Digital Games as Social Presence Technology:

Development of the Social Presence in Gaming Questionnaire (SPGQ)

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Abstract

Digital gaming presents an engaging, widely varied, and increasingly popular pastime. Yet in recent theorising about digital game experience, the social richness of playing is often marginalised or neglected all together. We argue that, although not previously recognized or defined as such, digital gaming technology can usefully be regarded as social presence technology, as it provides a setting for interacting with others at a distance and augments communication in co-located settings. In the service of future investigations of game experience, and gaming as a social experience in particular, we developed a self-report measure, the Social Presence in Gaming Questionnaire (SPGQ), based on focus group interviews with both casual and avid gamers and a social presence scale developed for other social presence devices – the Networked Minds Measure of Social Presence [40]. This paper describes the factor structure of this new measure and explores basic sensitivity and validity.

Keywords--- **Digital games; Game experience; Social presence; Self-report measure**.

1. Introduction

To date for many people digital gaming has connotations of social isolation, raising concerns and criticisms from teachers, parents, researchers and policymakers [1]. Interestingly, scientific literature does not provide convincing evidence to this effect. On the contrary, studies indicate that digital gaming brings many opportunities for social interaction. The importance of such interactions for shaping the gaming experience is testified by the overwhelming participation in virtual communities (e.g., ActiveWorlds, Second Life) and massively multiplayer online games (MMOGs, e.g., World of Warcraft), and the personal relevance of these communities to those intensely involved in such games. Some have noted that such online games can be understood as collaborative virtual environments, e.g., [2,3].

But digital games also give rise to frequent and meaningful social interactions in the real and tangible world of the gamer. Naturalistic observations in home environments signalled unexpected instances of cooperative play, even around games that can only be played in single-player mode, e.g., [4]. Several studies report of electronic games' opportunities for social interaction and the enjoyment that results both from playing together or watching others play, enjoying the spectacle and sharing comments, and the enhancement of emotional experience that comes from the presence of a crowd (e.g., [5,6,7,8]). Some even argue that it is the social interaction and participation that, to a large extent, explain game enjoyment [1,4].

Market research also supports the notion that digital gaming has become an increasingly social activity. A 2005 Nielsen research report [9] commissioned by the Interactive Software Federation of Europe (ISFE) details that two-thirds of the gamers they sampled (N=2000, with equal proportions from Spain, Germany, Italy, the UK and France) play video games with other people for at least an hour a week. Moreover, when probed for their motivations to play digital games, the number one motivation, supported by 60% of the gamers, is the social component, i.e., "being able to play with friends".

The social embedding and social effects of digital gaming exist on multiple levels of interpersonal relations. For instance, Kubey and Larson [10] note that children often play electronic games together with companions. Most gamers were introduced to gaming while playing with others or watching others play [11], and in the past, video game arcades were reported to represent important social environments for young people, as places to build friendships and meet with one's peers [12]. Research has also demonstrated that kids who play video games on a regular

basis have equal amounts of friends to those who do not [13,14], that video game playing actually increases social contact [15], and that avid gamers meet each other more frequently after school than children who are not gaming frequently [16].

In many respects, electronic games are not all that different from traditional games (e.g., card games, board games), which have often been viewed as desirable materializations of family and peer interaction and involvement, and as sources for entertainment and liveliness in the public arena. Games present condensed forms of interaction, entertainment and liveliness, triggering short term interactions as well as long term relationships. For this reason, we argue that, although not previously explicitly defined as such, digital gaming technology should be regarded as social presence technology, as it provides a setting and medium for interacting with others at a distance (e.g., in online gaming) and augments and enlivens communication in co-located settings.

1.1. Social context in game experience research

Our work is strongly inspired by the realization that gaming is often as much about social interaction, as it is about interaction with the game content. Thus, the rich interactive experiences associated with gaming can only be fully understood when the game is conceptualised as more than the software and hardware one is interacting with, but includes a larger situational perspective, tapping in on the social-contextual contingencies that powerfully influence game interactions and associated experiences. After focus group investigation of presence experiences of gamers, Bracken, Lange and Denny [17] argue: ‘The social dimension of gaming may even overwhelm traditional ideas of visual and audial richness being the most important attributes to focus on in establishing spatial or social presence’ (p.18).

