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Challenging Presence

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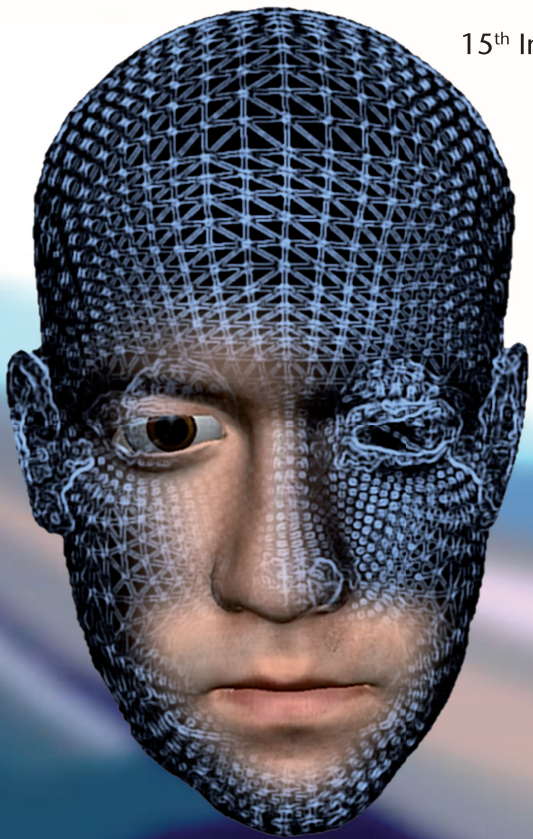

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Short Report

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Challenging gender differences in physical presence: Affective states, spatial abilities and presence in a relaxing virtual park

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Abstract. Gender differences in physical presence have repeatedly been suggested to be examined in more detail. Also, a number of factors such as spatial abilities and previous experiences with virtual environments have been proposed as a possible explanation of the observed differences in male and female presence experiences. Yet, the body of related research is still slim, results are contradictory and the above mentioned factors are far from being thoroughly examined in the context of presence. Considering this, the current study set out to assess physical presence in a sample of 14 male and 14 female students using a relaxing virtual park environment. Additionally, spatial abilities as well as previous computer and gaming experience were controlled for. The results revealed no significant differences between males and females neither on the used presence scale, nor regarding spatial abilities or previous experiences. These findings challenge past studies which assessed physical presence in rather stressful virtual environments and not, like presented here, in a relaxing scenario. Hence, influences of the environment's emotional content and appeal are discussed as a factor potentially mediating the relation between gender and presence.

Keywords. Physical Presence; Virtual Environment; Gender Difference; Spatial Ability

Introduction

A pressing question within presence research is how differences in user characteristics (i.e. previous knowledge, emotional states, gender etc.) may impact individual presence experiences in virtual environments (VEs). In this context, physical presence may be understood as a sense of being there in a mediated environment which is accompanied by an illusion that the environment is not a mediated one (Lombard & Ditton, 1997). Therefore, a hallmark of presence is a behavior which is congruent with one in a comparable physical environment (Slater, 2003). Among potentially interesting user characteristics, gender has repeatedly been suggested to be analyzed in more detail, yet research has to date failed to arrive at a final conclusion. Within the small body of literature, most authors have until now found higher presence levels in male participants as compared to their female counterparts when studying presence in flight simulators (Nicovich, Boller & Cornwell, 2005), video games (Lachlan & Krcmar, 2011) and in experimental VEs (Felnhofer, Kothgassner, Beutl, Hlavacs & Kryspin-Exner, 2012; Slater, McCarthy & Maringelli, 1998).

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Most gender differences, however, are reported for rather arousing scenarios, such as for instance holding a speech in front of a virtual audience (Felnhofer et al., 2012). Yet, it is unclear whether the observed difference would hold true also for a rather relaxing and soothing VE.

