PRESENCE 2008

Proceedings of the 11th Annual International Workshop on Presence
Padova, 16-18 October 2008

Printed by
CLEUP Cooperativa Libraria Universitaria Padova
Padova 2008

Edited by Anna Spagnolli, Luciano Gamberini

ISBN: 978-88-6129-287-1

Socio-Demographic and Psychological Determinants of Presence in a Gaming Experience

Wannes Ribbens, Mariek Vanden Abeele

K.U. Leuven
{Wannes.ribbens@soc.kuleuven.be, Mariek.vandenabeele@soc.kuleuven.be}

Abstract

Most research on the determinants of Presence focuses on aspects within the technology. Research on user characteristics and how they affect Presence is rather scarce. This paper presents the results from a stepwise multiple regression analysis in which the experienced Presence in video games is predicted by a set of user characteristics, among which three psychological constructs: the perceived analogy between the video game world and reality (Analogue Expectations), the perceived aliveness of the computer (Computer as Sort of Alive) and the perception of the video game as a source of experimentation (Experimentation). The regression results initially revealed that Gender, Age and Education were not significant predictors of the experienced Presence in video games, while Average Play Time and General Interest in video games were. When the three psychological constructs were added to the model all three constructs significantly and positively predicted the experienced Presence in video games.

Keywords--- **Determinants of Presence, Video Games, User Characteristics**

1. Introduction

The field of Presence research has grown exponentially over the past few years. The Presence concept is currently being studied in a wide variety of research domains and is applied in the research and development of various human-made technologies ranging from virtual reality environments to computer-mediated communication and video games. Given that the experience of Presence is usually regarded as a positive attribute of a technology that both developers and users strive for, considerable attention is being paid to discover Presence-enhancing determinants. Most of this research however, focuses on Presence-enhancing aspects within the technology itself, such as the technology's sensory richness, while little attention has been paid to user characteristics and how they affect Presence. The study presented in this paper aims at filling some of the gap in the research on Presence determinants, by examining the degree of Presence video game players experience and how this degree of Presence is predicted by a set of socio-demographic variables, video game usage, interest in video games and psychological user characteristics.

2. Literature

2.1. Presence

Over the past four decades the phenomenon of feeling present in a different (often virtual) environment has been referred to with a number of terms such as telepresence [1; 2] virtual presence, mediated presence, or simply Presence [3]. Unfortunately, the proliferation of terms to describe the Presence phenomenon (with an accompanying definition for each term) has led to perfunctory uses of the term Presence and to an overall confusion about what Presence really is [3]. The lack of conceptual clarity has been the breeding ground for a number of key articles in the Presence field, in which the authors attempt to summarize and categorize previous definitions [e.g. 4] and postulate a theoretically supported Presence concept [e.g. 3; 4; 5; 6]. Each of these articles still presents its own accents when defining Presence. We chose to follow the definition given by Lee [3]: Presence is "a psychological state, in which virtual (para-authentic or artificial) objects are experienced as actual objects in either sensory or nonsensory ways".

There is an overall agreement between Presence researchers that the Presence concept has multiple dimensions [3; 5; 7]. Usually three dimensions of Presence are discerned: physical presence (or the feeling that you are physically present in a remote or virtual environment), social presence (or the feeling that you are together with someone who does not really exist or is not really there) and self presence (or the experience of a virtual self) [3; 8]. Although the Presence concept is most often associated with virtual reality, it can be applied to a vast range of activities and media, among which video games.

2.2. Presence in video games

Presence is an important factor for enjoying entertainment media as there is a general agreement that a stronger sense of Presence corresponds with a qualitatively better entertainment experience [7; 9; 10; 11]. This is particularly the case for video games, since video games usually appeal to all three dimensions of Presence at once [7; 12]. First of all, the player

can feel physically present in the video game environment, which consists of (para-authentic or virtual) surroundings and objects. Second, the player can experience social presence when he/she encounters other (para-authentic or virtual) characters in the game. Finally, video games usually offer the player his/her own character to play with. If the player experiences this character as his/her real self and feels as if it is he/she who is interacting with the environment, the player experiences self presence. If the player experiences a high degree of physical, social and self presence the gaming experience is evaluated more positively [7; 13].

Although the Presence concept is highly relevant for the field of video games research and development, it is often overlooked by researchers. Therefore the research regarding Presence and video games is relatively sparse, and often Presence makes out only a small component of the research design [7]. This paper wishes to contribute to the field of research on Presence in video games by exploring some of the determinants.

2.3. Technological Determinants of Presence

The importance of Presence for the success of (technological) applications has motivated researchers to search for the factors that influence people's sense of Presence. This search has revealed numerous influential factors. The number of human senses involved, consistency of sensory output, image size, multimodal presentation, and obtrusiveness [see 4; 14; 15] are only a few characteristics theoretically identified as determinants of Presence. While some determinants of Presence can be equally identified in all media (e.g. image size), other determinants are typical for certain media. Video games, for example, are a very distinct medium with specific attributes beyond traditional passive watching environments. Tamborini [7; 13], for example, presented two typical attributes of video games that enhance spatial presence. The first attribute, vividness, refers to the technology's ability to produce a rich sensory environment and is defined by the manner in which information is presented to the senses. This notion can be traced back to authors such as Steuer [1] and Witmer & Singer [16]. Given the vividness of video games, video games should elicit strong feelings of spatial presence. A second attribute, interactivity, refers to aspects such as the speed with which the video game environment responds to actions. These aspects allow the user to influence the form and content of the video game environment [7; 17], which contributes to the user's sense of Presence. Both vividness and interactivity are examples of specific attributes of video games that determine gamers' sense of Presence.