Given the growing anecdotal and empirical support for the social richness of digital gaming, it is increasingly surprising that social processes and interpersonal dynamics are underrepresented in conceptualisations and theoretical deliberations of game experience and game enjoyment. In most models a marginal role, at best, is reserved for social influence (e.g. see, [8,18,19,20]). The relevance of social factors in gaming is generally acknowledged by most of these scholars, however it has not been translated into an explicit incorporation of social processes into their models. Perhaps this is due to the fact that accounts of social interaction and social context effects do not lend themselves easily for combination with conceptualisations of flow and immersion [18,21,22], phenomena which are generally acknowledged as central to game experience and are thought to be highly sensitive to external distractions such as, for instance, the presence of other people. This is also noted by Sweetser & Wyeth [8] who state: 'social interaction is not an element of flow, and can often interrupt immersion in games [...] However, it is clearly a strong element of enjoyment in games' (p.10).

Research into the social interactions during game play has indicated positive effects on performance, social interaction, and motivation for small group interactions during educational games in classrooms [23,24,25,26]. Recent research with adolescents and adults has also demonstrated that playing games with others adds to game experience, demonstrating that playing against a co-present friend elicits higher engagement, arousal and more positive emotions (fun) than playing against a stranger, or a computer [27,28].

Accounts of the psychological processes behind these findings are still speculative. In Ravaja’s [28] study, playing against a human generally elicited higher anticipated threat, and post-game challenge ratings tended to exceed those in person-computer competitions. Mandryk et al. [27] however, demonstrated higher arousal levels for playing against a friend, irrespective of perceived challenge, which appears to undermine perceived challenge as the cause for higher arousal levels.

As a first step towards understanding the interplay of social and individual experiences of digital gaming, the present research aimed to develop a measure of social presence in gaming situations.

1.2. Social presence

In face to face conversation, people communicate via a host of cues - verbal, paraverbal, non-verbal - employing multiple sensory channels. In mediated settings, communication between individuals is filtered by media technology. Research in this area has shown that the level of social presence and/or communicative realism is strongly dependent on properties (richness) of the media interface, allowing, for instance, for verbal and/or non-verbal communication, and supporting varying levels of naturalistic representations in terms of appearance and behaviour (e.g., [29,30,31]).

Developments in telecommunications and internet connectivity have opened a wide range of potential channels for social interaction: ‘The mediated other is not simply “here or not-here,” but is present to a lesser or greater degree along some definable continuum' [32]. A related, yet somewhat different situation is ‘copresence’ (the sense of being there together) as experienced, for example, when meeting each other as avatars in a virtual world [33]. But even in unmediated interactions, assuming a dichotomy of persons being either there or not-there doesn’t do justice to the subtlety with which individuals engage in, or withdraw from, interpersonal communication [32]. In their theoretical and empirical analysis of ‘networked minds’, Biocca, Harms, and Burgoon, [30] argue that sensory awareness of bodily representations, psychological involvement with another intelligence and behavioural engagement through interaction and synchronisation are dimensions that characterise the

social presence of a person in *both* mediated and unmediated settings [34].

Interpersonal awareness, involvement and engagement are the result of a complex interplay of compensatory and reciprocal behaviours – sometimes called immediacy behaviours - involving verbal communication as well as interpersonal distance, body orientation, gestures, and gaze direction (e.g., [35,36,37,38]). Concepts such as involvement and immediacy - the directness and intensity of interaction between two people [37,38] - are most often used in contexts where the primary activity is face to face communication. However, they appear equally appropriate to describe a person's involvement with his/her social context during digital gaming, even though in these situations attention is distributed between the game, the controller, and the co-player(s).

Biocca et al.'s Networked Minds conception of social presence [32,34], appears to fit both mediated and co-located interaction settings and serves as an interesting measure in the study of socially situated gaming that may contribute to game experience and enjoyment.

1.3. Developing a social presence measure for digital gaming

The Game Experience Lab has recently developed a multi-dimensional self-report measure of game experience, which probes the multi-dimensional subjective experiences associated with digital gameplay and feelings after the gaming session has ended: the Game Experience Questionnaire (GEQ) [39]. In view of the relevance of social context in digital gaming, we felt the need to also develop a social presence module for this instrument. This social presence module, the Social Presence in Gaming Questionnaire (SPGQ), should probe gamers' awareness of and involvement with their co-players.

