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Avatar-based Virtual Reality and the Associated Gender Stereotypes in a University Environment

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Abstract

Avatar-based virtual reality (VR) is becoming more prevalent in industry and educational settings. There is, however, limited research on the extent to which gender stereotypes are present in this environment. The university laboratory study presented in this paper was conducted in an VR environment with participants who were randomly assigned to male or female avatars and instructed to negotiate the role of a manager or member of staff. The results reveal differences in satisfaction regarding their roles and gender. Participants, who embodied a female avatar were less happy when they were subordinates interacting with a male avatar, compared to participants embodying a male avatar in the staff role (interacting with a female avatar). Male avatars with staff roles were also more content with their avatar than male avatars with manager roles and also reported being more comfortable in the VR experience. Relevant for diversity management when integrating VR in education and business, the results are discussed in regard to self-similarity and social identity dynamics and provide insight into understanding the extent to which gender stereotypes may be present in avatar-based virtual reality.

Index Terms—Computer mediated communication, virtual reality, gender stereotypes.

1. Introduction

Industry 4.0, digital transformation, computer-mediated communication (CMC), e-learning, social media, big data, cloud computing, virtual/augmented reality, or internet of things (IoT) are some of the current trending topics in the business field. Technology is transforming business and there is a need to successfully utilize new technologies, adopting processes which allow company leadership and staff to strategically employ new technologies on an ongoing basis (Herbert, 2017).

The integration of enterprise social media, which enables workers to communicate online and create digital spaces sharing and exchanging information (Leonardi, Huysman & Steinfield, 2013), and consequently the transformation of the business and education structures supporting this digitalized era, are within a dynamic area where ubiquitous technologies and social aspects intersect. In this sense, different technologies might ascribe sociopsychological features related to behavior and personality (Lytras et al, 2013).

Social media and CMC are understood as remote interaction which takes place through the use of computer networks (Baym, 2015) allowing a user to overcome challenges in regard to distance, through the development of tools and processes supporting cooperation in distributed teams (Giuffrida & Dittrich, 2015). Many of the key barriers to global collaboration are geographic, temporal, linguistic, and cultural distance (Noll, Beecham & Richardson, 2011). Modern technologies offer primary solutions in overcoming barriers with the provision of site visits and synchronous communication technologies which enable real-time communication (Walther, 1992) and a knowledge sharing infrastructure (Noll, Beecham & Richardson, 2011). Another of the traits of global collaboration is the inclusion of a diverse workforce. Diversity, understood as the presence of difference, would include dimensions such as ethnicity, gender, age, religion, ability (mental and/or physical), sexual orientation and

socio-economic status (Blaine and Brenchley, 2018). Managing a diverse workforce through computer-mediated communication requires very specific knowledge and much preparation.

Nevertheless, CMC is essential for global collaboration. CMC enables users to reach out to a vast number of receivers simultaneously allowing to notify a large group of people about the same thing and it helps to break down the barriers of communication such as physical limitations, shyness, or appearance (Althaus, 1997) While the main media for communication in many globally distributed teams has traditionally been telephone, email and video conferencing systems (Giuffrida & Dittrich, 2015), alternative technologies such as virtual reality (VR) offer some potential, since it allows for the construction of digital simulations which people can experience as virtually real. VR dissipates the separation between what is digital and what is real and it enables the user to step into digital worlds and a full envelopment (Tredinnick, 2018). Until recently VR has found application in telepresence, remote collaboration, data visualization, medicine (including surgical simulation), entertainment, and education among others (Fisher et al, 2018), but the very extent of how VR might develop and change the world still remains unclear (Slater & Sanchez-Vives, 2016). VR has a wide range of applications in psychology and neuroscience, but there has been little research linking sociopsychological investigations in the area of human behavior with education or industry contexts. Thus far, the key contexts in which VR is being applied in business are simulation, situations requiring co-presence, and training applications (Tredinnick, 2018).

In this paper, we present findings from an empirical study on stereotypical perception in a VR setting. The study was a co-present situation, where participants had to interact and negotiate different roles in a virtual room. In the negotiation process, it was observed if gender had an influence on role assignment. Traditionally, women have been negatively stereotyped and perceived as less competent within digital communities (Kaye, Pennington & McCann, 2018). Knowing how far sexism and gender stereotypes are present in virtual environments, or

on social media, this will be relevant for diversity management when integrating VR in education and business encounters. Therefore, within the framework of these criteria, the paper aims to provide insights into understanding the extent to which gender stereotypes are present in avatar-based virtual reality, inviting a discussion about the impact it could have when using VR in an educational setting.

The paper is structured as follows: We first present the hypotheses of the study based on research on avatars and social perception, demonstrating how broad and intricate the issue of stereotypes is and how it relates to avatar-based VR. Subsequently, the research design is presented to determine the extent to which gender stereotypes are present in avatar-based virtual reality. In conclusion, a discussion about how avatar creation can impact social learning situations in virtual settings will be initiated.

2. Related Work

Our perception of other people is – at least partially – informed by stereotypes. A stereotype offers a simplification of a complex social reality, it comprises knowledge about attributes and behavior about people (Denmark & Paludi, 2007). As socio-cognitive knowledge structures, stereotypes are something that each person carries within themselves, yet they are socially shared, created, and recreated through social situations. This dual structure of stereotypes leads to a continuous validation through consensus, leading to alleged knowledge of a social group being perpetuated in every act of repetition (Eckes, 2008; see also Ashmore & Del Boca, 1979, Schneider 2004).

