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The Pleasure of Being (There?). An Explorative Study into the Effects of Presence and Identification on the Enjoyment of an Interactive Theatrical Performance using Omni- Directional Video

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Abstract

In this study, we explore how participants in an immersive theatrical performance perceive their role in the virtual environment (VE) and the effects of this perception on how they experience the performance as a whole. Using a quasi-experimental 2 x 2 design we manipulated narrative and task-based search to explore effects on spatial presence, social presence, identification and enjoyment. Results show that the effect of spatial presence on enjoyment of the performance is entirely mediated by identification with the role of the self in the VE. This could have interesting consequences for the experience of more narrative VE's and suggests that the role of identification is something to explore further in future presence research.

Keywords---**Performance, Virtual Environment, Mediation, Identification, Enjoyment, Haptic Feedback.**

1. Introduction

The use of omni-directional imagery is on the rise. In the past, QuickTime VR allowed people to explore panoramic, 360° pictures by looking around in the photo with their mouse. Nowadays this kind of technology is more common and is mostly known and used in the form of Google StreetView. With this application users are able to move up and down streets around the globe, able to take a 360° look around at every step they take. One step further is the exploration of surround- or omni-directional video (ODV). ODV can easily be explored through a computer interface (mouse or keyboard) or a remote control, on tablet computers or touch-screen smart phones, through a HMD with head orientation tracking, or in CAVEs of various sorts. It offers users the ability to explore moving images "from the inside" rather than "as an outsider". We are investigating the potential of ODV in creating a novel, truly interactive television [1] experience, in which users are invited to step in and take control of the direction of the camera. This iTV experience will be closer to "exploring a broadcasted environment" than to "viewing broadcasted imagery".

The usage of ODV technologies is expected to have a significant impact on the user experience and research into these effects is being performed in the domain of (tele-) presence in media and virtual environments. Further down, a more elaborate explanation of the concept of presence and research on this topic will be presented. In this study we present an exploration of the user experience of participants in an interactive performance called C.A.P.E. by the Brussels theatre company CREW as a case study. In this performance ODV shown in a head mounted-display (HMD) is used to immerse participants in a quasi-virtual environment, in this case an ODV recording in Brussels. Our main goal is to explore the drivers of the user experience of the performance, more particularly the effects of presence and identification on enjoyment.

1.1. Omni-Directional Video (ODV)

Whereas ordinary cameras capture only a field of view in front of them, omni-directional video cameras are able to capture the entire space that surrounds them. To increase the field of view of a camera, one can employ curved lenses such as fish-eye lenses and mirrors. These single-camera solutions have a limited resolution however, so using multi-camera systems currently provide higher quality recordings. In these systems the cameras are positioned together in such a way that each one of them covers part of the surrounding space with some overlap between them.

The use of a multi-camera system requires for the separate images to be stitched together using algorithms,

creating one big surrounding image. This stitching is not trivial since non-coincidence of camera centra causes parallax artifacts, and colour inconsistencies between the different cameras can cause further problems. However, for investigating the creative potential of ODV, a perfect stitching is not required, and if one allows a certain amount of imperfections, ODV footage is fairly easy to obtain with recently developed compact and mobile capture rigs. This makes it less time consuming compared to creating a 3D computer-animated environment, and requires significantly less computational power. A disadvantage of using an ODV set-up compared to a computer-generated VE is the limited interactivity when using pre-recorded video. The "path" the camera follows in pre-recorded ODV (using present technology) is predetermined and linear which allows freedom of viewing direction but not of movement.

Figure 1 Top: recording in the field, left bottom: a stationary ODV "ladybug" camera, right bottom: ODV projected in a CAVE set-up

Working together for more than ten years, the primary partner of CREW, the Expertise center for Digital Media (EDM), Hasselt University (Belgium) has intensively been developing ODV (and other multi-camera) technology. CREW is adopting this technology in an early stage in their production work, which is in the first place aimed at a stage theatre audience not interested in technology as such. Their work thus goes far beyond mere technological demonstration. The technology development at EDM is to large extent steered by insights and requirements resulting from CREWs investigation of the creative potential of the technology. Both go tightly hand in hand. The central question is, and has always been, to identify and realize the added value to the spectator, that may be offered by the technology.

