THREAT AND IDENTIFICATION ON GAMING PERFORMANCE: A PILOT STUDY USING CUSTOM AVATARS

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Abstract: *Stereotype threat, the fear of conforming to negative stereotypes associated with one's group, can significantly impact individuals in various contexts, including education, professional settings, and even entertainment, such as video games. In this study, a pilot experiment is conducted to examine the effects of stereotype threat on players' performance within a gaming environment. The methodology follows existing literature and employs a 2x2 matrix design. The participants play a simple 3D platform game and are divided into two groups: Custom Avatar Group - Participants in this group use avatars created from their own images; and Premade Avatar Group - Participants in this group use preexisting avatars that correspond to their gender while playing the game. Additionally, the presence of stereotype threat is manipulated by exposing half of each group to a fictitious article specifically designed to induce gender-related stereotype threat. This paper aims to address the following questions: (i) Can the recently available technology that enables players to create custom avatars based on their own images be successfully utilized for this type of experiment? (ii) How does stereotype threat impact players' in-game performance? (iii) Is there a correlation between the higher impact of stereotype threat and gender?*
The results of this paper will check for the impact on in-game performance of the new technology allowing players to play as themselves in video games.

Key words: Avatar creation, Identification effects, Computer Games, Digital Character

1. INTRODUCTION

Digital characters and avatars can have an impact on the user's attention, engagement, and thinking. The impact stems from the idea that users tend to identify with digital characters (Cohen, 2001), and as a result, the identification effects such as the Proteus effect (Van Looy, Courtois & De Vocht, 2010) or stereotype threat (Kaye & Pennington, 2016) may take place. In the context of this particular paper, the focus is put on the stereotype threat. Stereotype thereat can occur in everyday situations, professional or educational setting (Brooks, 2023) as well as in entertainment settings (Kaye & Pennington, 2016). As such, it is important to define it. It was first defined by dr Claude Steele as a threat that may occur when one does something or is in a situation or belongs to the group to which a negative stereotype applies (Brooks, 2023). This paper is a pilot study that checks for identification effects, specifically stereotype threat in players, depending on their gender and avatar type. In accordance with existing literature (Li, Lwin, & Jung, 2014; Ratan & Sah, 2015), this paper utilizes a 2 x 2 matrix. Participants are divided into groups based on whether they play with a generic character or a lookalike avatar. Additionally, they are further divided into two subgroups: one exposed to a fake article claiming men are generally better than women in video games, and the other to a real article stating that women progress at least equally well compared to men when given the same amount of time (Shen et al, 2016; UC Davis Department of Communication, 2017).
The purpose of this pilot study arises from the possibility that individuals in various regions may react differently to typical stereotype threat triggers. Additionally, the study aims to investigate whether participants with diverse video game skill levels are suitable for participating in this kind of experiment. This paper aims to address the following questions:

1. Can the recently available technology that enables players to create custom avatars based on their own images be successfully utilized for this type of experiment?
2. How does stereotype threat impact players' in-game performance?
3. Is there a correlation between the higher impact of stereotype threat and gender?

This research paper consists of three main sections in addition to the introduction and conclusion. The second section introduces the methods, participants and materials. The third section showcases the results of the experiment, including significant correlations. Finally the forth section discusses the results and answers the research questions.

2. METHODS

This section introduces the participants and experimental design, followed by procedure and materials. One of the key elements of the experiment is the game made specifically for the experiment by the authors. The game followed a simple mechanic explained in (Doran, 2023) with the addition of importing the Ready Player Me Unity software development kit (SDK) (Ready Player Me, 2024) in order to allow the participants to make and play with their lookalike avatars.

2.1 Participants and Experimental Design

This pilot study involved 33 participants who spoke the Serbian language, including participants who identified as men (*N=12*) and women (*N=21*). Women who participated in the experiment were between the ages 18 and 50, with the average age range being 18–24 with a standard deviation (SD) of 0.995 and the average education level being a bachelor's degree (*SD=0.653*). Similarly to women, men who participated were between the ages 18 and 50, with the average age range being 18–24 (SD=0.669) and the average education level being a current university student (*SD=1.603*). Looking at both groups combined, they have reported that, on average, they play video games less than once a month (*SD=1.889*), and the average self-reported general in-game skill level was at 1.79 (*SD=1.244*) on a 5-point Likert scale from 0 to 4, where 0 represented "not skilled at all," and 4 represented "extremely skilful."
Disregarding gender, the experiment employed a 2 (stereotype threat present vs. no stereotype present) x 2 (played with the character that looks like a participant vs. played with a generic character) matrix design.