2.4. User Determinants of Presence

All of the above discussed determinants of Presence (whether more general or more specific) are attributes of the technology itself. However, given the fact that Presence is conceived of as a psychological state of the user, most of the Presence researchers agree that there are other, more important determinants of Presence than medium attributes that can be sought in the user himself [11]. Or as Tamborini & Skalski [7] put it: "…although technology might help open the door to spatial presence, the essence of spatial presence lies in the perceiver" (p. 228). In addition, Klimmt & Vorderer [11] present a number of psychological theories that are linked to Presence and that indicate how interindividual differences in user characteristics such as perceptual, cognitive, emotional and motivational processes can lead to a different experience of Presence (both in the experienced quality and degree of Presence).

This paper will explore how socio-demographic variables, video game usage, video game interest and three possible psychological user variables affect Presence.

2.4.1. Socio-demographic variables, Average Play Time and General Interest in video games What concerns the socio-demographic variables, the suggestion is made that a relationship exists between Presence and Gender, Age and Education level of the respondents [4]. Evidence of the relationship between socio-demographic variables and the degree of Presence is particularly scarce; however, there is support that gender, for example, predicts Presence [18].

RQ1: Are Gender, Age and Education level predictors of Presence in video games?

Besides socio-demographic variables, we were also interested in the relationship between video game play time and interest in video games on the one hand, and the experienced Presence in video games on the other hand. Given the fact that Presence is often equated with involvement [3], we hypothesized that players with a higher average play time and a higher interest in video games would experience a higher degree of Presence in video games.

H1: Video game players who play video games more often, will experience a higher degree of Presence in video games.

H2: Video game players who are more interested in video games, will experience a higher degree of Presence in video games.

2.4.2. Analogue Expectations A review of the Presence construct reveals different, distinct conceptualizations of Presence. One important conceptualization concerns Presence as realism: the degree to which a medium can produce seemingly accurate representations of objects, events, and people [4]. Media portrayals that are 'true to life' should then enhance a feeling of Presence. The degree of perceived realism however, is not only an attribute within the technology but also depends on the user.

In the field of television studies, different concepts already exist to describe the degree of analogy a viewer perceives

between the content of a medium and the actual world. Hawkins [19], for example, has coined the term social expectations, Potter [20; 21] refers to the semantic component of magic window realism, while others [4; 22; 23; 24] prefer the term social realism. In a video game context, however, the term 'social' is loaded with different meanings (e.g. multiplayer, MMORPG's, …). We therefore suggest withholding the term 'Analogue Expectations'. Analogue Expectations refers to the degree of analogy the player perceives between the video game world and the real world.

Some remarks are in place when considering the Analogue Expectations concept in the context of video games. As has been argued by ludologist scholars such as Frasca [25] there are a number of problems associated with transferring a linear notion of realism to an interactive medium such as the electronic game. The player of a game is not only a spectator of the diegetic representation of the video game world on the computer screen, but, more importantly, he/she is also an active agent within the game and is in constant negotiation with the rules of the game. A video game is thus considered analogous to reality not only when the diegetic representation on the screen mimics reality; the actions that the player or other agents in the video game perform must have a referent in the actual world as well. Players seem to construct mental models of what to expect from a video game, and subsequently compare these mental models to the output generated by the computer. If the expectations are met for the player, then he/she will label the situation as realistic. In a football simulation game, for example, the player does not only expect that the grass of the pitch will be green, but also that the opponent is penalized when shooting the ball into touch. Direct support for the importance of analogue expectations and for credible simulations is found by Vinayagamoorthy, Brogni, Gillies, Slater, & Steed [26]. The authors found that perceived behaviour realism of characters correlates strongly with Presence.

The academic argument that Analogue Expectations contributes to Presence is robust [3; 4; 27]. This is reflected in scales measuring Presence, which often include items referring to perceived similarities between the world created by the medium and the actual world [27; 28]. However, the empirical evidence remains relatively scarce and mixed [26], especially in the realm of video games.

Analogue Expectations, in this study, was regarded as a user variable. After all, perceived realism is dependent on past experiences and can thus be different for each individual. Therefore, we expected that the degree of analogy which the user perceives between the video game world and the actual world will positively predict the degree of Presence the user experiences.

H3: Video game players who perceive the video game world to be more analogous to the real world will report a higher degree of Presence.

2.4.3. Games as a source of experimentation Video games are not so much a medium of representation, but of simulation [25; 29]. Players actively influence the quality and outcome of the presented action, and as such, become co-author of the video game [30]. Video games therefore are considered to be laboratories, where the player can play with hopes, fears and believes [25, 31]. The claim that the meaningfulness of the experience can contribute to an overall sense of Presence [4; 27] might be especially applicable to the medium of video games. Two theories are presented in support of this claim.

Oatley's [32; 33] theory of simulation, although initially only applied to narrative media, emphasizes internal processes of construction. The theory has asserted that readers of a book add their personal memories to the realm presented by the text to make it more meaningful. A comparable idea, minimal departure, has been applied by Van Looy [34] in a video game context. While exploring the video game world, players are able to complement that world by activating and retrieving relevant information from their memory. The video game can thus be seen as a credible environment to explore and, as such, the feeling of Presence might be enhanced. The theory of simulation is important because it points out that in the context of Presence minimal sensory input can be compensated by the meaningfulness the presented situation has for the player. Video games, however, turn out to have characteristics which combine the best of both worlds.