1.2. CREW

CREW is a theatre company that operates on the border between art and science. Unlike other groups in the arts they do not see digital media, such as video and audio as a means to offer support to their performances or as an added effect to the dramaturgy. Instead they use these media as a starting point for their theatrical work and explore the contexts it offers. Since 1996, they have been incorporating immersive technologies in their performances, creating a unique mix of live and recorded performance. Evolving from the use of simple computer-animated rooms to full omni-directional video, they have been creating both single- and multi- participant performances.

CREW"s latest works typically involve three components [2]. First of all, they aim to immerse the spectator in a virtual environment through a HMD with omni-directional video. The immersed spectator is able to freely look and guidedly walk around in this world and is given the impression that it is dynamic and interactive. Secondly, the spectator is always given the role of the protagonist of the performance through narration and content. Thirdly, by involving as many senses as possible (visual, acoustic and haptic) and often switching between recorded and live footage the border between reality and the virtual is blurred. By adhering to these goals, CREW is able to create highly immersive experiences, which often lead to situations in which spectators lose themselves in the performance in extreme ways. Crucial for their work is the help of stewards, so-called "buddies", that guide the participants wearing HMD gear through the performance. Their role is both that of choreographer and performer, touching and leading the spectator through the virtual spaces.

The performance that was used as a case study in this paper is called C.A.P.E, which stands for Cave Automatic Personal Environment, written by Eric Joris. For CREW it is a device to transport the participant inside another body, to another place or even to another time dimension. It allows users to experience a place they have never been before or never will be able to visit. In that light, CREW recently created a performance in which people with lesser mobility were given the opportunity to (virtually) visit the castle of Pierrefonds, a historical landmark, which is otherwise difficult to access. The C.A.P.E.

performance, which took place at the VIA arts festival in Mons, Belgium, where we conducted our study, is a C.A.P.E. for Brussels. It was presented for the first time at the World Expo 2010 in Shanghai where it allowed visitors in Shanghai to walk around in Brussels.

Figure 2 Set-up: A buddy guiding a participant

The use of ODV in their performances required CREW to adapt and invent new dramaturgical strategies and create a new kind of cinematography [3]. One of the problems with ODV is that it is a challenging medium to incorporate a narrative or story line. Cuts between scenes tend to cause a break in the visual continuity in a medium where the spectator can look in the direction they want, whenever they want. CREW therefore applies, what they call, the "tactile cut". To maintain continuity in the flow of scenes and the narrative, they use the element of touch to mask the transformations. By touching or pushing the participants, their attention is temporarily diverted and the transformation between scenes happens more inadvertently.

1.3. Role of Haptic Feedback

Touch is something CREW pays a lot of attention to in their performances. More than once spectators of C.A.P.E. see the arms and hands of the protagonist as if they were their own. A feeling of ownership is established and strengthened by the buddies through precise tactile stimulation and feedback in accordance with the visual, which the buddies can follow on a screen nearby. When a person in the ODV walks up to you, taps you on the shoulder, grabs your hand to give you a piece of paper, precisely the same actions are performed by the CREW buddy who accompanies you throughout the performance. When a few scenes later you see and, crucially, feel someone writing something on the piece of paper you received minutes ago, the sense of ownership of the body in the virtual environment is renewed and strengthened even more. This phenomenon of ownership of a strange body part has been studied before and is often dubbed "the rubber-hand illusion", named after the famous experiment by Botvinick and Cohen in 1998 [4]. In this experiment subjects described a rubber hand as belonging to themselves when they saw it being touched in the same way they felt their own hand being touched. This and subsequent research [5] has pointed to the importance of intermodal integration and the support role of auditory and tactile information.

1.4. Presence

As mentioned previously, using immersive technologies such as ODV can be assumed to have effects on the spectator and research on this is being done in the domain of presence. An elaborate definition of presence can be found on the website of ISPR and several articles give an overview of how presence can be measured [6, 7]. Studies on presence can be useful because it is believed that the sense of presence leads to effects on the user and their behavior with and in the media or VE [8]. Different authors have identified different components and different kinds of presence, which makes it difficult for researchers in the domain to come to unified constructs or conclusions about the issue. Some authors try to give an overview of presence, related terms and conceptual definitions [9] but a unified conceptual framework is still to be agreed upon. This disunity also makes it challenging to conceptualize presence and find hard evidence for these proposed conceptualizations. Multiple questionnaires have been validated and are being used in different studies but each seem to have their limitations [10]. More and more researchers are using physiological measures [11] and are trying to find neural correlates of presence [12], despite its conceptual elusiveness and the practical difficulties involved in measuring it [13].