Biocca and colleagues [40] have developed the Networked Minds Measure of Social Presence (NMMSP), which provides a self-report based measure of users' sense of being with their communication partner. It is based on their theory of social presence and constructed for measuring experiences in social presence technologies such as mediated collaborative work environments, mobile and wireless telecommunication, and teleconferencing interfaces [34]. In their model, social presence consists of three underlying dimensions, varying 'from a superficial to deep sense of co-presence, psychological involvement, and behavioural engagement with the other' (p.2) [40]. The three dimensions thus simultaneously characterise progressively higher levels of social presence.

However, despite the fact that digital gaming technology can usefully be conceptualised as a social presence technology, there are a number of significant differences between digital games and the kinds of communication technologies listed above that need to be taken into account when attempting to characterise and measure their associated user experiences. For one, most communication applications are designed specifically for engendering a level of experienced social presence between users. That is, their design affords the transmission of verbal and nonverbal communication cues that are aimed to facilitate social involvement, understanding, and interaction between users. On the other hand, the majority of digital game technologies were originally intended to be used individually, and opportunities for playing with others (serially or in parallel, competitive or cooperative) were only added later in the process. Secondly, most social presence applications are primarily geared towards transmitting the user's thoughts and ideas, and only secondarily towards presenting the task at hand - if there is a task at all - whereas multi-player digital gaming technology does exactly the opposite: it primarily aims to present the task and task setting to players, i.e., the game world, and only secondarily – if at all – allows the transmission of additional social communication cues. Thirdly, social presence applications are generally not developed to be interesting or engaging by themselves, whereas in digital gaming, the medium is clearly designed to be intrinsically motivating and fascinating, potentially diverting players' attention away from each other.

In view of these considerations, we cannot simply assume that Biocca et al.'s [40] measure is directly applicable for this class of applications and that it presents an adequate and appropriate instrument for probing players' social presence experience in digital games. A new questionnaire was therefore developed, inspired on the Networked Minds measure (and in fact borrowing a number of its items) but also based on focus groups interviews with both casual and avid gamers. These focus group interviews were performed to explore gamers' first hand experiences of playing digital games. The focus groups were used both for discovering the various components of game experience, and as a reference – a dictionary so to speak – for formulating the items probing these components. These data served as a basis for both the core GEQ (probing seven components of individual game experience, see [38]) and the SPGQ. For a detailed description of this phase, see [41]. The current paper presents a survey study in which the factorial structure and internal consistency of the SPGQ was established and discusses the first exploration of scale validity and sensitivity.

2. Method

2.1. Design

For exploring the factor structure of our original set of items a sizeable and representative sample of gamers was needed. As the questionnaire measure is intended to be applicable across a range of gaming genres and platforms, it was important to allow participants to play a self-selected game on their own preferred gaming platform (PC, console, mobile), and in their own preferred physical setting (e.g., living room, bedroom, Internet Café, etc.). Based on these

considerations we chose to use an online survey, inviting people to play a game of choice and to subsequently fill out our questionnaire.

2.2. Participants

The present research sample consists of those participants in the larger GEQ sample [see 39], who reported having played against another social entity (real & co-located, real & mediated, or virtual, i.e., in-game character). In total, 191 participants who participated in the larger survey also filled out the SPGQ. This group consisted of 169 men and 20 women (three participants did not report their gender), with an average age of 19.8 years (range 10 to 40 years, SD = 4.46). With respect to educational level, 8% had a low education, 19% a mid level education, and 73% was highly educated. Gaming frequency varied from daily (30%), to at least weekly (43%), at least monthly (12%), and less than monthly (15%).

Participants were recruited via the internet, using two different channels: Virtual Lab (vlab) and internet game forums. Both websites allowed us to track the time participants had spent on filling out the questionnaire, and to exclude users who had filled out the questionnaire before. On average, it took 10 to 15 minutes to complete the full survey.

An invitation to participate in a study on game experience was sent out to people registered at the vlab database. Respondents who participated through vlab were paid 3€. We further recruited participants by posting invitations at several Dutch and Belgian internet game forums (e.g., InsideGamer.nl, Minatica.be). The invitation included a link to our survey created with the online survey tool SurveyMonkey (www.surveymonkey.com). As an incentive, we raffled a PlayStation 3 among participants who took part via this online link.