In CMC avatars symbolize the self in interaction, therefore when different users interact in digital environments, judgements, attributions, and stereotypes will be based on appearance and behaviors of others' avatars and avatars may influence users' behaviors in the interactions (Nowak & Rauh, 2005; Nakamura, 2009). The different representations of avatars have an

influence on perception and attribution of determined sources and characteristics (including stereotypes), having implications for digital interactions. Characteristics of avatars are determined by user preferences, experiences within different environments, social norms and technological capabilities – these characteristics in turn can augment or limit people’s ability to self-present and engage in digital environments (Blascovich et al, 2009; Stromer-Galley & Martey, 2009). Among the characteristics included would be appearance, abilities, traits or behaviors that can reflect reality or not. Apart from providing a form of embodiment that enables navigation through virtual spaces, avatars can also facilitate nonverbal communication via gestures, body posture, proxemics, and even haptics (Biocca, 1997). As avatars have an influence on beliefs, attitudes and behaviors in communication, differences in representations are notable (Nowak & Fox, 2018).

To understand avatar perception, information processing theory (Walther, 1992) provides insights about how people attribute emotions or intentionality based on categorizations such as age or gender (McGuire, 1968). The more human-like avatars are perceived, the more likely it is that the findings and theories of human communication will also apply to avatar-based interactions. Therefore, understanding how people perceive avatars might help to predict processes and outcomes in CMC. Among the aspects that can influence users’ perceptions of avatars would be agency, referred to people’s perception of an entity as a human or not, anthropomorphism, referring to possessing human forms or behaviors, and realism, related to having accurate forms or behaviors.

Due to the fact that avatars are perceived as social entities, people engage similar categorization processes as in reality applying the same heuristics and stereotypes associated with human members of the different categories (Nowak et al, 2006). In concern with the information processing theory (Walther, 1992) the more social potential avatars are perceived, the more likely this categorization would occur. One of the most common categorizations

humans make of others are based on their gender. In understanding others, identifying appropriate interaction scripts and predicting behaviors, people believe that sex categorization provides useful information (Lakoff, 2008). Thus, unsurprisingly sex and gender attributions have remained salient in CMC contexts (Fox et al, 2015).

One of the most prominent models of stereotypical intergroup/interpersonal perception is the Stereotype Content Model (SCM), which conceptualizes social perceptions on two basic dimensions: warmth and competence (Fiske, 1999; Fiske, 2002; Cuddy, 2008). “Warmth” describes how benign, likable and warm members of a certain group are considered to be, and “competence” describes how able, competent, and independent the group member are perceived. Generally speaking, women are perceived to be warmer than men, whereas men elicit higher ratings of competence (Fiske, 2002; Cuddy, 2007). High ratings on both dimensions are commonly reserved for the members of one’s in group or groups that are highly admired in society, such as celebrities and stars. Remarkably, perception of out-groups is often not generally negative, but ambivalent, with high values on one dimension and low values on the other dimension (Fiske, 2007). Groups that are classified comparably on these dimensions usually provoke similar emotional and behavioral responses (Cuddy, 2007).

Typically, some groups are perceived as cold but competent (e. g. rich people) and are envied, whereas other groups are perceived as warm, but incompetent (e. g., the elderly or housewives) and are pitied. The SCM reveals how references based on these two dimensions lead to subtle and complex patterns of stereotyping, prejudices, and discriminating behavior (Cuddy, 2008; Fiske, 2007). Notably, gender stereotypes do not only have descriptive aspects (i.e. how members of a group *are*) but also prescriptive aspects, i.e. what members of a group *should* be like (Eckes, 2008). Deviations of these prescriptive stereotypes can lead to rejection or punishment. Social and economic sanctions for counter-stereotypical behavior are known as the backlash effect (Rudman, 1998). Referring to the SCM, this is also evident in the

stereotypical perception of certain subgroups, e.g., businesswomen are perceived as more competent than the “average woman”, but cold(er), whereas businessmen are perceived as competent but without the loss of warmth that businesswomen receive. Not surprisingly, the perceptions of professional groups also cluster in alignment with gender stereotypes. Several studies demonstrate (Glick, 1991; Glick, 1995) that healthcare professions such as social workers, psychologists, nurses and jobs in education such as schoolteachers are linked to warmth traits, whereas managerial and technical professions are not considered to require such traits.

Research on stereotypes shows that people unwittingly ascribe characteristics based on physical characteristics such as biological sex and race (Lee, Nass & Bailenson, 2014; Nakamura, 2009). Regarding education or business attainment, gender stereotypes and bias, understood as cultural beliefs about gender (Ibarra & Petriglieri, 2016) are reflected in occupational segregation of men and women. In literature, vertical segregation, also known as the “glass ceiling”, refers to the invisible barrier that difficulties women to make their way up in the corporation while preventing them to fully develop professionally (Barreto, Ryan & Schmitt, 2009). The word “ceiling” denoting high distance, refers to the struggle for women to climb up the organizational ladder while the word “glass” reflects the lack of a clear visibility of this barrier (Barreto, Ryan & Schmitt, 2009). The newly-coined expression inspired the arise of many other terms, “glass walls” refers to the horizontal segregation, this is, high concentration of women in certain departments such as marketing, sales or human resources (Miller, Kerr & Reid, 1999); “glass slipper”, namely the lack of ambition to leadership positions (Rudman & Heppen, 2003); and “glass cliff” refers to the fragile and uncertain presence of women on top (Ryan & Haslam, 2007). The variety of terms confirms gender stereotypes and bias which negatively impact women’s leading role assumptions.