2.2 Procedure and Materials

All participants played a game made by the author. The game was made in Unity engine 2021.3.11f1 (Unity, 2024) and consists of an endless platform environment with obstacles that players had to avoid appearing randomly as the game progresses. The environment is simple, utilizing only white colour, while obstacles are noticeable and in dark red. Upon hitting the obstacle, it would turn bright red, as depicted in Figure 1, indicating to the player that they have lost a life. Players had five lives (were allowed to hit the obstacle five times before game-over) or were limited to 240 seconds of playtime in case they did not lose all five lives. Player movement was done using the keyboard and the following keys:
W - forward, *S* - backward, *A* - left, and *D* - right, or corresponding arrow keys. The perspective of the game was third person, with camera control using a mouse.

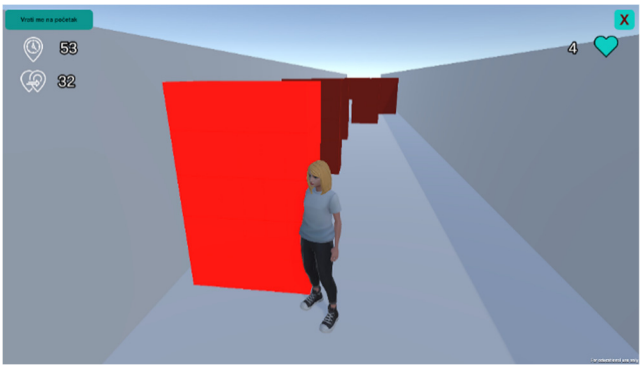

Figure 1: Overview of the game if a player hits an obstacle

Participants were invited to participate via a Google Form, where they got privacy notice in advance and were able to select which day and time was the most suitable for them to participate. The experiment spanned five working days, and the testing hours were divided into two intervals: 9:00 am – 12:5 pm and 16:00 pm – 20:00 pm in order to accommodate participants who are employed. The experiment took place in one of the classrooms of the Department of Graphic Engineering and Design, allowing for a maximum of 8 participants at the same time. Four computer workstations were labelled as "white group" and the other four as "blue group." Since the experiment took place at the end of August, the air condition was set to the same temperature for the duration of the experiment, and all participants had a water bottle and a granola bar prepared for them on the workstation (Figure 2, detail d). On the workstation, there were two sheets of paper stacked, one on top of the other. The top paper explained the privacy policy, what happens with

the collected data, and how it is stored. Under the privacy policy paper, there was a paper that had an online article printed out and translated into Serbian describing a research paper regarding the topic of skill progression between men and women. One-half of the participants got the correct version of the article that stated: "... they found that women advance at least as fast as men do in both games," while the other half of the participants got the fabricated article that stated: "... they found that women progressed much more slowly than men in both games." The second article was used to enforce the stereotype threat among participants identifying as women. Figure 2 depicts the workstation in the classroom.

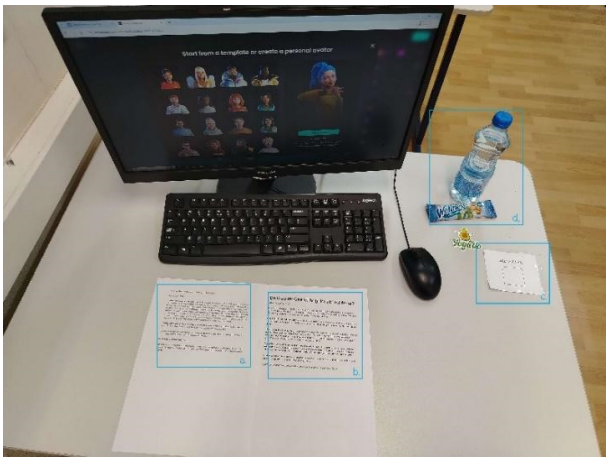

Figure 2: Workstation setup for participants. a) Policy privacy and information; b) Article that was used to trigger stereotype threat; c) White/Blue group indicator for participants playing with generic/custom characters; d) Snack