2.3. Game characteristics

The type of games participants played, were myriad. Participants filled in the full name of the game and, with the help of a game expert, we recoded those games into 12 game genres. Participants played First Person Shooter games (35%), Role Playing games (12%), Sports games (14%), Puzzle/board/card games (6%), Action adventure games (10%), Strategy games (9%), and other genres (e.g., simulation games, fight games, children's games, music games) (9%). Most games were played on the PC or on a console. A minority used another platform (e.g., handheld console or mobile phone). The majority of participants played the game in their own homes.

2.4. Procedure

First, as outlined above, participants were invited to take part in a study on game experience. The invitation described the purpose and the procedure of the study. More concretely, we told participants that we were interested in how people experience digital gaming and that everybody, also non frequent gamers, could participate. In the invitation we further included the instruction that before opening the link to the questionnaire they had to play a digital game. Participants could freely chose the game they played, but we did suggest them to play this game the same way as usual (with regard to the type of game, gaming platform, game setting). After playing the game, participants could click on a link that guided them to the online survey.

2.5. Research materials

A list of items was constructed based on the findings from the focus groups. In addition, the NMMSP [40] was reviewed and those items that appeared relevant and seemed to roughly match descriptions by gamers were selected. Items were selected from each of the three dimensions: six items measuring co-presence, four measuring psychological involvement, and four measuring behavioural interdependence. Two additional items from the psychological involvement scale were adapted and used (instead of ‘opinions were clear’, we used ‘intentions were clear’, to better match the present application area). Besides these items, we included items measuring positive feelings of togetherness (enjoyment of social context, connectedness, empathy, sympathy, admiration), as well as those measuring negatively toned emotions (jealousy, revenge, schadenfreude, i.e., malicious delight). In total, the long-list consisted of 25 items. The answering scale used was identical to that used for the GEQ, which was a five point intensity scale with points anchored at not at all (0), slightly (1), moderately (2), fairly (3), and extremely (4).

3. Results

Exploratory factor analysis (EFA) was performed on the full set of items. Subsequently, scales were constructed and their sensitivity and validity were explored using additional background variables collected during the survey.

3.1. Dimensionality analysis

Dimensionality analysis of the social presence gaming questionnaire (SPGQ) resulted in three subscales: (1) Psychological involvement – Empathy, (2) Psychological Involvement – Negative feelings, and (3) Behavioural involvement. Although a few more eigenvalues were higher than one, the scree plot showed a clear bend after the third factor. The three-factor solution was easily interpretable, and explained 46% of variance. It consisted of two psychological involvement components (Empathy and Negative feelings), and one Behavioural Involvement component.

3.1.1. Psychological Involvement – Empathy The first factor that emerged was called Psychological Involvement -

Empathy. Seven of the eight items loading on this factor were selected for the scale. The eighth item loading on this first factor ('the other was influenced by my moods') was one of a matched pair, taken from the Networked Minds measure. We excluded it because the other item of this pair loaded on the third factor. The resulting scale consists of the following items:

- When the others were happy, I was happy*[1]
- When I was happy, the others were happy *
- I empathized with the other(s)
- I felt connected to the other(s)
- I admired the other(s)
- I found it enjoyable to be with the other(s)
- I sympathized with the other(s)

Starred items were taken from the NMMSP [40], specifically from the Psychological Involvement scale (Empathy). The scale is very reliable, Cronbach's alpha = 0.856, and factor loadings range from .60 - .81.

3.1.2. Psychological Involvement – Negative feelings

The second component of Psychological Involvement was called Negative feelings. Again, six of items were selected for the scale, which has a satisfactory internal consistency (alpha) of 0.68, and factor loadings between .595 and .615.

- I tended to ignore the other*
- The other tended to ignore me*
- I felt revengeful
- I felt schadenfreude (malicious delight)
- I felt jealous of the other
- I envied the other

The first matched pair of items was taken from the NMMSP Co-presence scale (Attentional Allocation).

3.1.3. Behavioural Involvement The third scale is termed Behavioural Involvement. The scale has good reliability, Cronbach's alpha=.84, with factor loadings between .37 and .85. The items are:

- My actions depended on the other's actions*
- The other's actions were dependent on my actions*
- What the others did affected what I did*
- What I did affected what the other did*
- The other paid close attention to me*
- I paid close attention to the other*
- My intentions were clear to the other
- The other's intentions were clear to me

The first four items are also used in the NMMSP Behavioural Engagement scale (Interdependency). The third matched pair of items were originally used in the NMMSP Co-presence scale (Attentional Allocation).

[1] Original items are in Dutch. An English version of the scale was developed at the same time, and is currently being tested.