Unsurprisingly, sex and gender attributions have remained salient in CMC contexts (Fox et al, 2015). Gender stereotypes also occur in CMC (Nowak et al, 2009) and in comparison to the male avatars, female avatars are subject to more sexual harassment (Behm-Morawitz & Mastro, 2009). Stereotypical or sexualized virtual representations of women elicit more sexism than non-stereotypical representations (Fox & Bailenson, 2009), encouraging to perceive women as less intelligent (Behm-Morawitz & Mastro, 2009), in line with the assumptions of the SCM that demonstrated the association of femininity with lower competence, as women generally are attributed a lower competence traits than males (Fiske, 2002; Cuddy, 2007).

One of the possibilities that avatar customization offers, is the creation of androgynous avatars where gender categorization is not possible. However, no research has been done to understand how people process and categorize androgynous avatars to our knowledge. This additional research would be particularly interesting considering self-similarity and social identity approaches. Bearing in mind that the characteristics of the avatars influence in the way the receivers interpret messages and sources, manipulating the characteristics of the avatars and playing with androgynous dyads in CMC environments would be interesting to see how outcomes such as social influence, communication satisfaction or task performance are affected.

In relation to avatar selection as self-representation, it is important to consider that the way people present themselves has an impact on people's ability to achieve their social goals (Goffman, 1978) and on career success (Ibarra, 1999). Besides attributes such as gender, age and ethnicity, the physical height of a person has also found to be an influential factor in human communication and a potential source of stereotyping (Judge & Cable, 2004; Moeller, Robinson & Zabelina, 2008) Being taller is associated with a number of qualities such as being more dominant, composed, expressive, dramatic, self-assured, persuasive, having more leadership qualities and showing less self-censorship (Burgoon & Dunbar, 2000). Regarding

augmented reality settings, Walker, Szafier and Rae have found that the relative size of the other interaction partners avatar matters: they found the equal-sized avatars of a remote user to be significantly more influential (on the local user) than the small-sized avatars (Walker, Szafir & Rae, 2019).

In digital environments, the flexibility at modifying self-representation is much greater than in face-to-face settings. As summed up in the previous section, the use of avatars for self-representation influence people's evaluation and judgment. As users make judgments of avatars, avatar selection is significant to meet interaction goals. Through avatar selection people aim to identify and express the self to others. It is common among users to choose avatars that truthfully represent any physically or psychologically trait about them (Nowak & Rauh, 2005). Even when users try to convey elements of their social identities such as gender, age or race when selecting avatars (Nowak & Rauh, 2005; Nakamura, 2009) the tendency is to select avatars that depict more aspirational or idealized versions of the self (Bessièrè, Seay & Kiesler, 2007). In this sense, avatars can accurately represent some characteristics of the users, and inaccurately present other aspects of the self. However, this not always is a choice. Sometimes technological constraints, social norms or limitations on avatar options make difficult to convey one's authentic identity (Nowak & Fox, 2018).

Alternatively, some users select different avatars with the intention of exploring different identities and see how it feels to be an "other" (Bessièrè, Seay & Kiesler, 2007). While identity exploration via avatars can contribute to gaining identity self-acceptance, to building relationships or to self-disclose others, it can also have negative outcomes such as reinforcing negative stereotypes (Nakamura, 2013). As it was shown in some of the experiments described during the development to this thesis and in line with the *Proteus* effect (Yee & Bailenson, 2007), avatar embodiment enacts stereotype-consistent behaviors, this is, the behavior of the user conforms to the representation of the self, regardless of the real self. The avatar's

characteristics may influence the user's online and off-line communication. Being embodied by an attractive avatar results in closer approaches by the partner's avatars and in a disclose of more personal information, while being embodied by tall avatars elicits more confident and aggressive negotiating behaviors (Yee & Bailenson, 2007). Recent work by Peck, Good, & Bourne (2020) brings more evidence forward that gender stereotypes are not only are effective in VR settings regarding the perceptions of others, but they also affect the behavior and performances of those embodying an avatar and can even lead to the nullification of the - usually very robust effects- of stereotype threat. Female participants with female avatars showed working memory impairment under stereotype threat (which did not occur in the female/female avatar group). Interestingly, female participants embodying a male avatar did not show this memory impairment under stereotype threat, either. These findings suggest that using a male avatar was able to protect the female participants from the negative effects of stereotype threat, thus replicating a previous study. They found more evidence of the Proteus effect, as even men with a female avatar showed impairment in the stereotype threat condition, whereas men with a female avatar under no threat did not. Additionally, men's performance within male avatars suffered in the "no threat-conditions, in line with assumptions about the workings of positive stereotypes, i.e. "stereotype lift" (Walton & Cohen, 2003), which in this case, was not activated. However, as Palomares and Lee demonstrated, users tend to adopt a gender-typical language that suits their avatar's gender (2010). These findings suggest that communicative outcomes of avatar selection are not only based on receiver's impression, but also on sender's experience.

To summarize avatar appearances have an impact on self-perception, attitudes and behaviors as well as on its perceptions by others. As mentioned, choosing an avatar that masks one's gender is a common practice for women in order to prevent harassment in videogaming and virtual communities (Cooper, 2007; Ducheneaut et al, 2006; Williams, et al, 2009). Also

people of color sometimes prefer not to disclose their race or ethnicity to avoid being stereotyped, discriminated or harassed (Yee & Bailenson, 2007). But as discussed above, limiting the visibility of targeted groups, as women or people of color, as if they were not present in virtual environments has more downsides than benefits.