2.2.1 Introducing the participants to the experiment

Participants entered the classroom and were instructed to sit at the labelled workstations (Figure 2 detail c). In front of them were two papers stacked one on top of the other. They were informed to read the top paper first, which explained the privacy policy, which included a sentence stating that at any point in the experiment, participants can decide that they do not want to participate anymore (Figure 2, detail a) detail a, while the examiner provided any additional explanations. The examiner further informed participants about all the steps of the experiment and instructed them to read the second sheet of paper (Figure 2, detail b) without asking any additional questions about it.

2.2.2 Character creation

When participants were done reading, all of them were instructed to move their attention to computer monitors, where they were presented with a web page by Ready Player Me, which allowed them to take a picture of themselves using a web camera. Figure 3 showcases the step using an image created with the platform "Random Face Generator (This Person Does Not Exist)" instead of using a webcam in order to protect privacy.

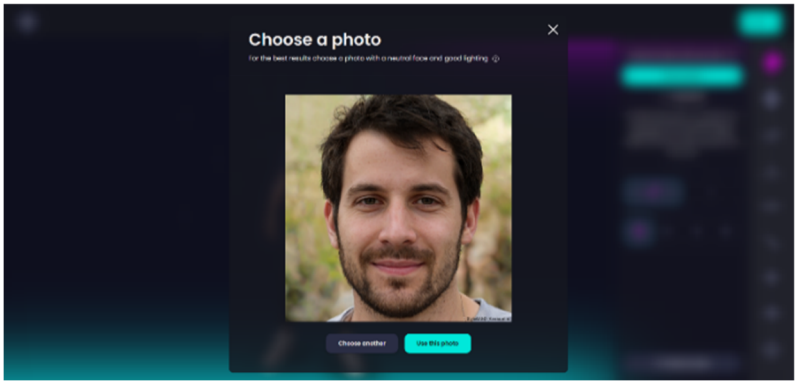

Figure 3: The first step in creating a custom avatar using an image of a participants (the face on this figure was generated using "This Person Does Not Exist")

The platform created the avatars resembling them, and the participants were further instructed to edit and dress the avatars so that they best represent themselves, depicted in Figure 4.

Figure 4: Customized character

When the participants were satisfied with the result, all participants were told to copy the avatar link, which is illustrated in Figure 5.