One thing most researchers agree upon is that there are different types of presence [14] and most of the time a distinction is made between physical/spatial and social presence. Physical presence refers to the sense of physically being in another location, forgetting about the immersive technology involved and accepting the virtual environment as a true environment. Worth mentioning in this context is the two-dimensional construct of spatial presence Wirth, Hartmann and Böcking have described [15]. Their two-step model of spatial presence exhibits a rare thoroughness that is often missing in other definitions of presence. Social presence [16] is generally referring to the sense that virtual entities are real entities with which

interaction is possible. People with a high sense of social presence no longer (or partly) acknowledge the fact that a technology is making it appear as if they are interacting with another social entity. Another explanation of presence is given by Witmer and Singer [17] who name the two components of immersion and involvement. Immersion refers to the spatial constructive element of the presence experience while involvement refers to the attentional aspects of the spectator. Both media factors and user characteristics are known to have an influence on the sense of presence one can experience in a VE [14].

In their overview of the concept of presence, Lombard and Ditton [14] state that the number and consistency of senses for which a medium provides stimulation is one of the form variables that has an impact on the feeling of presence. In the case of the performances by CREW the tactile sense is stimulated and much attention is paid to the consistency and synchronicity of the tactile with the visual and hearing senses. For instance, two scenes can be cut by rotating the view of the ODV 180° and creating a blur between both scenes as the rotation takes place. To prevent confusion or breaks in immersion, the spectator‟s face is touched and slightly pushed to turn simultaneously with the visual cut. The spectator can rely on touch to guide them through the cut without getting lost in the otherwise confusing cut. It is expected that the characteristics of the ODV set-up of C.A.P.E. are all sufficiently optimized to induce a sense of presence on the user. Form variables such as image quality, camera techniques, subjective camera shots, aural presentation and interactivity are all present and should positively influence the sense of presence [14].

1.5. Enjoyment

The goal of a performance such as C.A.P.E. is to give spectators an enjoyable experience. Participants should not merely perceive the virtual environment, they should also enjoy visiting it, even if they are made confused or scared. Enjoyment in a media use context has been approached and defined in several divergent ways such as an emotion, an attitude or a form of cognition. All of these definitions seem to be talking about the same concept, but few of them offer a theoretical underpinning. Tamborini and colleagues [18] explicitly define enjoyment as a need satisfaction and state three needs related to psychological well-being that are of importance, i.e. autonomy, competence, and relatedness. They go on by validating their model through an experiment and find considerable explained variance.

1.6. Identification

Cohen defines identification [19] as „an imaginative experience in which a person surrenders consciousness of his own identity and experiences the world through someone else‟s point of view. Identification leads to the (temporary) adoption of an external point of view and to viewing the world through an alternative social reality.‟ With this definition it would seem that identification shows some similarities to spatial presence, but applied to content-related factors such as narrative, characters and their roles in a story. Until now, little research on identification in VE‟s has been done, but in the related medium of gaming, we find several authors exploring the workings of this concept. Klimmt, Hefner, & Vorderer [20] propose a monadic model of identification as opposed to the dyadic models usually found in traditional, less participatory media. Interactive media such as games allow the media user to no longer solely observe characters but to cross the distance and „become‟ the characters themselves. The spectator experiences a merging with a protagonist or character because the media allow them to take control over a character. To deal with this kind of interactive medium, Klimmt et al. [20] define this merger of player/observer and character as a temporary change in self- perception through adoption of salient properties of the game character. It is the adoption of certain characteristics displayed by the character that changes the observer‟s self- image. This change in self-perception can lead to enjoyment of the media because of self-discrepancies that are weakened or resolved [21].

Furthermore, Klimmt and colleagues [20] propose that identification is never an absolute process in which the player‟s entire identity is replaced by the identity of the character, but rather a partial alteration in self-perception. They argue that certain elements, such as the lack of full- body tactile feedback lowers complete presence in the game world. Just as Wirth‟s two-dimensional model for spatial presence [15], they recognize that media factors and user factors can both influence this process.