3. Research Questions

Encounters with other people – whether face-to-face or in VR – are perceived as social interactions. People use similar cognitive processes to perceive virtual representations of a person, so avatars in VR can evoke stereotypes in a similar way a bodily representation of a person does (Nowak & Fox, 2018). Virtual others that are represented as women are therefore subject to gendered perception and can trigger sexist reactions (Behm-Morawitz & Mastro, 2009). Gender stereotypes imply an association between men and leadership and women and follower (Braun et al, 2017). We therefore have the following hypothesis for our setting in which a male and a female avatar meet and have to agree on a who takes the role of the manager and who takes the role of the team member:

Hypothesis 1: The manager role was mostly played by the male avatar, and the team member role was mostly played by the female avatar.

For the understanding of gender stereotypes and bias, we refer to the stereotype content model (SCM), a social psychological theory that determines that all group stereotypes and interpersonal impressions are formed along two dimensions: (1) warmth and (2) competence (Cuddy, Fiske & Glick, 2008). The warmth dimension would aim to assess a stranger's intent to either harm or help while the competence dimension seeks for judging stranger's capacity to act on a perceived intention. Stereotypically, men are perceived as (and expected to be) more competent, while women are perceived as (and expected to be) warmer (Cuddy, Fiske & Glick, 2008).

Hypothesis 2: Male avatars were more associated with competence traits than female avatars and female avatars were more associated with warmth traits (likable, good-natured, warm) than male avatars.

In line with SCM, we expected a general perceived gender stereotypicality: We expect, considering the ratings of women and men on a general level, the stereotypical pattern of high ratings for females' warmth and higher ratings for males' competence to emerge. Regarding self-perception: We expect positive self-ratings on both dimensions, warmth and competence (in-group favoritism).

Research that aimed at exploring how the physical characteristics of an avatar relate to the perception of the avatar have shown that it plays an important role how similar somebody perceives the avatar to themselves. In online games, players that are able to identify with their avatars have a more positive experience and the actual physical similarity results in better performance with a task (Wauck, 2018). At the same time, it has been shown that the virtual self-representation has an influence on the behavior and the cognitions of users, i.e. people behave in line with the way their avatar would stereotypically be expected to behave. This phenomenon has been called stereotype lift (Lee, Nass & Bailenson, 2014) or Proteus effect (Yee & Bailenson, (2007). Research done specifically to analyze the effects of gendered stereotypes show that independent of their gender, users tend to conform to female-typed behavior when embodied in a female avatar (Palomares & Lee, 2010). We therefore hypothesize:

Hypothesis 3: People that had the "male – manager role" enjoyed the experience more and were happier with the avatar they had.

Hypothesis 4: "Female avatar – member of staff" was the less preferred role.

4. Research Methodology

In order to test our hypotheses, we ran a quasi-experimental study. The study took place in two VR labs on two different campuses of a university in Germany. From the two locations the participants scheduled in the same time slot would meet in a virtual room and work on a task together. The task was to explore how suitable the VR room that they found themselves in was for a performance review talk between a manager and a member of staff. For this, one of them was to take the role of the manager, the other one was to take the role of the team member and explore the room from that perspective. The room itself was designed like a modern business-style flat featuring several rooms with big glass windows, design chairs and other furniture. This cover story was used to explain why the participants had to agree amongst themselves who would be the manager and who the member of staff. The participants were randomly assigned a male or a female avatar, i.e. participants were not allowed to choose the gender of their avatars but were allowed to choose the roles they wanted to play.

Participants

The experiment was conducted with students of the Bachelor's program Software Engineering at a University in 2018. The students participated in the study for extra credit. There were $N=48$ participants ($M_{age} = 21.56$, $SD_{age} = 3.119$, 95%), six of them identified as female ($M_{age} = 23$, $SD_{age} = 3.536$, 95%) and 41 male ($M_{age} = 23.32$, $SD_{age} = 3.092$, 95%) and one did not reveal their gender.

Design

The study featured a 2 (avatar gender: male vs. female) x 2 (performance role: manager vs. member of staff) design. Dependent variables were (a) the role (manager or member of staff) assigned to the female or the male avatar, (b) evaluation of gender stereotypes based on the stereotype content model (SCM), (c) enjoyment of VR experience, (d) happiness with the

avatar, and additionally, (e) evaluation of the suitability of VR for performance review was measured.

Procedure

At the beginning of the session participants were shown the system and the head-mounted VR headset HTC Vive was put on the participant's head. They were made familiar with the functions of the controllers and were provided with an accommodation time of two minutes, during which users could test the controls and ask questions. Following this, the audio headset was put on and switched on. The maximum time that participants were in the VR room was set to ten minutes. After exiting the VR, participants completed a questionnaire administered on a tablet computer using a standard survey software (keyingress).

Materials

Based on the SCM, using the items by Cuddy & Fiske (2002), three variables were combined to determine warmth: "likeable", "good-natured" and "warm" and three variables were included to evaluate competence: "competent", "competitive" and "independent". Participants were asked to rate the other participant they were negotiating roles and exploring the room with on these dimensions Responses were recorded on a 7-point Likert scale anchored between 1 (Disagree) and 7 (Agree).

The effect of variables avatar gender and adopted role on happiness with the given avatar was examined ("I was happy with the avatar I had"). Responses were also recorded on a 7-point Likert scale anchored between 1 (disagree) and 7 (agree).

The participants engagement, enjoyment and immersion was assessed with 14 questions, enjoyment was understood to be a feeling of pleasure or contentment during the VR experience (Witmer & Singer, 1998). The questions were based on Makransky's multimodal presence scale for virtual reality environments (Makransky, Lilleholt & Aaby, 2017), with following additional items: "I enjoyed myself during the virtual reality experience.", "I felt sad

when the virtual reality experience was over.”, “I would like to repeat the experience I just had.” “The virtual reality experience was interesting.” Responses were recorded on a 7-point Likert scale anchored between 1 (disagree) and 7 (agree).