The second theory, the psychological theory of play [35; 36] is more profound in explaining why video games can create a meaningful experience. Video games are considered similar to children's make-believe games, which can be described as a form of coping with one's life [36]. Responsibility for the ongoing action, immediate feedback and excellent evaluation mechanisms are clearly not only available in make-believe games, but also in video games. By fully occupying this active role, then, the player can construct a parallel reality in which he/she can experience feelings of mastery and self-efficacy [11]. "Such feelings of mastery may foster the users' readiness to maintain their engagement in the actions within the media system and prevent tendencies to exit the exposure situation, which would support and/or preserve states of Presence" [11]. In other words, users' tendency to consider the video game world as a place for identity construction should increase their motivation to feel a sense of Presence. Kim [37], for example, found that subjects for whom the advertised product was personally relevant reported experiencing greater Presence than other subjects. Other authors have associated agency, the satisfying power to take meaningful action and see the results of our decisions and choices, with higher feelings of Presence [38].

An interesting question we should raise here is whether the precondition of analogue expectations has to be met before players can use the video game world for experimentation. The theory of play provides us with an answer. When we draw the parallel between video games and make-believe games, then it seems that analogue expectations is not a necessary

precondition. By defining a situation as play, individuals establish a set of expectations that may differ from what should be expected in the real world [11, 39]. Transferred to a video game context, players introject themselves into the character and accept for the duration of the game that one is restricted to the rules valid in that specific context [34]. However, at the same time the recognition of those rules can be seen as an acknowledgement that experimentation with certain behaviours impossible or inhibited in real life is allowed for the duration of the game. This is in line with research on identity construction in virtual (fantasy) worlds [40; 41].

H4: Users' tendency to consider the video game world as a place for experimentation should increase the user's overall sense of Presence.

2.4.4. Computer as Sort of Alive When technology enters people's lives, a human-computer interaction process takes place. While it may seem logical that the technological objects in this interaction are inanimate objects, research has shown repeatedly that people often perceive and treat these technological objects as if they were social actors. A number of studies on human-computer interaction at the Center for the study of Language and Information at Stanford University, for example, have shown how people tend to be polite to computers [42], how people enjoy being praised by a computer [43], how people assign personality to computers [44], etc. (for an overview see [42]). The results of these studies indicate that the interactions of people with technology are "*fundamentally* social and natural, just like interactions in real life" ([42] italic in the original). As a consequence, even though people may be aware that technology is not 'alive' in the way that humans are, they still treat the technology as if it is.

While Nass and his colleagues reached this conclusion by investigating how social psychological laws of human-human interactions apply to human-computer interactions, Turkle [40; 45] took a more direct approach in her research on human-computer interaction. Turkle's observations of, and interviews with children who interact with technology has revealed how children think about the ontological nature of technology. Her research has demonstrated how children no longer refer to physical properties but use psychological properties (e.g. "the computer cheats") to define the 'aliveness' of a computer [40; 45]. For this generation who grew up with computers, aliveness is no longer a biological matter of yes or no. Instead children use a new discourse of aliveness that includes criteria such as control, embodiment, movement, feelings, etc. to discern whether a computational object is 'sort of alive' [40]. Moreover, there are inter- (and even intra-individual) differences in the degree and sort of 'aliveness' that is ascribed to computers.

Video games are particularly interesting in light of the aliveness of the computer, since the belief that computers are sort of alive not only applies to the game computer (or console) itself but also to the computer-animated objects within the game world (e.g. the video game characters). The way in which children talk about the characters in *the Sims* video games exemplifies this [40].

Illustrative for the fact that a user perceives the computer as a social actor/as sort of alive, is the fact that the computer, like a social actor, is capable of evoking cognitive, behavioural and emotional reactions in the user. Users who perceive the computer to be more alive, experience a more intense involvement with the computer. In the case of computer games, this means that players who perceive the computer to be sort of alive will be more involved with their game console and the video game content. This is where Presence comes into place. Given that involvement is a crucial aspect of the experience of Presence [4] we expected that higher perceptions of the computer as sort of alive will contribute to a player's sense of Presence.

H5: Video game players who perceive the computer as sort of alive, will experience a higher degree of Presence.

3. Methodology

3.1. Sample

A sample was drawn of 521 Flemish high school students, whose age ranged between 15 and 19 years old. Surveys were administered in an assembly setting. Given the focus of this study, only respondents who played video games more than zero minutes per week were withheld. This group made up 57% (N=296) of the original sample. 69.3% of this subsample was male, 30.3% female. The average age was 16.8 years (*SD*=1.4).

3.2. Measures

Apart from Age and Gender, respondents were asked for their level of Education (1=Vocational Secondary School; 2=Technical Secondary School; 3=General Secondary School; *M*=2.36, *SD*=.61), their Average Play Time per week in minutes (*M*=131, *SD*=134) and their General Interest in video games. General Interest in video games was measured by two items expressing the amount of time players spend looking up information on video games in magazines or on the Internet (0=never to 5=daily; *M*=2.10; *SD*=.92).

The three psychological precedents of Presence (Experimentation, Analogue Expectations and Computer as Sort of Alive) were each measured by using a multiple item scale, ranging from totally not agree (=1) to totally agree (=5). A Principal Axis Factoring (PAF) with oblique rotation was performed to see whether the three proposed factors would emerge. Following Kline [46] the sample size was considered adequate for performing an exploratory factor analysis with this amount of variables. Prior to examining the factor solution, the suitability of the data for factor analysis was assessed. Closer examination of the correlation matrix revealed the presence of many coefficients above .3. The Kaiser-Meyer-Olkin measure

of sampling adequacy was .852, exceeding the minimum recommended value of .6 (47). The value of the determinant was .045, indicating that multicollinearity was no problem. Finally, the Bartlett's Test of Sphericity (48) reached significance, supporting factorability of the correlation matrix. Eigenvalues and close visual examination of the scree plot were used to support the decision on the number of factors to retain.