Considering the theory discussed, we expect that there will be some kind of synergy between presence, enjoyment and identification. As Lombard already stated in 1997 [14], there is still remarkably little research on the effect of presence on enjoyment. Add identification to the mix and surprisingly few studies have investigated these three constructs together. Most of the research that does look into the behavior of these constructs is done in the field of gaming. One study [22] investigated the effects of playing a game against a computer- versus human-

controlled player on presence and enjoyment. Playing against humans made participants experience a higher sense of presence and

increased enjoyment, with a correlation between presence and enjoyment. Another study [23] found that natural mapping of controls of a racing game resulted in a higher spatial presence and a positive effect on enjoyment was found. In another gaming study [24], surround sound led to more presence and enjoyment as opposed to standard stereo- sound while playing a shooter game.

1.7. Research questions

The performance by CREW offers an interesting testing ground to explore the possible relationships of these constructs in an immersive setting. Our first research question is directed at the sense of presence. In a highly immersive VE such as C.A.P.E. we expect participants to experience spatial and social presence as part of the broader experience of the performance.

RQ1: Do spectators of the C.A.P.E. performance experience spatial and social presence and how are these senses of presence affected by other variables?

For this kind of performance in which a lot of attention is paid to narrative and in which the spectator is placed in the role of the protagonist, we expect identification to take place, again as part of the overall experience, and have an effect on presence and enjoyment.

RQ2: Does identification play a role in the experience of presence and the overall enjoyment of the performance?

Our third question is directed at the end goal of a performance: enjoyment. Knowing which factors increase or diminish the amount of enjoyment that participants of performances experience will help to improve future performances and VE technologies.

RQ3: How is enjoyment of a VE performance influenced by presence, social presence and identification?

In order to explore these research questions, we administered a questionnaire containing items measuring a number of constructs we thought relevant based on the scientific literature and the nature of the performance.

We have reasons to believe that by giving more context and generally make the participants more involved we would see some effects on our dependent variables [25, 26]. We also assume that by giving a purpose or goal to the participants, they will pay more attention to the performance and experience a heightened sense of presence, because of higher involvement [14].

RQ4: Can we influence perceived experience of the ODV by manipulations of involvement and context?

2. Method

2.1. Design and Manipulations

A 2 x 2 between subjects design was employed with manipulations of story and task. In the context/story manipulation participants could read on the pre-questionnaire that the protagonist and the guide in the performance was actually a couple that visits places where they shared memories. In the mission manipulation we gave participants a mission and asked them to pay close attention to the passing of time during the performance and look for clues why some characters seem to be moving differently in time.

2.2. Participants

Participants in the quasi-experiment (N = 60) were people who showed interest in participating in the C.A.P.E. performance by CREW, an activity that was part of the VIA Festival in Mons, Belgium. Almost everyone participating in the performance was also willing to take part in our study. Forty-one of these willing participants were art and media professionals who participated in the performance for free. The 19 other participants were paying visitors to the festival. No significant differences in socio-demographics or scores on the dependent variables were found between these two groups. Fifty-five percent of the sample was male (N = 33), the average age of participants was 38 (SD = 12) and most participants (N = 52) spoke French as a mother tongue. While the performance was in English, relatively little is said.

2.3. Procedure

Only three persons at a time could participate in the performance by CREW due to technical and logistical limitations. We introduced ourselves as scientific partners of CREW aiming at ameliorating the performances by CREW through research. Before each session, participants were given a short pre-questionnaire that contained measures of experience of being in Brussels, experience with the performances of CREW and demographics. This pre- questionnaire also contained our manipulations of story and task. Participants were randomly assigned to conditions.

After filling in this pre-questionnaire, participants were invited to put on the necessary equipment and were

given instructions on the procedure of the performance. Every participant was personally guided and helped by one person, their "buddy". This person also took care of the participant during their immersion, guided them, held them back when they were on a collision course with obstacles or other participants and took care of the tactile cuts. The actual video lasted 13 minutes after which participants were helped out of their equipment. Post-questionnaires were given as quickly as possible after the experience so as not to disturb their thoughts and feelings about what they had just experienced. Post-questionnaires were the same across conditions. All of the post-questionnaires contained manipulation checks for both manipulations. After the post-questionnaire, participants were thanked and given a small token of appreciation.