Together these items make up the social presence module for the GEQ, which is only to be used in gaming situations where players played with or against others, be they virtual (e.g., in-game characters), mediated (e.g., online), or co-located.

3.2. Basic descriptives

Scores for all subscales are computed as the mean score of the items in the scales. Basic descriptives are reported in Table 1.

Table 1. Descriptive statistics for Social Presence subscales

	Mean	SD	min	max
Empathy	1.47	.90	.00	4.00
Negative feelings	.75	.65	.00	3.20
Behavioural involvement	2.20	.84	.13	4.00

Note: scales range from 0 to 4.

There were two very modest but significant correlations between the subscales, specifically between the Behavioural Involvement scale and the two Psychological Involvement scales (Empathy r=.21; Negative Feelings r=.27, both p<.05). Note that there is no correlation between the two psychological involvement scales, implying that these two scales actually do measure two different experiences, and not the extreme opposite ends of one experience. In fact, the correlational trend between the two is positive, indicating that participants reporting more positive feelings towards their co-players also reported more negative feelings. This illustrates that both measures are indicators of psychological involvement: the more 'socially present' the other person is, the stronger their mutual influence on each other's feelings, both positively and negatively toned.

3.3. Sensitivity and validity

As a first exploration of the sensitivity and validity of the SPGQ, scores were compared for reported play frequency, duration of play, and, most importantly, between various social settings in which participants played.

3.3.1. Frequency of play Participants reported how often they played the game for which they filled out the questionnaire (at least daily, weekly, monthly, or less) as an indicator of their experience with the game. Differences were explored for all three SP indicators, employing analyses of variance (see Figure 1). Both psychological involvement variables showed significant differences between play frequencies. Empathy increased with play frequency, $F(3,184)=3.48$, $p=.02$, while negative feelings decreased,

F(3,184)=3.07, p=.03. Behavioural involvement did not show significant differences, F<1.

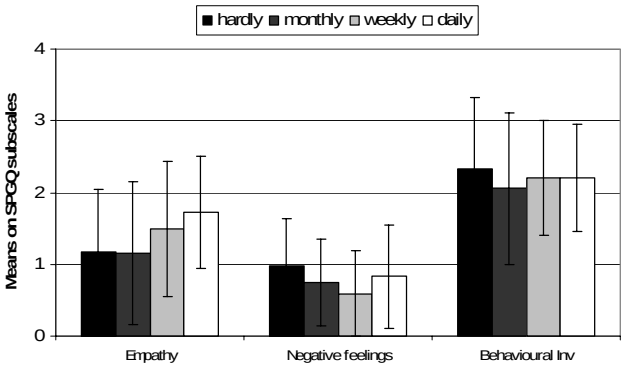

Figure 1 Social presence as a function of play frequency, scale values range 0 to 4 (SD indicated in graph)

3.3.2. Duration of play Participants' social presence experience was also explored as a function of duration of play. They reported higher levels of Empathy after playing longer, F(3,187)=5.81, p=.001. No differences were found on Negative Feelings. A marginally significant difference appeared on Behavioural Involvement, F(3,187)=2.52, p=.06, with gamers who had played for longer than three hours reflecting higher experienced behavioural involvement than those who had played for a shorter period (see Figure 2).

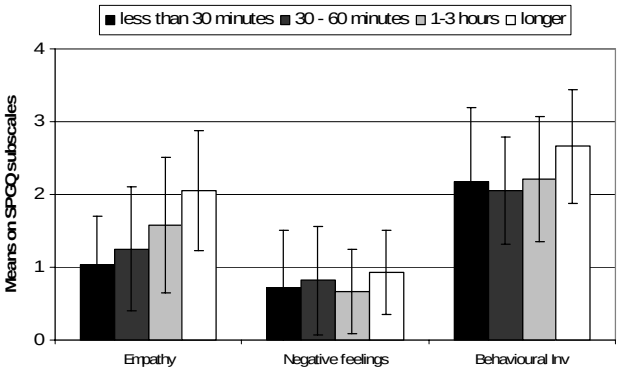

Figure 2 Social presence as a function of play duration, scale values range 0 to 4 (SD indicated in graph)

3.3.3. Social setting Based on participants' responses on two scales from the background questionnaire we constructed a categorisation of increasing social presence and relatedness. The analyses are performed on a slightly smaller dataset than the original one, as the categorisation could not be unambiguously made for 28 participants (due to missing or conflicting data). The categories describe settings in which the objective 'distance' (physically & psychologically) between players and co-players gets smaller. The 5 categories are: (1) playing alone (not included in the present analyses),
(2) playing with virtual others (i.e., in-game characters),
(3) playing online with unknown others,
(4) playing online with friends/family,
(5) playing with co-player(s) physically present.