When trying to explain gender differences in presence one encounters a range of possible influencing factors. Previous experiences with computer technology and video games have for instance been shown in past studies to positively influence presence levels (Lachlan & Krcmar). This result is in line with the Process Model of the Formation of Spatial Presence Experiences (Wirth et al., 2007): it theorizes that the cognitive processes involved in the formation of presence underlie past spatial experiences. In other words, a person who frequently plays computer games is expected to more easily engage in a novel VE and construct a mental model of that VE, both of which are preconditions for physical presence to appear (Wirth et al., 2007).

Similarly, spatial and navigational abilities are thought to be possibly accountable for gender differences in presence. A considerable body of literature perpetuates a male advantage in tasks such as rotating 3-dimensional objects virtually, reading maps or navigating through mazes (Kryspin-Exner, Lamplmayr, & Felnhofer, 2011; Larson et al., 1999; Lautenbacher, Güntürkün & Hausmann, 2009). The relevance of spatial and orientational abilities for the formation of physical presence seems evident: the prerequisite for physical presence according to Wirth and colleagues' model (2007) is both, spatial orientation and the mental construction of a spatial model. The better the person is at constructing such a spatial representation of the environment, the more presence he/she will experience.

Objectives

The current study sets out to enhance the understanding of gender specific presence experiences in a non-stressful VE. Specific user characteristics such as previous VE experiences and spatial abilities, which have been suggested as factors possibly shaping the observed gender differences, shall be accounted for. The corresponding research questions (RQs) are the following:

RQ 1: Are there differences between males and females in their reported presence?

RQ 2: Are there differences between males and females regarding their previous experiences with computers and video games as well as spatial abilities?

RQ 3: Do these factors (previous experiences, spatial abilities) explain the observed gender differences in presence?

Methods

Participants were recruited via University courses and were given course credits for their participation. They were invited to the laboratory on weekdays between 9 and 12 a.m. and were provided with an informed consent upon their arrival. After filling out the pre-experiment questionnaires (see below) they were guided to the laboratory where the head mounted display (Sony HMZ-T1 3D Visor, Tokyo, Japan) with an externally applied head tracking system (TrackIR 5, NaturalPoint, Corvallis, USA) was donned. For navigation purposes a smart phone (HTC Desire SV, Taoyuan) was used. It had to be tilted forwards to initiate gait or backwards to come to a stop. Participants had a first-person view of the park and were able to see their virtual bodies when looking down. The task was to freely explore the park for five minutes.

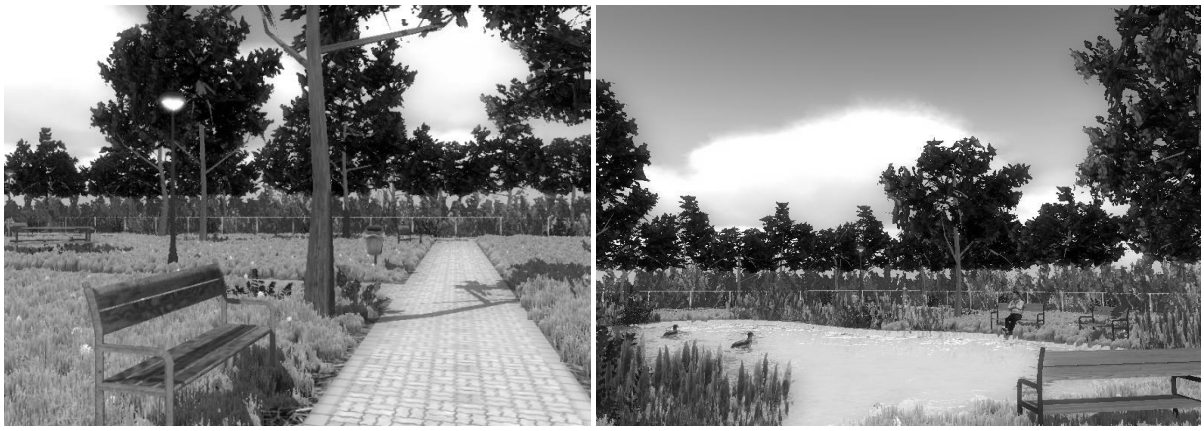

Figure 1. The participants' view on the relaxing day-time virtual park.