2.4. Apparatus

Participants wore a head-mounted display, which consisted of video goggles and a webcam. The video goggles are Z800 manufactured by Emagin. They consist of two OLED screens on which the participants see an image approximately the size of 800x600 pixels. A cap was drawn over their heads as to occlude light coming in from the outside. Audio was presented through Sennheiser HD 201 headphones. Video goggles and headphones were connected to a laptop that participants wore as a backpack.

Two tracking devices, made by EDM and CREW, were employed. One device was mounted on top of participants‟ heads, while the other was attached to the backpack of the participants. The head-mounted tracker took care of head movements (i.e. looking around in the VE), the other tracker was used to calibrate and recalibrate the position of the body of the participant in relation to the position of their head. This differential tracking made it possible for the participants to walk around in the VE.

Video streams of the three participants were started simultaneously with a fourth video that served as guidance. The three video streams were constantly monitored on a fourth independent laptop that served as a "control center". Software on this fourth laptop gave the possibility of communicating with the other laptops and calibrating and re- centering the video streams of each one of the three participants. Three large LCD screens were set up around the room, which displayed the fourth guiding video. This way accompanying buddies could always check in which part of the performance their participants were.

2.5. Materials

The video material for the performance was a 13 minute omni-directional-video captured with a person-mounted ODV camera. The video was shot with 3 cameras, each with a resolution of 1288x964, which makes the total resolution of the ODV 3864x964 pixels. The video is played back as a QuickTime movie (1920x1080) at 20 frames per second.

The sound was designed to create an ever-present sense of the environment by constant use of ambient and background noises, fitting background music (e.g. organ music in the church scene). Audio was stereophonic and did not adjust to lateral head movement.

Parts of the video (and subsequently the audio) were played back backwards so as to create an interesting and intriguing atmosphere.

2.6. Measures

All the questionnaires were translated into French because the majority of the participants only spoke French. We asked participants to fill out the questionnaires truthfully.

Experience with Brussels: According to Wirth [15] perceptual organization is powerfully determined by expectations built upon past contact with the environment, so we checked if previous visits to Brussels could have an effect on the variables we measured. Experience with the medium could also influence our results [14]. Therefore we included a question measuring the number of previous experiences with CREW and their performances. For similar reasons, we questioned the experience with playing of video games.

Spatial Presence: The ITC-SOPI questionnaire [27] is a presence scale that is meant to be technology-agnostic, i.e. applicable to all kinds of technologies and media, as opposed to other technology-specific scales. The full 43-item version consists of four factors of presence, each validated for independent use. We wished to keep the questionnaire relatively short and therefore opted for the spatial presence sub-scale, the first factor Lessiter et al. found when developing the scale. It consists of 18 items (Cronbachs $\alpha = .87$) measuring the sense of being located in another place. ("I had a sense of being in the scenes displayed", "I felt I could have reached out and touched things (in the displayed environment)").

Social Presence: Subjects were asked to think about the person they felt closest to whom they „met‟ in the performance and to respond to five items on a five-point Likert scale (Cronbachs $\alpha = .80$) from the social presence

questionnaire used by Bailenson and colleagues [28]. Sample items were: "I felt the person was watching me and was aware of my presence" and "The person appeared to be sentient (conscious and alive) to me."

Identification: The Short Gamer Identification Scale (SGIS) [29] consists of 6 five-point Likert scale items (α = .66). The scale, which is meant to be used as one construct, is a shorter version of the Gamer Identification Scale taking two items of each sub-dimension of Avatar Identification: perceived similarity ("My character was similar to me."), embodied presence ("When I was walking through Brussels, it felt as if I was my character.") and wishful identification ("I would like to be more like my character.").

Enjoyment: 4 items on a five point Likert scale (Cronbachs α = .65) from the revised GEQ scale [30] measured enjoyment of the performance ("I enjoyed the performance").

3. Results

Two participants were omitted from data-analysis due to not fully completing the questionnaire. Data analysis was performed with IBM SPSS Statistics 19, except for the mediation analysis, which was performed with the Lavaan package for R [31]. We employed a significance level of 0.05 for every test.