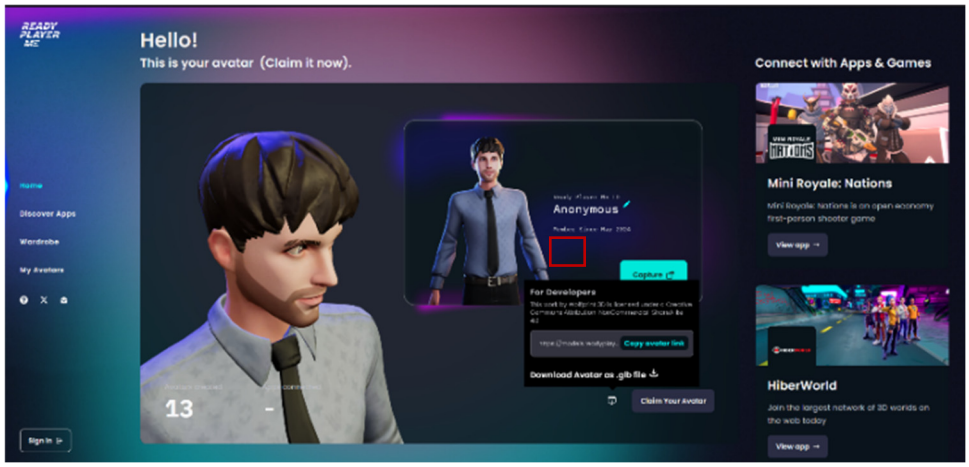

Figure 5: Copy the avatar link button

2.2.3 Game session

Finished with the avatar creation stage, participants were instructed to open up the game, where they were presented with the screen welcoming them and thanking them for participation (Figure 6, detail 1). Pressing the button "NEXT," participants entered the tutorial that explained the mechanics, movement, and metrics of the game (Figures 6, details 2 and 3) and allowed them to try and practice the game until they felt comfortable with the controls. Participants could see two scores, one representing the time played and one distance crossed in the game. The only way to successfully finish the tutorial was to lose all five lives. Figure 6, detail 4 shows the screen with the message that reads: "This is the end of the tutorial. If you want to try again, press the button in the top left corner. If you are ready, press the NEXT button." Following the tutorial, all participants got to the screen, which asked them whether they were in the white group or the blue group (Figure 6, detail 5). Participants that were part of the white group could only choose between two generic characters, one male and one female (Figure 6, detail 6.a), while the blue group was instructed to paste the previously created avatar link in the field (Figures 6, detail 6.b and detail 6.b.1), which then loaded their custom character (Figure 6, detail 6.b.2). The game session was finished after 240 seconds, or after participants lost all five lives. Losing all five lives triggered a screen that instructed the participants to

wait for the examiner to give further instructions, as depicted in Figure 6, detail 7. Following the game session, all participants began the next stage at the same time.

Figure 6: The main screens that participants were interacting with while playing the game. Screen 6. a was the screen the White group saw, while screens 6. b to 6.b.2 were the screens that the Blue group saw

2.2.4 Questionnaire

The final stage of the experiment process presented participants with a questionnaire consisting of the following sections, which were later translated to variables used in result analysis:

1. Game result questions:
    a. Selecting the group that they played as (white/blue),
    b. For how many seconds they have played the game, and
    What distance did they cross;
2. Game experience questionnaire:
    a. In-game questionnaire, and
    b. Post-game questionnaire;
3. General questions:
    a. Gender/age/Education,
    b. Previous experience in playing video games,
    c. Self-reported general in-game skill level, and
    d. Feelings towards the character creation platform used during the experiment:
        i. If the in-game character looked like them,
        ii. If they liked this way of character creation,
        iii. Whether other platforms should implement it and
        iv. Whether they are worried about the privacy policies and actions regarding these platforms;
    e. Feelings towards men and women in video games:
        i. Whether they believe that men are inherently better in games compared to women,
        ii. Whether both genders have equal chances to be good at video games and
        iii. If they believe that women are more often exposed to uncomfortable situations while playing video games and

4. Participants were asked to check either STDA or STNE, as a control question (participants reading the article that was inducing stereotype threat had to press STDA and participants that got neutral/real article had to press STNE).

It is important to note that some questions of this questionnaire were not directly used as variables in the results section of this paper, most notably questions 3.d.ii, 3.d.iii, and 3.d.iv.
After finishing the questionnaire, the participants were offered more water and granola and were on their way.

3. RESULTS

In the context of this particular paper, the following variables are of importance:

1. From section: Game result questions:
    a. *Was the group that had a Stereotype Threat trigger or not (1 = no stereotype threat, 2 = stereotype threat)* – ST,
    b. *White or Blue Group (1 = played with generic character, 2 = played with custom character)* – WB,
    c. *How long did they stay alive in seconds* – T,
    d. *What was the distance crossed during the playing time* – D,
    e. *Weighted Speed* – WS,

2. From section: General questions
    a. *Previous Gaming Experience (choice between 7 levels of experience, from none to playing multiple times a week)* – PGE,
    b. *What is your general skill level (5 point Likert scale, 0 = none, 4 = extremely skilled)* – GSL,
    c. *My character in-game looked like me (5 point Likert scale, 0 = completely disagree, 4 = fully agree)* – LLM,
    d. *Men are generally better in video games, compared to women (5 point Likert scale, 0 = completely disagree, 4 = fully agree)* – MBW,
    e. *Both genders have equal chances to become good at games (5 point Likert scale, 0 = completely disagree, 4 = fully agree)* – MEW,
    f. *I think that women are more often exposed to uncomfortable situations compared to men while playing video games (5 point Likert scale, 0 = completely disagree, 4 = fully agree)* – WUS,

3. From section: Game experience questionnaire,
    a. *In Game Competence* – IGC,
    b. *In Game Sensory and Imaginative Immersion* – IGSI,
    c. *In Game Flow* – IGF,
    d. *In-Game Tension or Annoyance* – IGTA,
    e. *In Game Challenge* - IGCH,
    f. *In Game Negative Affect* – IGNA,
    g. *In Game Positive Effect* – IGPA,
    h. *Post-Game Positive Experience* – PGPE,
    i. *Post Game Negative Experience* – PGNE,
    j. *Post Game Tiredness* – PGT, *and*
    k. *Post Game Returning to Reality* – PGR.