Analysis

Data was analyzed using SPSS. Outlying rates, determined by stem and leaf plots, were replaced with the highest or lowest extreme rates in the dataset (Tabachnick & Fidell, 2013).

This outlier exclusion did not alter the reported results.

A two-way 2 (avatar gender: male vs. female) x 2 (performance role: manager vs. member of staff) analysis of variances (ANOVAs) and Chi-square tests were used for analysis. Dependent variables were (a) the role (manager or member of staff) assigned to the female or the male avatar, (b) evaluation of gender stereotypes based on the stereotype content model (SCM), (c) enjoyment of VR experience, and (d) happiness with the avatar.

5. Results

Positive effect sizes denote that the results are consistent with experimental predictions, whereas negative effect sizes denote that they are contrary to predictions.

5.1 Gender Bias

According to hypothesis 1, and in line with stereotypical social beliefs regarding gender and roles, we expected the manager role would be mostly played by the male avatar, and the team member role would be mostly played by the female avatar. Figure 1 shows the frequencies of the adopted roles in relation to avatar gender: The differences were not significant ($\chi^2 = .201$, $p = .654$), i.e. our study did not show a significant effect of avatar gender on the role that was adopted by the participant.

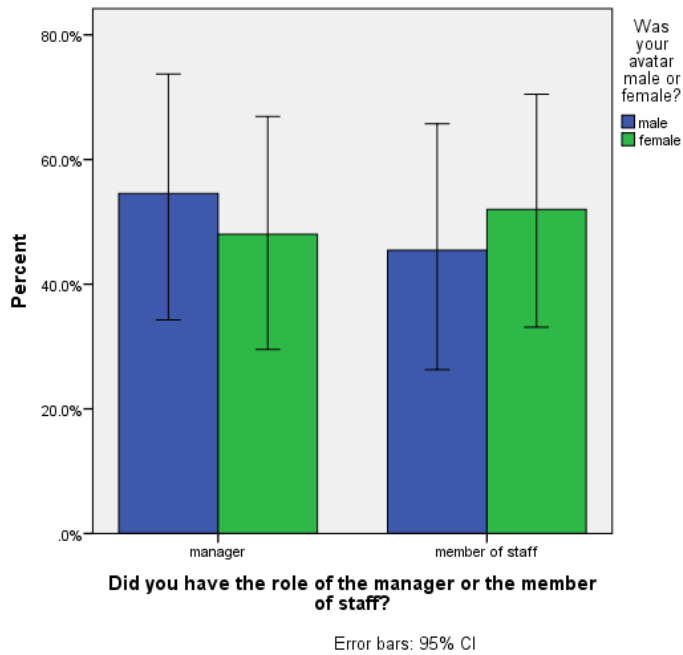


Figure 1. Relationship between gender and role.

5.2 Warmth and Competence traits

There were no significant differences between the groups, so hypothesis 2 was rejected, i.e. there was no link between the gender of the other avatar and perceived warmth or competence traits as the ANOVA showed no significant effect of the gender of the avatar on warmth or competence ratings in our sample, WELCH $<.247$, $p>.662$. Figure 2 shows the perceptions that people had regarding the warmth and competence dimensions of themselves (SCM Self), of VR users (SCM-Users), and of other people in general, distinguishing between genders (SCM Women and SCM Men).

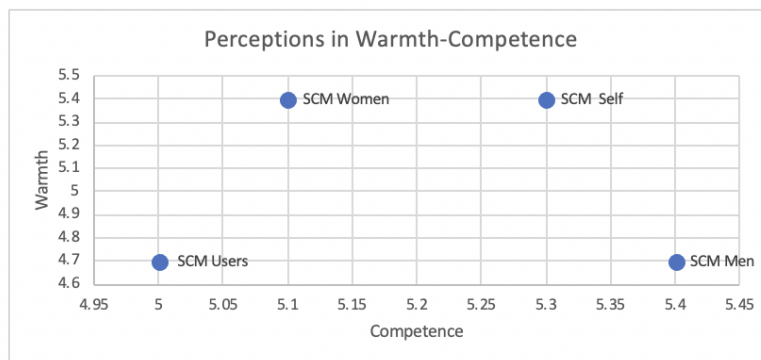


Figure 2: Perceptions in warmth and competence dimensions.

Regarding differences between genders and confirming the predictions of the stereotype content model, the ANOVA of within-subject factor “Competence” showed that women ($M = 5.12$, $SD=.92$), were perceived as less competent than men ($M = 5.46$, $SD=.99$, $F[1,40]=15.23$, $p<.000$).

Considering the warmth dimension, women ($M = 5.37$, $SD=1.07$), were considered to be warmer than men ($M = 4.68$, $SD=.89$; $F[1,40]= 26.09$, $p<.000$). Concerning self-perception, people also perceived themselves as high in both dimensions ($M_{warmth} = 5.42$, $SD= M_{competence} = 5.28$, $SD=.88$).

5.3 Avatar Self-Similarity and Evaluation

In testing H3 and H4 the effect of variables avatar gender and adopted role on happiness with the given avatar was examined. The two-way 2 (avatar gender: male vs. female) x 2 (performance role: manager vs. member of staff) analysis of variance of the variable “happiness with avatar” showed that no main effects emerged, but the interaction between role and avatar gender was significant ($F [1;43] = 6.53$, $p = .014$, see also Figure 3).