The virtual park scenario

The virtual park used in this study was modeled using Blender 3D. Rendering was achieved via the rendering engine OGRE3D and textures were created with GIMP. The park depicted a sunny scenario (see figure 1) within which a few non-playing characters were strolling around. There was a pond in the middle of the park and the outer pathways were enclosed by a fence so participants could not exit the park.

Measures

Apart from a demographic survey which assessed participants' age and previous computer and gaming experience two questionnaires and one test were used:

Presence: To assess physical presence, the iGroup Presence Questionnaire, IPQ (Schubert, Friedmann & Regenbrecht, 2001) was applied. It consists of 14 7-point-Likert-scaled type items which - apart from the additional single item Sense of Being - add up to three subscales: Spatial Presence, Involvement and Realism. Past factorial studies support this threefold structure of presence (c.f. Takatalo, Nyman & Laaksonen, 2008).

Spatial ability: Spatial abilities were measured using the Rasch-scaled 3DW (3-dimensionaler Würfeltest, Gittler, 1990). Participants were asked to mentally rotate 13 three-dimensional dices with different marks on three visible sides and match them to 6 alternatives. Both, the number of correctly solved tasks and the time needed to complete the task were used as indicators for spatial ability.

Affective states: To assess the participants' affective states elicited by the virtual park scenario they were asked to rate them on the Positive and Negative Affect Schedule, PANAS (Watson, Clark & Tellegen, 1988). The two scales (negative and positive) comprise 10 adjectives each (5-point-Likert-scaled).

Sample

The current sample consisted of 14 female students with a mean age of 23.93 years (SD = 2.895) and 14 male colleagues with a mean age of 26.29 years (SD = 3.791). There was no significant age difference between the two groups ($t(26) = 1.819$, $p > .05$). All participants had normal or corrected to normal eyesight. Both, males and females had a comparable amount of previous computer knowledge ($\chi2(1) = 0.190$, $p = 1.000$) and similarly engaged in computer and video games ($\chi2(1) = 1.348$, $p > .440$; see Table 1).

Table 1. Demographic variables depicted for males and females separately

	males (n =14)	*females (n=14)*
Computer experience *(little/much)*	21%/79%	29%/71%
Playing video games *(yes/no)*	71%/29%	50%/50%

Results

Statistical analyses were performed with SPSS Version 20 (SPSS, Inc. Chicago, USA) considering an alpha error of 5%. Student t-tests were conducted to estimate group differences.

To evaluate the affective state elicited by the virtual park, male and female students were asked to rate their emotional states after exposure to the virtual park: both groups showed a considerably positive affective state ($t(26) = 0.381$, $p > .706$), whereas the negative affect was low for both, males and females ($t(26) = -1.540$, $p > .136$). Furthermore, no significant differences between males and females could be found for the IPQ scales Spatial Presence ($t(26) = -0.580$, $p > .576$), Involvement ($t(25.93) = -0.222$, $p > .826$) and Realism ($t(26) = 0.000$, $p = 1.000$) as well as the single item Sense of Being There ($t(26) = -0.380$, $p > .707$). Also, male and female students demonstrated comparable spatial abilities on the 3DW ($t(22.38) = 0.404$, $p > .690$) and needed approximately the same time to solve the tasks ($t(21.94) = -0.701$, $p > .491$). Since no gender differences could be found neither for presence nor for the possible influencing factors, research question 3 had to be dropped at this point. For a graphic overview over group means see figure 2.