The variables with the prefixes "In Game" and "Post Game" are made according to scoring guidelines in the Game Experience Questionnaire (GEQ): Scoring guidelines – GEQ Core Module, and Scoring guidelines – GEQ Post-game Module (IJsselsteijn, de Kort & Poels, 2013).
The variable "Weighted Speed" is calculated using the following Equation(1):

$$WS = \frac{\sum PGE}{PGE} * \frac{D}{T} \quad (1)$$

The experiment design is a 2 x 2 matrix; however, since participants were both identified as men and women, it is necessary to look at the results separately.
In order to check for correlations, using IBM SPSS, Pearson's correlation was calculated.

Generally, for the sake of this experiment, the important correlation, regardless of gender, occurred between *WB* and *LLM* with [*r=.688, n=33, p<.001*]. Other sets of important correlations are WS and GSL, WS and IGC with [r=.717, n=33, r<.001] and [r=.539, n=33, r=.001], respectively. Finally, an interesting correlation in the context of this paper occurred between *ST* and *IGC* [*r=-.352, n=33, r=.044*]

3.1 Results for Men

Following the previous literature in the field in regards to whether there was an impact of stereotype threat, there were no significant correlations. Another expected correlation is between *WB* and *LLM* with [*r=.607, n=12, p=.036*]. Interestingly, there was a strong correlation between *WB* and *WS* [*r=.607, n=12, p=.036*].

In regards to the translated version of the Game Experience Questionnaire, there were some reaffirming correlations showcased in Table 1. *GSL* and *IGCH*, as well as GSL and PGNE, have strong negative correlations [r=-.619, n=12, p=.032] and *[r=-.678, n=12, p=.015*] respectively. Other significant correlations happened in regards to *IGC* and *IGF, IGC* and *IGTA, IGC* and *PGPE*, and *IGC* and *PGNE* [*r=.641, n=12, p=.025*], [*r=-.735, n=12, p=.006*], [*r=.702, n=12, p=.011*], [*r=-.763, n=12, p=.004*] respectively. *IGSI* and *IGCH, IGSI* and *IGPA* with [*r=.606, n=12, p=.037*], and [*r=.728, n=12, p=.007*] respectively. Another correlation following the logic of GEQ is between *IGF* and *IGPA* and IGF and PGPE with [r=.826, n=12, p=.001], [r=.761, n=12, p=.004], respectively. *IGCH* and *PGNE* have a positive correlation [*r=.635, n=12, p=.026*]. *IGNA* is, as expected, in a negative (albeit not very strong) correlation with *IGPA* with [*r=-.594, n=12, p=.042*], and *IGNA* is in a positive correlation with *PGT* [*r=.631, n=12, p=.028*]. *IGPA* and *PGPE* are in yet another expected correlation [*r=.681, n=12, p=.015*]. Following the previous correlation, *IGPA* and *PGR* are in correlation as well [*r=.709, n=12, p=.010*]. *PGPE* and *PGR* are in a positive correlation with [*r=.634, n=12, p=.027*]. Finally, an interesting negative correlation appeared between *WUS* and *IGNA* [*r=.-728, n=12, p=.007*].