For those who had the manager role, the difference between male and female avatars was not significant ($F [1;43] = 2.09$, $p = .155$, see also table III). However, for the participants who assumed the member of staff role, the difference in happiness between male and female avatars was significant ($F [1;43] = 4.38$, $p = .042$), i.e. people with a male avatar in a staff member role ($M= 6.10$, $SD = .99$) expressed much more contentment with their avatars than female avatars ($M = 4.69$, $SD = 1.97$) in that role.

Regarding avatar gender, participants who were represented by the male avatar showed differences in happiness when assuming the different roles ($F [1;43] = 5.06$, $p = .030$), as participants, who played a male staff member ($M= 6.10$, $SD = .99$), were happier with their avatar than participants who played a male manager ($M=4.58$, $SD=1.44$). Meanwhile participants who played the female avatar showed no significant difference ($F [1;43] = 1.72$, p

= .197) when assuming the roles of the manager or member of staff. Thus, participants who had a “male avatar – member of staff role”, were happier with the avatar they had (compared to the female member of staff and the male manager role) and contrary to our prediction the people were the least happy with the “male avatar – manager role” combination ($M = 4.58, SD = 1.44$).

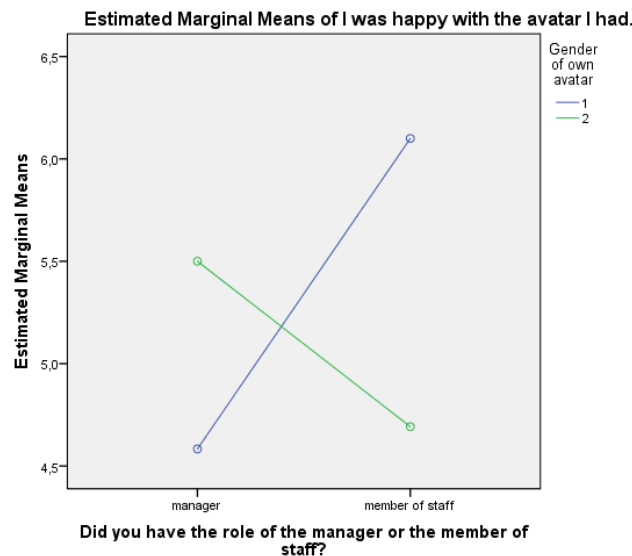


Figure 3. Interaction effect of avatar role and avatar gender on one’s happiness with the avatar (Gender of own avatar: 1 = male avatar, 2 = female avatar)

The ANOVA of the variable “Sadness when the VR experience was over” with between-subject factors “avatar gender” and “role” showed a significant effect of avatar gender, $F [1,43]= 4.14, p<.048$. Participants who were assigned a male avatar ($M=5.32, SD=1.67$) indicated more sadness that the VR experience was over than participants who embodied a female avatar ($M=4.32, SD=1.75$).

The ANOVA of the variable “the environment was beautiful” with between-subject factors “avatar gender” and “role” showed a significant effect of avatar gender, $F [1,43]=4.60, p<.038$. Participants who embodied a male avatar considered the VR environment to be more beautiful ($M=5.86, SD=1.01$) than participants embodying the female avatar ($M=5.00, SD=1.64$).

The ANOVA of the variable “I was comfortable in the virtual environment” with between-subject factors “avatar gender” and “role” showed a significant effect of role, $F [1,43]= 4.58, p<.038$. Participants in the member of staff role were more comfortable in the environment ($M=6.17, SD=1.15$) than participants who had the manager role ($M=5.42, SD=1.21$).

The ANOVA of the variable “The virtual reality experience was immersive” with between-subject factors “avatar gender” and “role” yield a significant effect of “role”, $F [1,43] = 4.34, p<.042$. Participants playing a member of staff ($M= 5.64, SD=1.43$) rated the experience as more “immersive” that participants in the manager role ($M=4.88, SD=1.08$).

The ANOVA of the variable “The virtual reality experience was exciting” with between-subject factors “avatar gender” and “role” yield a significant effect of “role”, $F [1,43]= 6.64, p<.014$. Participants, who adopted a member of staff role ($M=6.52, SD= .73$) considered the experience as more exciting than participants in a manager role ($M=5.79, SD=1.14$).

The ANOVA of the variable “I was completely captivated by the virtual word” with between-subject factors “avatar gender” and “role” yield a (marginal) significant effect of role, $F [1,42]= 3.90, p<.055$. Participants who were embodying members of staff ($M=4.86, SD=1.73$) indicated being more captivated by the virtual world than participants in a manager role ($M=3.92, SD=1.64$).

The ANOVA of the variable “my experience in the virtual environment was pleasant” with between-subject factors “avatar gender” and “role” showed a (marginally) significant effect of “role”, $F [1,43]= 3.81, p<.058$. participants, who played the staff role ($M=6.17, SD=1.23$), evaluated their experience as more pleasant than participants who played the manager role ($M=5.54, SD=1.10$).

The ANOVAs of the other variables from Makransky's multimodal presence scale for virtual reality environments regarding embodiment, sense of presence and easiness of figuring things out in the VR environment, as well as the other additional items ("wish of repeating the experience.", "the VR experience was interesting", "I enjoyed myself during the experience"), with between-subject factors "avatar gender" and "role" did not yield any significant effects.