Through ANOVAs we tested if age or sex had any significant effects on our dependent variables, but none were found. We omitted mother tongue from analysis because there were too few participants speaking another language besides French to conduct a valid analysis. Furthermore no effect of experience with Brussels or of video game playing was found in conducting ANOVAs

There were no significant differences between conditions, implying that our manipulations had no effect on the experience of the performance, at least not for the experience dimensions we measured. Moreover, few participants gave satisfactory answers to the manipulation checks. This confirms our beliefs that the priming manipulation was too weak in such an uncontrolled context, i.e. not every participant read the manipulation attentively or even at all. Thus, we will not further discuss these results.

When taking a look at correlations between our independent variables we find that Spatial Presence correlates significantly with Social Presence ($r(56) = .68$, $p < .001$) and Identification ($r(56) = .52$, $p < .001$). Furthermore Identification correlates significantly with Enjoyment ($r(56) = .38$, $p < .005$).

Surprised by the lack of correlation between Spatial Presence and Enjoyment, we investigated further and found that a form of mediation is taking place. The effect of Spatial Presence on Enjoyment appears to be mediated by Identification. When testing this mediation we opted to perform a path analysis, instead of the Baron & Kenny [32] method. Despite its common and widespread usage, the latter method has some statistical issues such as inflation of Type I errors (multiple testing problem) [33] and lack of power [34]. Moreover the indirect effect or mediated effect of Spatial Presence on Enjoyment through Identification is measured as a product of paths a and b (see figure 3). This should address the mediation more directly than the separate regressions proposed by the Baron and Kenny method. Bootstrapping the sampling distribution of *ab* allows for testing of the indirect effect, even in the relatively low sample (N = 58). [35] We tested a path model, which proposes Identification as a mediator between Spatial Presence and Enjoyment.

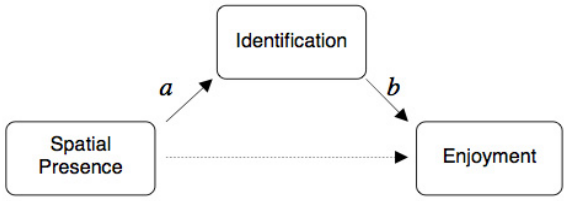

Figure 3 Mediation model

Goodness-of-fit indices of this path model (N = 58, $\chi^2(1)=.85, p=.35, CFI=1.0, TLI=1.02, RMSEA=0.0$) indicate that this proposed mediation model fits the data. An effect of Spatial Presence on Identification was found ($\beta = .60$, $z = 4.43$, $p < .001$) and, in turn, an effect of Identification on Enjoyment was found ($\beta = .20$, $z = 2.38$, $p < .05$). The direct link between Spatial Presence and Enjoyment, however, was not significant ($\beta = .11$, $z = 0.93$, $p = 0.35$) The bootstrapped parameter ab was also found to be significant ($\beta = .12$, $z = 2.05$, $p < .05$).

Given that our bootstrapped *ab* effect is significant and the link between Spatial Presence and Enjoyment is not, we therefore conclude that Identification completely mediates the relationship between Spatial Presence and Enjoyment.

4. Discussion

In this paper we try to investigate a performance in which a VE is used and to figure out which factors are important. Due to the relative weakness of our

manipulations and the uncontrolled environment of the quasi-experiment, no significant differences were found between conditions. This did not impede us from exploring the relations between different experience variables however. When looking at the constructs of presence, identification and enjoyment we found that a complete mediation took place of the effect of presence on enjoyment, which is remarkable. We take a look at what this mediation means for the relationships between constructs and offer a tentative explanation.

As opposed to a partial mediation, whereby a direct effect of presence on enjoyment would remain, a complete mediation implies that all effect of presence on enjoyment is routed via the construct of identification. A heightened sense of spatial presence leads to easier identification with the protagonist, which in turn makes participants enjoy the performance more.

In his literature study, Cohen [19] reviews some consequences identification might have for other processes. He states that identification is seen by some as a process that mediates between exposure to media messages and persuasion by those messages. Increased identification leads to more involvement and more intense exposure to certain media messages or mediated texts, which makes them more memorable instance, a spectator cannot decide to suddenly start running and push bystanders on the street. There are, however, several moments in the video when the spectator is led to believe that characters are indeed interacting with them through tactile feedback. Based on our results, we believe that, if these "pseudo-interactions" and synchronicity of feedback to all senses are sufficient in number and intensity, identification takes place.