The PAF immediately extracted the three postulated factors (see Table 1). An inspection of the structure matrix indicated some crossloadings between experimentation and computers as kind of alive. However, as indicated by the determinant, none were problematic.

	Exp	AE	CSA
VG offer an interesting world in which you can discover aspects of your identity.	,774		
VG are useful to learn about the consequences of certain actions in the real world.	,634		
Online Mud's and MMORPG's such as World of Warcraft and Second Life offer an environment to discover aspects of one's identity.	,572		
VG are similar to real life because in both learning how to control a situation is a central theme.	,558		
VG are realistic because they allow me to discover how to handle certain emotions.	,474		
The characters I see in VG are similar to people in real life.		,621	
The things that happen in VG resemble the things that happen in real life.		,588	
The things that happen to people in VG, resemble the things that happen to people in real life.		,551	
Characters in VG have the same characteristics as people in real life.		,536	
A computer cannot really be considered a machine, because it can reliably evoke the same emotions as real world situations.			-,672
A computer is sort of alive.			-,617
A computer cannot really be considered a machine, because it can reliably evoke the consequences of actions in the real world.			-,569

Table 1 Factor Solution Psychological Determinants of Presence

A correlation analysis of these three factors revealed that they were highly related, with the correlation between Experimentation and Computer as Sort of Alive (r=.477 $p<0.01$) stronger than that between Experimentation and Analogue Expectations (r=.329, $p<0.01$) and that between Analogue Expectations and Computer as Sort of Alive (r=.259, $p<0.01$). The Cronbach's Alphas for the different factors were good to sufficient ($\alpha_{Experimentation}$=.78, $\alpha_{Analogue\ Expectations}$=.65, $\alpha_{computer\ as\ Sort\ of\ Alive}$=.73). Mean scores for each of the factors were calculated and retained for further analysis.

The dependent measure in our study was a 7-item scale of Presence. The scale originated from a related study on perceived realism in video games [49]. The items express physical, social and self-presence in the gaming environment, e.g. "While playing a video game, I have the feeling that I'm in the middle of all the action" (see appendix A for the full scale). The internal consistency of this scale proved to be very good ($\alpha_{Presence}$ = .86).

3.3. Analysis

In line with the literature [50] on exploratory model building, the decision was made to use stepwise multiple regression to discover user characteristics that determine Presence in video games.

4. Results

Basic descriptive statistics for each variable and intercorrelations between the independent variables themselves and between the independent variables and the dependent are briefly presented first. Subsequently, stepwise multiple regression analyses are reported.

4.1. Basic descriptive statistics and bivariate correlations

Respondents on average played 131 minutes per week (SD=134), with boys playing on average 171 minutes per week (SD=140) and girls playing on average 42 minutes a week (SD=21) (t(292.773)=11.246, p<.000). A similar gender difference was found for general interest in video games. Boys (M=2.4, SD =.92) in general were more interested in video games than girls (M =1.5, SD=.47) (t(289.039)=11.741, p<.000).

As regards the psychological user variables, respondents on average were not convinced of using video games as laboratories to experiment in (M=2.62, SD=.75), nor that video games bear many analogies to the real world (M=2.18, SD=.78). Finally, in general respondents did not tend to see video games as sort of alive (M=2.25, SD=.87). No significant gender differences were found with regard to the psychological user variables. The low scores on the three psychological user variables are probably partly the result of our research design.

	Gender	*Age*	*Educ*	*APT*	*GI*	*AE*	*CKA*	*Exp*	*Pres*
Gender	1	-,295***	,269***	-,585***	-,477***	,007	,015	-,109*	-,160**
Age		1	-,403***	,178***	,191***	-,107*	-,061	-,010	,049
Educ			1	-,224***	-,117*	-,169***	-,206***	-,203***	-,029
APT				1	,614***	-,010	,081[a]	,239***	,283***
GI					1	,021	,056	,224***	,301***
AE						1	,259***	,329***	,260***
CKA							1	,477***	,395***
Exp								1	,562***
Pres									1

[a] p = .083
* p < .05, ** p < .01, *** p < .001

Table 2 Correlation Matrix

The correlation matrix (Table 2) revealed that our socio-demographic variables were highly correlated. The older our respondents were, the more they tended to be male *(r*=-.295, p<.000). The negative correlation between Age and Education *(r*=-.403, p<.000) can be explained by the fact that vocational and technical secondary school students have often repeated one or more years in comparison to general secondary school students.

Average Play Time (APT) and General Interest in Games (GI) correlated significantly with each other (*r*=.614, p<.000) and with each of the socio-demographic variables: males, older adolescents and lower educated adolescents played more and were more interested in video games.

The three independent variables that we were particularly interested in (Analogue Expectations (AE), the Computer as Sort of Alive (CKA) and Experimentation (Exp)) all related significantly and positively to each other ($r_{AE\text{-}CKA}$ = .259; $r_{AE\text{-}Exp}$ = .329; $r_{Exp\text{-}CKA}$ = .477, p<.000). Education level correlated negatively with all three independent variables: the lower the respondent's education level, the more similarities he/she saw between video games and reality (*r*=-.169, p<.000), the more he/she perceived the computer to be alive (*r*=-.206, p<.000) and the more video games were perceived as a source of experimentation (*r*=-.203, p<.000). Only Experimentation correlated significantly with Average Play Time and General Interest in video games. The more people played, or the more interested they were in video games, the more they perceived video game worlds as a possible source to experiment in and learn from.