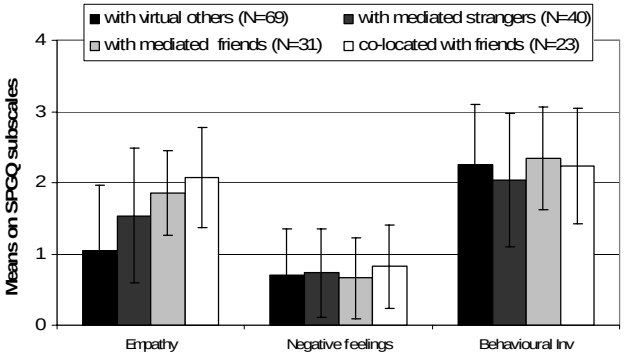

Figure 3 Social presence as a function of social setting, scale values range 0 to 4 (SD indicated in graph)

The social presence subscales were explored for these social settings. The results are shown in Figure 3. Significant differences were found for the first scale of Psychological Involvement: Empathy increased with increasing social presence and relatedness, F(3, 159)= 12.04, p<.001. Contrast analysis showed that scores increased significantly (p<.005) with each subsequent category. Negative feelings and Behavioural involvement were equal for all social settings. As reported earlier, scores on Negative Feelings were very low. Interestingly, Behavioural Involvement was equally high for all conditions: even for settings with low social presence and relatedness, players' actions are influenced by the other social entity's actions.

2.4. Discussion

Digital game content and associated interface technologies provide rich media settings for interacting with others at a distance as well as augmenting communication in co-located settings. One of the most prominent motivations for gamers to play digital games is the ability to interact with other players. Thus, digital games should not merely be regarded as applications for individual enjoyment, but should also be recognised for their potential to enhance and enrich social interaction. As such, gaming applications can be usefully conceptualised as social presence technology.

At present, the social richness of the digital game setting and the social interactions within and around digital games have been undervalued as contributing factors in theoretical accounts of player experience. No measurement tool is currently available to assess the impact of social interaction and social context on the digital game experience. As we view such a measure as essential to informing our efforts in

both theory development and game design, we developed the Social Presence in Gaming Questionnaire, as part of a larger effort to understand and measure digital game experience. This questionnaire was based in part on the Networked Minds Measure of Social Presence [40], but was significantly adapted based on focus group interviews with casual and avid gamers, exploring their first-hand experiences while gaming.

Exploratory factor analyses performed on the full list of items resulted in a three-dimensional structure: Two subscales related to psychological involvement respectively describe positively (Empathy) and negatively (Negative Feelings) toned emotions towards co-players. The third subscale that emerged describes Behavioural Involvement and measures the degree to which players feel their actions to be dependent on their co-players actions.

The structure differs from the one presented by Biocca and colleagues. Co-presence did not emerge as a separate dimension in our scale. Psychological Involvement partly overlaps, and the third component of the SPGQ – Behavioural Involvement - does quite closely match the third 'behavioural interdependence' dimension of the NMMSP.
The differences found appear to reflect differences in application domains: Digital gaming technology originally was not specifically intended to bring people together, nor was it designed to primarily transmit social communication cues. On the other hand, digital games facilitate continuous mutual awareness through the very nature of gaming, characterised by high interactivity and (mutual) action interdependency. The act of playing a game together implies that players' actions are dependent on each other, even in conditions of minimal 'media richness'. In contrast, in Biocca et al.'s [34,40] conceptualisation, behavioural interdependence is a state attributed only to the highest levels of social presence. Apparently, interdependence is one of the harder to reach targets in application domains such as teleconferencing systems. As Behavioural Involvement was generally high, and equally high for all social conditions, our data demonstrate that in gaming, even for settings with low social presence and relatedness, players' behaviour is influenced by the other social entity's behaviour. In a game, the player's and opponent's actions are interdependent and make up the very core of the activity.