Furthermore we wish to contextualize the construct of identification used in our study. The identification scale consists of three components: perceived similarity, embodied presence and wishful identification. When exploring the scale using principal component analysis, we find two components, not three. Perceived similarity and embodied presence are taken together in one component and the two wishful identification items end up in the other. It seems that an item such as "I would have liked to be more like my character", which loads heavily on the second component, caused some confusion (some participants specifically asked for further explanation). The protagonist is a rather neutral character and does not undertake any moral actions or even actions with a consequence. Hence we could argue that, although participants do identify with the character, they do not have a strong opinion as to whether the protagonist is someone they would or would not like to be. Therefore we wish to point out that the construct of identification may behave differently depending on the content of a performance, especially when the character to identify with has stronger values, performs more significant actions or makes more extreme choices. As stated before, however, the relative lack of wishful identification does not necessarily imply the impossibility of identification. When providing a believable character in a rich, realistic environment, identification is possible and the relative neutrality of a character is not an issue.

Finally, we were not able to find any effect of our measure of social presence on identification or enjoyment. We did find a correlation of our measure of social presence with spatial presence and bilateral effects in regression analysis between the two constructs. These observations can be related to the fact that the performance did not contain any real interaction with other social entities (see definition social presence above). Furthermore, the pseudo-interactions that did take place were part of the interaction with the environment as a whole, which is related to the sense of spatial presence and explains the correlation between the two. Because of this relative absence of real direct interaction with other characters, it is not surprising that no effects of social presence on enjoyment or identification were found.

Future research could shed more light on the use of ODV and VE in theatrical performances. First of all, more powerful manipulations and a more favorable context should provide „cleaner" results with less noise. There was no controlled, tranquil space in which participants could be immersed. Instead the performance took place in a (sometimes) crowded place filled with bystanders and visitors of the festival. Some participants were also late for their appointment, were distracted, met people they knew, etc. The manipulations in the pre-questionnaire turned out to be too weak for this stimuli-rich environment. Nonetheless, once in the performance, participants seemed to forget all about the busy environment and were immersed in the VE. Afterwards, most participants were impressed by the performance and were more than willing to partake in the second part of the questionnaire.

Another major improvement in future research would be if the content of the performance could be adapted. In this study we could not alter or manipulate the content of the performance for artistic and logistic reasons. It would be interesting, however, to be able to manipulate some elements of a performance. A future study could, for instance, manipulate the haptic feedback participants receive. This feedback could be delayed, incoherent (you see the protagonist being touched differently in the video)

or even missing. When creating conditions by manipulating touch coherence and consistency, it would be interesting to see differences in presence, identification and ultimately enjoyment.

As noted before, using pre-recorded ODV also has the disadvantage of being predetermined as spectators cannot choose where to go or what to do. Ideally a VE should have the photo-realistic qualities and naturalness of ODV, combined with the freedom of a computer created environment in which one can act and walk freely. Perhaps interactive, pre-recorded ODV in which the spectator can decide between outcomes or has to make some choices could be one step closer to this ideal. Essentially the ODV then becomes layered and consists no longer of one pre-recorded video, but several tracks of ODV at once between which the spectator can choose to switch.

Conclusion

In a quasi-experimental set-up we explored the behavior of constructs such as presence, identification and enjoyment in a performance using ODV technology. We found a mediation effect whereby identification was a mediator of the effect of spatial presence on enjoyment. The C.A.P.E. performance is a highly immersive experience that spectators can enjoy, but this enjoyment can only be attained if they are able to identify with the protagonist of the performance. It seems that a rejection of being placed in the body of this protagonist would make the performance less enjoyable. For CREW, and similar theatre companies using immersive technology, this would mean that they should pay attention to the role of the self in their performances. A balance should be found between making the character with which to identify interesting and exciting and keeping it relatively easy to identify. A greater sense of presence and identification with the character will lead to enjoyment of the performance. We hope that future research will elaborate on these results and more attention will be given to identification in immersive performances.

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