6. Discussion

In this study participants were randomly assigned a male or female avatar and were instructed to negotiate a role - manager or member of staff. The analysis examined the influence avatar gender may have on role negotiation with variables based on the SCM (Cuddy, Fiske & Glick, 2008), on the theories of the *Proteus* effect (Ducheneaut et al., 2006), as well as on other experiments conducted in the fields of avatar-self-similarity (Wauck et al., 2018). Our study results did not find any significant effect on the gender of the avatar on role negotiation, nor did the gender of the other person's avatar have an effect on either the warmth or competence ratings of the other. As expected, when looking at the scores of self-perception, people rated themselves highly in both dimensions, but when rating others, women (as a social group) received higher scores regarding their warmth, but lower competence ratings than men, and vice versa.

Concerning the satisfaction relating to roles and avatar gender, the results showed significant interaction between gender of the avatar and role. Contrary to our hypotheses, participants with a staff role and a male avatar were considerably more pleased with their avatar than female avatars in the same role. Participants in managerial roles however were equally content with their roles, regardless of their avatar gender. Furthermore, on the level of avatar gender, participants embodied in a male avatar were also happier with their avatar when adopting a staff role instead of a manager role, while role did not affect participants with female

avatars in regard to their happiness. Furthermore, participants who were provided with the male avatar and who had assumed the member of staff role were happiest with the avatar they had. They were more content with their avatars than participants with male avatars, in the manager role, and participants with female avatars, in the staff role.

Avatar gender and role affected the evaluation of the VR experience in various ways. Participants in the role of a 'member of staff' reported more enjoyment regarding the VR experience, being more comfortable in the VR environment, rating the experience as more exciting and more immersive and pleasant and being more captivated by the virtual world than participants in the manager role.

Again, in reference to avatar gender, participants with male avatars reported more sadness when the VR experience had concluded and rated the VR environment as more 'beautiful' than participants with a female avatar.

These findings can be interpreted with regard to perceived psychological or visual similarity to the self and its influences on perception and attribution in interactive and communicative contexts (Wauck et al, 2018). Similar to outcomes in face-to-face contexts where people prefer to maintain relationships with those individuals they perceive to share any kind of social identity with (Slater et al, 2013), in avatar-based VR people also tend to select self-similar avatars and prefer to interact with other avatars they identify as similar to them (Nowak and Rauh, 2005; Nowak and Fox, 2018; Nowak et al, 2009). The fact that in our experiment the majority of the participants were male students may explain the greater enjoyment of the VR experience when having the male avatar and member of staff role. This interpretation is further supported by the evaluations of the experience. Due to the self-similarity, participants in the staff role could identify more with their avatar and thus, experienced more immersion, excitement and were more captivated by the virtual reality than

the other group. This may also be supported by the findings regarding male avatars, who were associated with being more 'comfortable' in the virtual world.

6.1 Limitations

The study holds limitations due to the small size of the sample, which may weaken statistical validity in terms of findings. In addition, the sample presented disparity on participants' real genders, as – in line with the gender distribution in the computer science student population – the majority consisted of male participants. As the participants were assigned to the groups at random, which does not skew the results, it does however lower the ecological validity and we cannot yet draw conclusions of gender differences, or the lack thereof, regarding male and female participants. Effects of gender stereotypes on one's behavior might also have been enhanced if the participants had had more time to become acquainted with their avatar – they only had an initial 10 minutes to familiarize themselves with the setting and avatar.

Another limitation is that some of the participants knew each other, and hence their real genders; while others in the group did not know each other, which may have limited the effect of the avatars gender on the stereotypical perception of another person. Even if they did not know each other the voice link gave cues about their partners gender which might override the effect of the avatar. Alternatively being with a friend or classmate in the VR Room may cause participants to feel more relaxed and less focused on the task, negatively affecting performance and engagement. All of the participants were undergraduates of software engineering and already familiar with VR, and the fact that they were participating for extra academic credits might have also influenced participants enjoyment in the VR experience and satisfaction with the given avatar.

6.2 Future directions

Keeping in mind that people conform to stereotypes based on what they see and that in VR avatars might serve as the primary identity cue, it can be concluded that people will be

stereotyped based on the characteristics of their virtual self-representations (Lee, Nass and Bailenson, 2014) without asking who is the person hidden behind the avatar.

In this sense, being represented with socially acceptable or desirable characteristics might help to thrive in the digital world. However, the creation of “ideal selves” in avatar customization may have a negative impact on gender equality, as well as the integration of other disadvantaged or marginalized groups based on disabilities, homosexuality, skin color, etc. The creation of “ideal selves”, which in the beginning may aim to avoid negative gender-related stereotypes and prejudices also prevalent in the offline world, can result in the long term in a poorer integration (and even higher discrimination) towards those groups that might not correspond to the white-young-attractive-competent-men considered the societal reference par excellence.

In the introduction, the terms *glass ceiling*, *glass walls*, *glass slipper* and *glass cliff* to present the obstacles women face in the workplace were briefly explained, and the many cultural prescriptions for leadership identity and behavior that many women found unattainable, originated (Ibarra and Petriglieri, 2016). When assuming new leadership positions or more senior roles, people have to engage in a new image and identity (Roberst, 2005) which conforms to role-related expectations (Ibarra and Petriglieri, 2016). Role transitions are often followed by feelings of anxiety, that can be a symptom of identity threat and often followed by a gender-based stereotype threat. This stereotype threat stems from cultural beliefs that are associated with the traditional masculine leader image, creating an additional identity threat to women. Women have to bridge the gap between current and desired identities as senior professionals, and concerns about identity are challenged simply for the fact of being women (Ibarra and Petriglieri, 2016).