In line with expectations, empathy toward co-players was higher for those playing against a locally co-present other than those playing against a mediated opponent, and higher for playing with friends than with unknown others. Interestingly, Negative Feelings did not differ between social conditions, i.e., participants did not report higher or lower levels of jealousy, revenge or malicious delight with decreasing physical or psychological distance. This intriguing finding calls for more research. We should note that scores on Negative feelings items overall were very low and skewed, potentially indicating suboptimal sensitivity. On the other hand, this scale did show significant differences for play frequency.

Co-located settings showed the highest scores on all social presence measures, but we would like to note that co-location does not, by itself, guarantee behavioural engagement, as is testified by Magerkurth and colleagues' [42] observations on the 'socially isolated' character of gamers in multiplayer settings. In essence, most co-located digital gaming takes place in socio-fugal type seating and viewing arrangements [43], which counteract mechanisms such as mutual eye contact, natural reciprocation of approach or avoidance cues and mirroring, or emotionally relevant communication signals. Therefore, although physical proximity does allow for a more intense and multi-sensory awareness and interactions than most mediated technologies presently do, in co-located settings we can also experience varying degrees of awareness, involvement and engagement, i.e., social presence.

Although intuitively one would assume physically co-located others to define the high end of the social presence dimension, this will also strongly depend on social affordances of the game content, the gaming interface, and the physical environment in which the game is played. Higher levels of social presence may be attained between remote players who are continuously and mutually engaged in a collaborative game, than between co-located players who are each concentrated on attaining their individual goals without the need to interact or share. The correlational and internet-based design gave us no control over, and limited information on whether gamers who played online were using additional communication media (e.g., headsets, phone, skype video) to enrich social interaction and enhance team play. Game content (e.g., game genre, specific game, and selected play configuration in the game) may also influence opportunities for experiencing social presence. The wide variety of games played in the present study unfortunately does not allow comparisons between genres or games. It does however hand provide a sound basis for scale construction, as was intended in this research.

The correlational design of the study limits possibilities for making further causal attributions. Limited control over background variables and their interrelations in non-experimental designs do not permit these types of inferences. We therefore regard the validation analyses presented in Section 3.3 as preliminary explorations and plan to perform additional studies to this effect under more controlled settings.

The emergence of the three factors of social presence in our analysis is in itself an important finding that could inform theory on social presence in general and on social presence in gaming in particular. In addition, the construction of a reliable self-report measure of social presence also facilitates investigations into the social effects of characteristics of digital games and gaming interfaces and opens possibilities for studying relationships between the social setting of gaming and central components of game experience such as enjoyment, flow or immersion. Moreover, a reliable subjective measure of social presence can be employed to

corroborate and check objective manipulations of social contexts in gaming studies and as such presents and important new instrument for game experience research in general.

Conclusions

The social potential of digital gaming is not sufficiently recognised, understood, or appreciated in current scientific literature. The rich interactive experiences associated with digital game play can only be fully understood when the 'system' is conceptualised as more than the software and hardware one is interacting with, but includes a larger situational perspective. Socially situated play is as much a function of the game as it is of where and with whom we play.

The Social Presence in Gaming Questionnaire can be regarded as a promising measure, having rendered reliable and easily interpretable scales, with satisfactory sensitivity and validity as evidenced by additional analyses performed on background variables. The SPGQ thus provides a useful tool for investigating the social use and social richness of digital games and gaming technologies (consoles, interaction devices). With the concurrent development of the Game Experience Questionnaire [39], researchers are now better equipped to probe gamers' experiences and potentially unravel some of the intricacies of social interaction in the 'magic circle' [44] of gaming. This should render deeper theoretical insight as well as allow for informed design of new 'socially enhanced' interaction and display technologies for gaming applications.

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References

[1] Bryce, J., & Rutter, J. (2003). The Gendering of Computer Gaming: Experience and Space. In S. Fleming & I. Jones, *Leisure Cultures: Investigations in Sport, Media and Technology*, Leisure Studies Association, pp.3-22.

[2] Benford, S., Greenhalgh, C., Rodden, T., Pycock, J. (2001). Collaborative virtual environments. Communications of the ACM, 44 (7), 79-86.

[3] Brown, B., & Bell, M. (2005). Play and sociability in there: Some lessons from online games for collaborative virtual environments. In R. Schroeder and A.-S. Axelsson (eds.). Avatars at Work and Play: Collaboration and Interaction in Shared Virtual Environments. London: Springer.