Finally, what concerned the correlations between the independent variables and the dependent variable, all independent variables except for Age and Education related significantly to the Presence measure. The intercorrelations between the independent variables themselves and between the independent variables and Presence help us to correctly interpret the regression results.

4.2. Regression results

Stepwise multiple regression analyses were computed with Presence as the dependent variable. Table 3 presents the results for these analyses.

4.2.1. Socio-demographics, Average Play Time and General Interest in video games Before discussing the predictive performance of our three psychological precedents, we first give an overview of the cumulative predictive power of the socio-demographic variables (Gender, Age and Education), of Average Play Time and of the respondent's General Interest in video games.

When comparing the β-values of Gender, Age, Education, Average Play Time and General Interest in the three successive steps of our regression analyses, a collinearity effect was found. Multicollinearity occurs when the independent variables in an analysis are highly correlated. As a consequence, even though two or more variables separately correlate significantly with the outcome variable, their separate beta-coefficients remain insignificant when they are entered together in the regression relationship [51]. In the case of our results, collinearity occurred between Gender and Average Play Time. In Step 1 Gender significantly predicted Presence (Step 1: β_{gender}=-.163, *t*(295)=-2.654, p<.000): male respondents reported a significantly higher degree of Presence in video games. But this 'gender effect' disappeared when Average Play Time is also entered into the equation in Step 2. This can be explained by the relationship between Gender and Average Play Time: male respondents (*M*=171, *SD*=140) spent significantly more time playing video games than female respondents (*M*=42, *SD*=21) (*t*(292.773)=11.246, p<.000) ($r_{gender\text{-}APT}$=-.585, p<.000). As a result, Average Play Time did not only happen to be a better predictor of Presence than Gender (ΔR^2= .06, *F*(4,292)=6.467, p<.000), but the variance

that was explained by Average Play Time also almost completely captured the variance explained by Gender.

		F	*ΔR²*	*β*
Step 1		*2,595*[a]	*,026*	
	Gender			-,163**
	Age			,008
	Education level			,018
Step 2		*6,467****	*,056*	
	Gender			,004
	Age			,014
	Education level			,041
	Average Play Time			,292***
Step 3		*7,037****	*,027*	
	Gender			,040
	Age			-,003
	Education level			,024
	Average Play Time			,183*
	General Interest			,211**
Step 4		*25,198****	*,304*	
	Gender			-,019
	Age			,112*
	Education level			,205***
	Average Play Time			,110 [b]
	General Interest			,121*
	Analogue Expectations			,117*
	Computer as Sort of Alive			,200***
	Experimentation			,415***

[a] → p = .053, [b] → p = .09
* p < .05, ** p < .01, *** p < .001

Table 3 Presence predicted by Age, Gender, Average Play time, General Interest

If we take all the socio-demographic variables, Average Play Time and General Interest in video games into consideration (Step 3), Average Play Time (β_{APT}=-.183, t(295)=-2.345, p<.05) and General Interest in video games (β_{GI}=-.211, t(295)=-2.939, p<.01) significantly predicted Presence. The more people played video games, and the more people were interested in video games, the higher the degree of Presence they experienced when playing video games. The effect size of this third model, however, was only moderate (Cohen's f^2=.122).

4.2.2. Experimentation, Analogue Expectations and the Computer as sort of Alive In our final model (Step 4) Analogue Expectations, the Computer as Sort of Alive and Experimentation were added to the set of regressors used in step 3. Each of these three explanatory variables significantly predicted Presence, with Experimentation (Exp) as the strongest regressor of Presence (β_{Exp}=.415, t(295)=-7.534, p<.000). Adding Analogue Expectations, the Computer as Sort of Alive and Experimentation to our model considerably increased its explanatory power (ΔR^2= .304, F(8,288)=25.198, p<.000, Cohen's f^2=.70).

Unfortunately, in our final step Average Play Time lost its significance as a predictor of Presence (β_{APT}=.110, t(295)=1.700, p=.09), and General Interest in video games became less significant (β_{GI}=.121, t(295)=2.038, p<.05). We can again attribute the changes in Average Play Time's and General Interest's β-values to collinearity. The substantial correlations between General Interest in video games and Average Play Time (r=.614, p<.000), and between these two variables and Experimentation ($r_{APT\text{-}Exp}$=.614, p<.000; $r_{GI\text{-}Exp}$=.224, p<.000) help explain how in our final model Average Play Time turned non-significant and the significance of General Interest was strongly reduced.

The effect of collinearity in regression analysis is not to affect the overall explanatory performance, but to make it difficult to identify the relevant explanatory variables sharply. Therefore the multicollinearity for the final set of predictors was assessed by examining two diagnostics, tolerance (1/VIF) and the Variance Inflation Factor (VIF), for each variable in our model. The general consensus is that a VIF value higher than 10 (or a tolerance value lower than .1) is cause for concern. In our model the highest VIF value was 2.030 and the lowest tolerance value was .493. Therefore collinearity did not seem to be a force that affects our model results in a problematic way.