When relating those strategies of the SCM (Cuddy, Fiske, and Glick, 2008), protective self-presentation styles would be aligned with warmth traits, and acquisitive strategies are more

likely linked to competency features. In an attempt to avoid disapproval women tend to behave kind and friendly, trying to gain respect by showing their capability, technical competency, as well as integrity and sincerity. In doing so, they need to master a balancing act between being seen as too feminine to be competent and too masculine to be likable (Williams, & Multhaup, 2018). In contrast, men will tend to make use of their intelligence and confidence to build positive first impressions or to take more aggressive stands in order to achieve their goals. Our results reaffirm that warmth traits are more related to relationship-oriented leadership styles while competence traits are more linked to task-oriented styles.

Even when men and women possess comparable analytic skills, the choice of protective self-presentation is consequential for women. It has been found that the ability to win confidence may facilitate career advancement, while the use of protective self-presentation confirms gender stereotypes that can lead to career stagnation (Ibarra and Petriglieri, 2016). Moreover, the majority of organizational hierarchies are dominated by men, providing few role models for women and perpetuating intrinsic beliefs that leadership behaviors are more appropriate and common in men (Eagly et al., 2007).

Role modeling involves cognitive processes for the understanding of which specific self-presentation behaviors are effective, why they are effective, and also the affective processes to determine whether the specific behavior will produce positive consequences (Bandura, 1986). In this sense, self-presentation enables one to create, maintain or modify a public self that is usually consistent with their ideal self (Baumeister, 1982). Career success relies importantly upon self-presentation, where the success factors generally include the ability to generate novel ideas, represent the firm, sell new business, and develop relationships with clients (Ibarra and Petriglieri, 2016).

This paper has explored the extent to which stereotypes might be present in VR, but further research will be needed to analyze women's behavior in VR in relation to role modeling,

self-presentation strategies, leadership positions or negotiation techniques. Would women also adopt protective self-presentation strategies in VR? Would women construct ideal selves through avatar customization? In the present era of digital transformation are we demanding a creation of what we term ‘women’s impossible selves’? Could avatar-based VR help at role modeling and self-presentation allowing us to overcome such demands? Or is it actually harder for women to thrive in VR environments due to the negative stereotypes associated with women and technology? These are intriguing questions to propose for further exploration in the domain of gender differences in immersive VR. In its applicability to the business field those questions might be of interest for the design of human resources practices and strategies that advocate for the inclusion of diverse workforce and promote gender equality within companies and organizations.

This study was designed assuming that avatar-based VR will play a growing role in remote learning and working. We also believe that the characteristics of current immersive VR displays still need to be developed in order to be sufficiently usable for educational as well as business purposes. Slater and Sanchez-Vives (2016) state that “...an ideal form of a shared VR would require real-time full facial capture, eye tracking, real-time rendering of subtle emotional changes such as blushing and sweating, subtle facial muscle movements such as almost imperceptible eyebrow-raising, the possibility of physical contact such as the ability to shake hands, or embrace, or even push, and so on. Such a system does not exist today, though it is one to strive for” (Slater and Sanchez-Vives, 2016). Considering that more human-like avatars can be perceived, it is more likely that theories of human communication will apply to avatar-based interactions, future work in VR should be conducted to investigate how technological improvements might impact on human behavior.

Aside from the pertinent improvements in apparatus, other technical issues should be involved in how to realize such a system (Steed & Oliveira, 2009). Questions such as how and

where to distribute the computation systems – in a distributed network or a one master machine broadcasting to all the others or how to keep the different participant environments synchronized with one another so that they all will be able to perceive the same consistent environment needed for consideration are among these issues. With the use of immersive technologies in virtual business teams, a redesign of work practices and workplaces might be necessary (Steed & Oliveira, 2009).

7 Conclusion

This paper has aimed to provide insights into understanding the extent to which gender stereotypes are present in avatar-based-virtual-reality, inviting to a discussion and reflection about the possible impact it could have when using VR for business and educational purposes. Correspondingly the possibilities offered by immersive VR to see if this tool could benefit the domain of co-presence, facilitating remote communication and collaboration has been explored. As simulated in the experiment conducted, the virtual environment was a shared space among multiple participants, where each participant was represented by an avatar observing and interacting with the representations of the others. In the experiment, participants were randomly assigned a male or female avatar and were instructed to negotiate a role – as manager or member of staff. The analysis focused on the possible influence that avatar gender could have on role negotiation with variables based on the SCM (Cuddy, Fiske and Glick, 2008), on the theories of the *Proteus* effect (Yee, Bailenson and Ducheneaut, 2009), as well as on other experiments conducted in the fields of avatar-self-similarity (Wauck et al., 2018). For the empirical research quantitative methods were used. A two-way 2 (avatar gender: male vs. female) x 2 (performance role: manager vs. member of staff) Analysis of Variances (ANOVAs) as well as Chi-Square tests and Statistics were used for the analysis of the effects of gender on the dependent variables. Findings indicate that the explicit gender of the avatar did not appear

to have a significant detrimental impact on role negotiation. Additionally, avatars were not significantly affected by gender-related stereotypes. The data did reveal significant differences in enjoyment and satisfaction regarding roles and avatar genders; participants who were arbitrarily represented by male avatars and assumed the role of member of staff showed greater satisfaction. This pattern would point to the importance of self-similarity and social identity theories. These results contribute to theoretical and practical implications for social identity dynamics in avatar-based virtual environments.

This paper contributes to the literature and understanding of avatar-based virtual reality and provided insights into understanding the extent to which gender stereotypes are present in avatar-based virtual reality. The importance of this cannot be understated as the design, connectivity, and functionality of new technologies such as VR environments, will undoubtedly play a more significant role in the complex global post-Covid context for both business and education.

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