Table 1: Pearson correlations regarding GEQ for male-identifying participants

		In Game Flow	In Game Tension Annoyance	In Game Challenge	In Game Negative Affect	In Game Positive Affect	Post Game Positive Experience	Post Game Negative Experience	Post Game Tiredness	Post Game Returning to Reality
What is your general skill level	Pearson Correlation			-.619*				-.678*		
	Sig. (2-tailed)			.032				.015		
	N			12				12		
I think that women are more often exposed to uncomfortable situations compared to men while playing video games.	Pearson Correlation				-.728**					
	Sig. (2-tailed)				.007					
	N				12					
In Game Competence	Pearson Correlation	.641*	-.735**				.702*	-.763**		
	Sig. (2-tailed)	.025	.006				.011	.004		
	N	12	12				12	12		
In Game Sensory and Imaginative Immersion	Pearson Correlation			.606*		.728**				
	Sig. (2-tailed)			.037		.007				
	N			12		12				
In Game Flow	Pearson Correlation					.826**	.761**			
	Sig. (2-tailed)					.001	.004			
	N					12	12			
In Game Tension Annoyance	Pearson Correlation			.578*				.802**		
	Sig. (2-tailed)			.049				.002		
	N			12				12		
In Game Challenge	Pearson Correlation		.578*					.635*		
	Sig. (2-tailed)		.049					.026		
	N		12					12		
In Game Negative Affect	Pearson Correlation					-.594*			.631*	
	Sig. (2-tailed)					.042			.028	
	N					12			12	
In Game Positive Affect	Pearson Correlation	.826**			-.594*		.681*			.709**
	Sig. (2-tailed)	.001			.042		.015			.010
	N	12			12		12			12
Post Game Positive Experience	Pearson Correlation	.761**				.681*				.634*
	Sig. (2-tailed)	.004				.015				.027
	N	12				12				12

3.2 Results for Women

Unlike men, there are some correlations that align with the literature regarding women. Most notably, there is a negative correlation between *ST* and *WS* [*r=-.524, n=21, p=.015*]. Moreover, women who played the game under stereotype threat gave a higher rate of agreement with the statement “Men are generally better in video games, compared to women,” with the correlation between *ST* and *MBW* [*r=.617, n=21, p=.003*]. However, there are no significant correlations between WB and WS in this case, but it is necessary to check for that correlation in the context of stereotype threat trigger, and not cumulative for all women.

WS had multiple positive and negative correlations with GSL, MBW, MEW, WUS, *and IGC,* with correlations [r=.674, n=21, p=.001], [*r=-.493, n=21, p=.023*], [*r=-.709, n=21, p<.001*], [*r=.525, n=21, p=.015*], [*r=.527, n=21, p=.014*].
GSL is in correlation with MEW, WUS, IGC, and *IGNA*, [*r=-.749, n=21, p<.001*], [*r=.666, n=21, p=.001*], [*r=.619, n=21, p=.003*], [*r=-.445, n=21, p=.043*]. *MBW* and *LLM* and *IGCH* are in the following correlations: [*r=-.564, n=21, p=.008*] and [*r=.445, n=21, p=.043*] respectively. There is a somewhat strong negative correlation between *MEW* and *IGC* [*r=-.522, n=21, p=.015*]. Furthermore, there is another somewhat strong correlation between *WUS* and *IGNA* [*r=-.446, n=21, p=.043*]. Table 2 showcases all previously mentioned correlations regarding female-identifying participants.

Table 2: Pearson correlations regarding female-identifying participants

		Weighted Speed	What is your general skill level	My character in game looked like me	Men are generally better in video games, compared to women	Both genders have equal chances to become good at games.	I think that women are more often exposed to uncomfortable situations compared to men while playing video games.	In Game Competence	In Game Challenge	In Game Negative Affect
Was the group that had Stereotype Threat trigger or not	Pearson Correlation	-.524*			.617**					
	Sig. (2-tailed)	.015			.003					
	N	21			21					
Weighted Speed	Pearson Correlation		.674**		-.493*	-.709**	.525*	.527*		
	Sig. (2-tailed)		.001		.023	.000	.015	.014		
	N		21		21	21	21	21		
What is your general skill level	Pearson Correlation	.674**				-.749**	.666**	.619**		-.445*
	Sig. (2-tailed)	.001				.000	.001	.003		.043
	N	21				21	21	21		21
Men are generally better in video games, compared to women	Pearson Correlation	-.493*		-.564**					.445*	
	Sig. (2-tailed)	.023		.008					.043	
	N	21		21					21	
Both genders have equal chances to become good at games.	Pearson Correlation	-.709**	-.749**					-.522*		
	Sig. (2-tailed)	.000	.000					.015		
	N	21	21					21		
I think that women are more often exposed to uncomfortable situations compared to men while playing video games.	Pearson Correlation	.525*	.666**							-.446*
	Sig. (2-tailed)	.015	.001							.043
	N	21	21							21

In regards to correlations dealing with GEQ, similarly to men, multiple correlations reaffirm the efficiency and accuracy of GEQ Serbian translation.
Finally, as already stated in this section, it is necessary to look at the results solely in case a stereotype threat is present. *WB* has no significant correlations with *WS*. However, there is an interesting negative correlation between *WB* and *MBW* [*r=-.603, n=12, p=.038*].