In our final model Age and Education unexpectedly became significant predictors of Presence. The increase in significance of the Age and Education's β's can possibly be attributed to a suppressor effect. A suppressor effect occurs when one or more variables have a zero correlation with the dependent variable, but -when combined with other predictors- they appear to significantly predict the dependent variable [52]. The reason for this sudden change in predictive power lies in the fact that, although there is no direct relation between the suppressed variable(s) and the regressand, there is an indirect relationship: Age and Education correlated significantly with each other and especially Education was strongly related to all three psychological precedents of Presence: the lower the education level of the respondent the more similarities he/she perceived between the video game world and reality ($r_{Ed\text{-}AE}$ =-.169, p<.000), the more he/she saw computers as living beings ($r_{Ed\text{-}CKA}$ =-.206, p<.000), and the more he/she saw the video game world as a world to experiment in and learn from ($r_{Ed\text{-}Exp}$ =-.203, p<.000). Age and Education therefore are significant *indirect* predictors because they remove the measurement artefact variance from the Analogue Expectations, Computer as Sort of Alive and Experimentation scores. This benefits the overall

explanatory value of our model. Contrary to the expectations, education's β suddenly became a significant positive predictor of Presence. A possible explanation[19] might be that education encompasses a number of distinct aspects, among which the respondent's intelligence, but probably also aspects such as creativity. Perhaps, the measurement artefact variance which was removed from our three psychological user characteristics overlaps completely with one distinct aspect of education (e.g. intelligence), leaving behind other distinct aspects of education (e.g. creativity) that are positively related to Presence. This argumentation is tentative, however.

5. Discussion

The theoretical literature on the determinants of Presence is vast. Congruous empirical evidence, however, is not always provided. The present research tried to fill some of this void by investigating user variables as determinants of Presence in a video game context. As hypothesized, interindividual differences in user characteristics are essential when discussing determinants of Presence. We chose to include not only socio-demographic user variables and video game usage variables, but also psychological user variables. This rationale was inspired by Klimmt and Vorderer's [11] emphasis on the need for research on psychological determinants of Presence.

The hypothesises concerning the three psychological user variables and their prediction of Presence were supported. First of all experimentation appeared to be the strongest predictor of Presence. The unique medium specific characteristics of video games, such as vividness, interactivity and multiple sensory input, help to immerse the players into credible virtual worlds, some with almost infinite possibilities. As such, players can utilize video games as laboratories to experiment in [25; 31]: the game play experience becomes meaningful for identity construction. Given that the meaningfulness of an experience contributes to the experience of Presence [27], we hypothesized that adolescents who have stronger perceptions of the video game world as a laboratory to experiment in, would report a higher experience of Presence in video games. This is indeed the case. Second, we hypothesized that stronger perceptions of the computer as sort of alive would contribute to the experience of Presence. Research has demonstrated that people often treat computers as social actors and specific research on the ontological nature of computers has revealed that in our contemporary society children differentiate between sorts and degrees of aliveness [45]. Our research results confirmed that in the case of adolescent video game players, the people who understand computers and video games psychologically rather than physically will experience a higher degree of Presence in video games. Finally, the experienced Presence in video games proved to be higher for video game players who agreed more strongly that the information conveyed by the video game is consistent with that learned through real world experience.

As regards the socio-demographic variables, the observation was made that Education level and Age are indirect predictors of Presence. While there was no direct relationship between Education and Presence, Education did have a profound influence on our three psychological user variables. Lower educated respondents saw video games more as a means for experimentation, were more inclined to emphasize the psychological aspects of the medium, and saw more similarities between the video game world and the real world than higher educated respondents. As such, the three psychological user variables indirectly link education to Presence in video games. Replications of these findings in a laboratory setting would increase the reliability and validity of our results.

The findings of this study have interesting implications for the field of Presence research. Previous research on the positive effects of video games, for example, has already revealed that certain video games can be useful for skill training of lower educated people [4] and video games are known to motivate bad school achievers [53]. A higher sense of Presence in the video game is important for the success of these video games, as Presence contributes to a better learning experience [54; 55]. As our results reveal, there are interindividual differences in users that moderate the relationship between education and the experience of Presence in video games. The knowledge of what moderates the relationship between education and Presence can help understand why for some people video games might have more educational value than for others.

The same goes for the possible negative effects of video games. Some authors [56; 57] argue, for example, that experiencing high feelings of Presence in e.g. violent video games might lead to desensitization to violence. Our research results show that the link between the experience of Presence in video games and a possible desensitization to violence can be explained by looking at the psychological determinants that constitute Presence. If a video game player perceives the game world as similar to the real world (Analogue Expectations) and as a world from which the player can learn valuable things for his real life, it is possible that a player of violent video games starts to regard violence as a valid way of dealing with problems in the real world.

A few important limitations exist in the study. First, we would like to remark that the strong correlations between the three psychological user characteristics and education level might partially be a consequence of the use of a self-report survey instrument or even a social desirability artefact. Nass and his colleagues [42; 43; 44] demonstrated that in a laboratory setting with implicit measures most respondents, regardless of education level, treat computers as if they were social actors. Our survey setup, however, where respondents

[19] Another explanation, the existence of interaction effects, was investigated, but no such effects were found.

had time to think about their answers, might have led higher educated respondents to behave more rational than they would in real life. Second, an often recurring problem in Presence research is the thin line between the determinants of Presence and the construct itself. This study is no exception. Despite careful conceptualization one might ask whether our determinants are predictors of Presence or a measure of Presence itself. Our conceptualization, however, is in line with several key Presence authors [3; 4; 27], who regard spatial, social and self presence as the essence of the construct, and technological and/or user variables as determinants of Presence. Third, the scales that were used for this study show mixed results. While the internal consistency of Presence and Experimentation was very good, the Alpha's of Analogue Expectations and the Computer as Sort of Alive are satisfactory. Future research is needed to create validated scales.