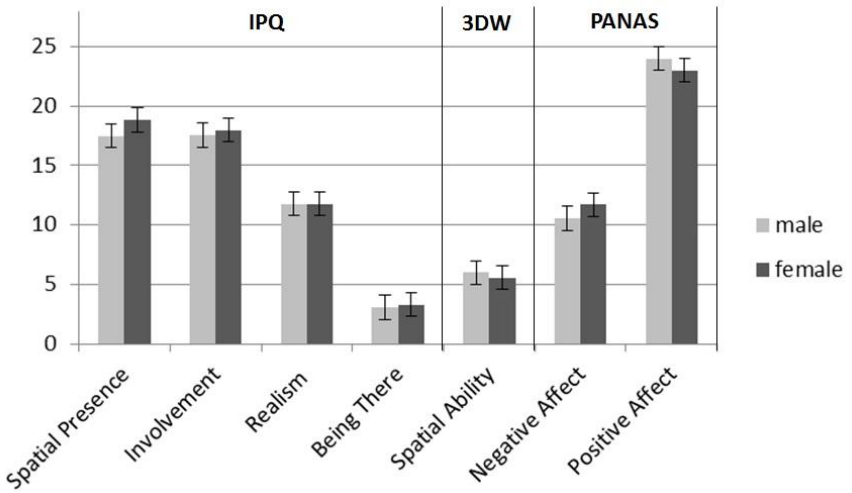

Figure 2. Comparison of means ±SEM of all measure for male and female participants separately

Discussion

This study set out to add to the rather scarce literature on gender differences in physical presence by comparing VE-experiences of male and female students in a relaxing virtual park environment. In addition, factors such as spatial abilities as well as previous computer and gaming experiences were accounted for. These factors are all thought to possibly explain observed gender differences in presence.

The present results do not support the previously found male advantage in physical presence (e.g. Felnhofer et al., 2012; Lachlan & Krcmar, 2011). In the current sample, males and females were similarly involved in the VE, they furthermore showed a comparable level of spatial presence and both rated the VE as being quite realistic. Also, none of the assumed influencing factors showed any gender difference: both, male and female students quite regularly played computer games and reported to have a lot of computer experience. Recent literature (ESA, 2012) supports our finding and thus, contradicts the largely adopted stereotype of predominantly male gamers. Considering furthermore the ubiquity of computers in our everyday lives, it is not surprising to find similar computer expertise in males and females. Therefore, in future studies it might be safe to disregard previous computer and VE experiences (at least for the cohort of young adults) when trying to explain gender disparities in presence.

Similarly, our male and female students did not differ in their ability to mentally rotate 3-dimensional cubes, thus, mostly contradicting the common tenor in literature (c.f. Kryspin-Exner, Lamplmayr & Felnhofer, 2011). Yet, recent research starts calling the male advantage in spatial abilities into question. Studies show that women achieve the same outcomes on measures of spatial ability as their male counterparts in certain phases of the menstrual cycle when testosterone levels are high (Hausmann, Slabberkoorn, Van Goozen, Cohen-Kettenis & Güntürkün, 2000). Furthermore, socially constructed beliefs and stereotypes have been demonstrated to have a powerful influence on spatial abilities in women (Lautenbacher, Güntürkün & Hausmann, 2009). Thus, spatial abilities should be treated with caution when considering them as an explanation for gender differences; yet, they may instead prove helpful in studying the concept of presence per se (see the Process Model of Spatial Presence, Wirth et al., 2007).

Apart from previous VE experiences and spatial abilities, one encounters yet another possible explanation for the null findings in this study. Most research reporting a male advantage in presence uses VEs which unlike our soothing and relaxing virtual park are rather stressful (e.g. a stress-inducing virtual lecture hall in Felnhofer et al., 2012). It has previously been hypothesized that arousal and negative affective states may influence presence. Here, again, the process model of Wirth and colleagues (2007) may hold a valuable explanation for this assumption: the attentional processes which are necessary for the engagement with the VE and the formation of a spatial model are susceptible to stress and negative affect. Being in a stressful VE may therefore result in less attention being directed towards the environment causing lower levels of presence. The question remains how this may translate into finding gender differences in a stressful VE but failing to do so for a relaxing one. Studies relating to coping with stress may hold the key to this question: they show that males and females differ in their reactions to chronic as well as to situational stressors (Matud, 2004). Thus, it is conceivable that differences between males and females in presence found in a rather stressful VE may be due to gender specific ways of attributing attentional resources under stress to the VE.

The lessons learned from this study are manifold: neither previous gaming experiences and computer knowledge nor spatial abilities may in fact be made accountable for the observed gender differences in presence. Instead, the content of the VE itself may prove more insightful. By taking the environment's emotional content and appeal into account and relating it to gender specific reactions to it one might find more satisfactory explanations for the often observed gender specific presence experiences.

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