4. DISCUSSION

In this paper, the methodology and results of the pilot study are presented. The method employed a 2 x 2 matrix, where participants are divided into groups based on whether they play with a generic character or a lookalike avatar. Additionally, they are further divided into two subgroups: one exposed to a fake article claiming men are generally better than women in video games, and the other to a real article stating that women progress at least equally well compared to men when given the same amount. All 33 participants created a lookalike avatar. However, 17 participants played the game with the created lookalike avatar, and 16 played with a generic character, which aligned with their gender. The game itself is a simple infinite runner game that allows its players to go through the tutorial and choose their character, depending on the group.

4.1 Can the recently available technology that enables players to create custom avatars based on their own images be successfully utilized for this type of experiment?

There is a significant positive correlation between the players that belonged to the group that was supposed to play with a lookalike avatar and participants' grades on the level of similarity between them and the lookalike avatar, indicating that the platform Ready Player Me outputted a satisfactory result. Thus, the answer to the first research question is positive.

4.2 How does stereotype threat impact players' in-game performance?

When looking at all participants, there is no significant correlation between the condition of stereotype threat and weighted speed of the participants; there is a somewhat significant negative correlation between the results of the Game Experience Questionnaire in the section of In-Game Competence and the

condition of stereotype threat, when there is stereotype threat present. These results may indicate that stereotype threat has some negative impact on participants' perceived performance. Finally, the answer to the second research question cannot be answered confidently from this pilot experiment.

4.3 Is there a correlation between the higher impact of stereotype threat and gender?

The trend of no significant correlations between the stereotype threat condition and in-game performance, measured through the weighted speed, continues when looking at the results for male participants. However, the opposite is true for women. The negative correlation between the weighted speed and stereotype threat condition means that if the women were in the group that had stereotype threat triggered through the fake article, they performed worse. In order to further support this correlation, there is a positive correlation between the weighted speed and self-reported general in-game skill.
Since self-reported general in-game skills did not go into the equation while calculating weighted speed, this is a good indicator of the participant's ability to judge their gaming skills. Moreover, there was no significant correlation between the self-reported general in-game skill and stereotype threat condition. These results indicate that stereotype threat has the potential to impact performance for women, which is not the case for men, providing the answer to the third research question. Finally, it is important to mention that there was a positive correlation that occurred between stereotype threat conditions and whether women think that men are generally better at video games than them. This result could indicate the following:

1. women believed the article and/or
2. women's confidence in their gaming performance was influenced by the article.

From this pilot study, it is not possible to conclude which one of these two statements is correct.

5. CONCLUSIONS

Following the existing literature on stereotype threat impact to users of interactive media, this paper presents the methodology and results of a pilot study which included 33 participants, from diverse background when it comes to gaming experience.
The methodology followed the 2 x 2 matrix design, differing from other research by adding a 3rd dimension, gender. In order to conduct the experiment, a simple game was developed that employed a mechanic of infinite runner with obstacles and in order to implement custom character creation, a Ready Player Me SDK was used.
Results indicate that the Ready Player Me platform was performing well enough for this kind of study despite it offering highly stylized characters instead of realistic ones, answering the first research question. Furthermore, the diversity of the participants when it comes to previous gaming experience was mitigated using formula (1) and further presented a non-issue.
This pilot study was able to answer two out of the three research questions. Looking at the answer to the third research question, it can be concluded that this experiment design is able to induce some level of stereotype threat in participants identifying as women, while the same cannot be said in regards to ones identifying as men. Another positive conclusion is that this type of experiment can be conducted in regions outside the English-speaking ones if the materials used in the experiment are adequately translated.
In future work, this pilot study should be expanded to a larger number of participants since the current participant pool represents around 15% of the ideal participant number. Furthermore, due to the results of this pilot experiment indicating that there were no significant impacts from stereotype threat on male participants, future studies should focus on working with participants who identify as women. Finally, the results discussed as a part of the third research question can act as a green light for future studies on the topic of lookalike avatars and their impact on users of interactive media.

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