Despite these limitations, this study provided clear indications that the essence of Presence cannot be grasped by taking only technological determinants of Presence into account. Future research dealing with Presence could profit from a larger emphasis on user variables. It is also clear that other user variables besides the ones discussed, such as mood, provide interesting avenues for further research. In addition, a psychological approach might be more useful in investigating the effects of Presence. Future research, for example, could investigate the influence of experimentation on the enjoyment of the video game experience. With this sort of research a more specific focus is created for designers of virtual learning environments to improve the learning experience. New avenues for further research are also available for video game researchers. The next generation consoles and new powerful personal computers raise new questions and possibilities in the sphere of credible simulation and rich sensory input. And the Nintendo Wii is an interesting, modifiable tool for investigating the influence of tangible interfaces on Presence. Finally, the construct of Presence benefits greatly when being associated with established theories. Klimmt and Vorderer [11] gave a strong impetus, but there is still need for more integrated theories.

References

[1] J. Steuer. Defining virtual reality: Dimensions determining Telepresence. *Journal of communication*, 42, 73-93. 1992.

[2] J. V. Draper, D. B. Kaber, J. M. Usher. Telepresence. *Human Factors*, 40, 354-375. 1998.

[3] K. M. Lee. Presence, explicated. *Communication Theory*, 14, 27-50. 2004.

[4] M. Lombard, T. Ditton. At the heart of it all: The concept of presence. *Journal of Computer Mediated Communication, 3*. 1997. URL: http://jcmc.indiana.edu/vol3/issue2/lombard.html.

[5] F. Biocca. Cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, 3. 1997. URL: http://jcmc.indiana.edu/vol3/issue2/lombard.html.

[6] M. Slater. Measuring presence: A response to the Witmer and Singer presence questionnaire. *Presence: Teleoperators and Virtual Environments, 8*, 560-565. 1999.

[7] R. Tamborini, P. Skalski. The Role of Presence in the Experience of Electronic Games. In P. Vorderer, B. Jennings (Eds.) *Playing Video Games: Motives, Responses, and Consequences*. Mahwah: Lawrence Erlbaum Associates. pp. 225-240. 2006.

[8] W. A. IJsselsteijn, H. de Ridder, J. Freeman, S.E. Avons. Presence: Concept, determinants and measurement. In *Proceedings of the SPIE*, 520-529. March 2000.

[9] S. C. Nichols. *Virtual Reality Induced symptoms and effects: Methodological and theoretical issues*. PhD dissertation, University of Nottingham. 1999.

[10] H. Patel, S. Nichols. View of the future: overview of the experimental programme via quantitative meta-analysis. Paper presented to *Virtual Reality design and evaluation workshop*, Nottingham, UK. 2004.

[11] C. Klimmt, P. Vorderer. Media Psychology "is not yet there": Introducing theories on media entertainment to the presence debate. *Presence: Teleoperators and Virtual Environments*. 12, 346-359. 2003.

[12] M. S., Eastin, R. P. Griffiths. Beyond the shooter game: Examining presence and hostile outcomes among male game players. *Communication Research*, 33, 448-466. 2006.

[13] R. Tamborini. The experience of telepresence in violent video games. Paper presented at *the 86th annual conference of the National Communication Association*, Seattle, LA. 2000.

[14] C. Heeter. Being there: The subjective experience of presence. *Presence: Teleoperators and Virtual Environments*,1, 262-271. 1992.

[15] T. B. Sheridan. Musing on telepresence and virtual presence. *Presence: Teleoperators and Virtual Environments*, 1, 120-126. 1992.

[16] B. G. Witmer, M. J. Singer. Measuring presence in virtual environments: A presence questionnaire. *Presenc: teleoperators and Virtual environments*, 7, 225-240. 1998.

[17] P. Zahorik, R. L. Jenison. Presence as being-in-the-world. *Presence: Teleoperators and Virtual Environments*, 7, 78-89. 1998.

[18] S. Kurita. Presence, involvement and gender differences: How emotional dimensions explain the mechanism of presence. Paper presented at *the Annual meeting of the International Communication Association*. Dresden, Germany. June 2006.

[19] R. P. Hawkins. The dimensional structure of children's perceptions of television reality. *Communication Research*, 4, 299-320. 1977.

[20] W. J. Potter. Perceived reality and the cultivation hypothesis. *Journal of Broadcasting, & Electronic Media*, 30, 159-174. 1986.

[21] W. J. Potter. Perceived reality in television effects research. *Journal of Broadcasting, & Electronic Media*, 32, 23-41. 1988.

[22] A. Dorr. No shortcuts to judging reality. In J. Bryant, D. R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension*. Mahwah: *Lawrence Erlbaum Associates*. pp. 199-219. 1983.

[23] R. W. Busselle, B. S. Greenberg. The nature of television realism judgements: A re-evaluation of their conceptualization and measurement. *Mass communication & Society*, 3, 249-269. 2000.

[24] J. C. Wright, A. C. Huston, A. Reitz, S. Piemayat. Young children's perceptions of television reality; determinants and development differences. *Developmental Psychology*, 3, 229-239. 1994.

[25] G. Frasca, Simulation versus narrative: Introduction to ludology. In M. J. P. Wolf, B. Perron (Eds.), *The video game theory reader*. New York: Routledge. pp. 221-236. 2003.

[26] V. Vinayagamoorthy, A. Brogni, M. Gillies, M. Slater, A. Steed. An investigation of Presence responses across variations in visual realism. Paper presented at the *7th Annual International Presence workshop*. Valencia, Spain. 2004.

[27] B. G. Witmer, C. J. Jerome, M. J. Singer. The factor structure of the Presence questionnaire. *Presence: Teleoperators and Virtual Environments*, 14, 298-312. 2005.

[28] T. Schubert, F. Friedman, H. Regenbrecht. The experience of Presence: Factor analytic insights. *Presence: Teleoperators and Virtual Environments*, 10, 266-281. 2001.

[29] J. Juul. *Half-Real: Video games between real rules and fictional worlds*. London: MIT Press. 2005.

[30] J. Kücklich. Perspectives of computer game philology. *Game Studies; The International Journal for Computer Games Research*, 3. 2003. URL: http://www.gamestudies.org/0301/kucklich/.

[31] J. Jansz. De uitdaging van videogames [The challenge of videogames]. In: J. de Haan, C. van 't Hof (Eds.) *Jaarboek ICT en samenleving. De digitale generatie*. Boom: SCP. pp. 63-79. 2006.

[32] K. Oatley. A taxonomy of the emotions of literary response and a theory of identification in fictional narratives. *Poetics*, 23, 53-74. 1994.

[33] K. Oatley. Meeting of minds: Dialogue sympathy, and identification in reading fiction. *Poetics*, 26, 439-454. 1999.

[34] J. Van Looy. Computer games and possible worlds theory. *Image and Narrative*, 12. 2005. URL: http://www.imageandnarrative.be/tulseluper/vanlooy.htm.

[35] B. Sutton-Smith. *The ambiguity of play*. Harvard: Harvard University Press. 1997.

[36] R. Oerter. Spiel als Lebensbewältigung. Einige Erklärungsansätze für Spielhand-lungen. In S. Hoppe-Graff, R. Oerter (Eds.) *Spielen und Fernsehen. Über die Zusammenhänge von Spiel und Medien in der Welt des Kindes*. Weinheim: Juventa. pp. 47-58. 2000.

[37] T. Kim. *Effects of presence on memory and persuasion*. North Carolina: University of North Carolina. 1996.

[38] G. Herrera, R. Jordan, L. Vera. Agency and Presence: A common dependency on subjectivity? *Presence: Teleoperators and Virtual Environments*, 15, 539-552. 2006.

[39] J. Huizinga. *Homo Ludens: a study of the play-element in culture*. New York: Harper and Row. 1970.

[40] S. Turkle. *Life on the screen: Identity in the age of the Internet*. New York: Simon and Schuster. 1995.

[41] F. Schaap. *The world that took us there*. Amsterdam: Aksant Academic Publisher. 2002.

[42] C. Nass, B. Reeves. *The media equation; How people treat computers, television, and new media like real people and places*. Chicago: University of Chicago Press. 1996.

[43] B. J. Fogg, C. Nass. Silicon sycophants: the effects of computers that flatter. *International Journal of Human-Computer Studies*, 46, 551-561. 1997.

[44] C. Nass, Y. Moon, B. J. Fogg, B. Reeves. Can computer personalities be human personalities? *International Journal of Human Computer Studies*, 43, 223-239. 1995.

[45] S. Turkle. Computer games as evocative objects: From projective screens to relational artefacts. In J. Raessens, J. Goldstein (Eds.) *Handbook of Computer Game Studies*. London: MIT Press. pp. 267-279. 2005.

[46] P. Kline. *An easy guide to factor analysis*. New York: Routledge. 2004.

[47] H. F. Kaiser. A second generation little jiffy. *Psychometrika*, 35, 401-415. 1970.

[48] M. S. Bartlett. A note on the multiplying factors for various chi-square approximations. *Journal of the Royal Statistical Society*, 16, 296-298. 1954.

[49] W. Ribbens. Perceived realism in video games: an exploratory factor analysis. *Research report presented at the Player2008 Conference*. Kopenhagen. August 2008.

[50] D. B. Wright. *Understanding statistics: an introduction for the social sciences*. Los Angeles: Sage. 1997.

[51] A. Field. *Discovering statistics using SPSS*. London: Sage. 2005.

[52] B. P. Lancaster. Defining and interpreting suppressor effects: advantages and limitations. Paper presented at *the Annual meeting of the Southwest educational research association*. Texas. 1999.

[53] K. Squire. Video games in education. *International journal of intelligent simulation and gaming*, 2. 2003. URL: http://www.cyberfest.us/Education/Video_Games_in_Education-MIT_Study.pdf.

[54] C. Dede. The evolution of constructivist learning environments: Immersion in distributed, virtual worlds. *Educational technology*, 35, 46-52. 1995.

[55] W. Winn, H. Hoffman, A. Hollander, K. Osberg, H. Rose, P. Char. Student-built virtual environments. *Presence: Teleoperators and Virtual Environments*, 8, 283-292. 1999.

[56] D. Zillmann, & J. Bryant. Pornography, sexual callousness, and trivialization of rape. *Journal of Communication*, 32, 10-21. 1982.

[57] R. Tamborini, M. S. Eastin, P. Skalski, K. Lachlan, T. A. Fediuk, R. Brady. Violent virtual video games and hostile

thoughts. *Journal of Broadcasting & Electronic Media*, 48, 335-357. 2004.

Appendix A

Dependent = Presence (alpha = .86)

1. While playing a video game, I have the feeling that I'm in the middle of all the action.
2. While playing a video game, I leave reality and I feel wrapped up by the video game.
3. While playing a video game, I'm the character on the screen.
4. While playing a video game, I have the feeling that I take up the role of the character I play.
5. While playing a video game, I feel the emotions that the character on the screen experiences.
6. While playing a video game, I have the feeling that my supporters and adversaries in the video game are real people.
7. While playing a video game, I have the feeling that the objects in the video game are real.