[4] Carr, D., Schott, G., Burn, A., & Buckingham, D. (2004). Doing game studies: A multi-method approach to the study of textuality, interactivity, and narrative space. *Media International Australia incorporating Culture and Policy*, No. 110, 19-30.

[5] Holmes, R. M., & Pellegrini, A. D. (2005). Children's social behavior during video game play. In: J. Raessens & J. Goldstein (eds.), *Handbook of Computer Game Studies.* Cambridge, MA: MIT Press, pp. 133-144.

[6] Jansz, J., & Martens, L. (2005). Gaming at a LAN event: the social context of playing video games. *New Media & Society, 7* (3), 333-355.

[7] Lazzaro, (2004). Why We Play Games: Four Keys to More Emotion Without Story. http://xeodesign.com/xeodesign_whyweplaygames.pdf

[8] Sweetser, P., & Wyeth, P. (2005) GameFlow: A Model for Evaluating Player Enjoyment in Games. *ACM Computers in Entertainment, 3* (3), July 2005. Article 3A.

[9] Nielsen Interactive Entertainment (2005). Video Gamers in Europe – 2005. Research Report Prepared for the Interactive Software Federation of Europe (ISFE).

[10] Kubey, R., & Larson, R. (1990). The use and experience of the new video media among children and young adolescents. *Communication Research, 17*, 1, 107-130.

[11] Griffiths, M., & Hunt, N. (1995). Computer game playing in adolescence: Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology, 5,* 189-194.

[12] Selnow, G. W. (1984). Playing video games: The electronic friend. *Journal of Communication, 34*, 148-156.

[13] Phillips, C. A., Rolls, S., Rouse, A., & Griffiths, M. D. (1995). Home video game playing in school children: A study of incidence and patterns of play. *Journal of Adolescence, 18,* 687-691.

[14] Rutkowska, J. C., & Carlton, T. (1994). Computer games in 12-13 year olds' activities and social networks. Paper presented at the British Psychological Society Annual Conference, April.

[15] Bonnafont, E. (1992). *Video games and the child. Paper presented at a seminar on Myths and Realities of Play*. London, England.

[16] Colwell, J., Grady, C., & Rhaiti, S. (1995). Computer games, self-esteem, and gratification of needs in adolescents. *Journal of Community and Applied Social Psychology, 5*, 195-206.

[17] Bracken, C., Lange, R. L., & Denny, J. (2005). Online video games and gamers' sensations of spatial, social, and co-presence. FuturePlay 2005, East Lansing.

[18] Ermi, L., & Mayra, F. (2005). Fundamental components of the gameplay experience: Analysing immersion. S. de Castell, & J. Jenson: *Changing views: Worlds in play*. Selected papers of the 20005 DiGRA's Second International Conference, pp. 15-27.

[19] Klimmt, C. (2003). Dimensions and determinants of the enjoyment of playing digital games: A three-level model. In M. Copier & J. Raessens (Eds.). *Level Up: Digital Games Research Conference*, pp. 246-257. University of Utrecht & DiGRA.

[20] Lindley, C. A., & Sennersten, C. C. (2006). A cognitive framework for the analysis of game play. Workshop on the cognitive science of games and game play, *CogSci 2006*, the 28th annual conference of the cognitive science society, 26-28 July, Vancouver, Canada.

[21] Brown, E. & Cairns, P. (2004). A grounded investigation of game immersion. *ACM CHI 2004*, 1297-1300.

[22] Csikszentmihalyi, M. (1990). *Flow. The Psychology of Optimal Experience*. New York: Harper & Row.

[23] Hawkins, S., Sheingold, K., Gearhart, M., & Berger, C. (1982). Microcomputers in schools: Impact on the social life of elementary classrooms. *Journal of Applied Developmental Psychology*, 3, 361–373.

[24] Inkpen, K., Booth, K. S., Klawe, M., Upitis, R. (1995). Playing together beats playing apart, especially for girls. *CSCL '95 Proceedings*, 177-181.

[25] Nastasi, B. K., & Clements, D. H. (1993). Motivational and social outcomes of cooperative education environments. *Journal of Computing in Childhood Education, 4* (1), 15-43.

[26] Watson, J. (1990). Cooperative learning and computers: One way to address student differences. *The Computing Teacher, 18* (4), 9-15.

[27] Mandryk, R.L., Inkpen, K.M., & Calvert, T.W. (2006). Using psychophysiological techniques to measure user experience with entertainment technology. *Behavior & Information Technlogy 25*, 141-158.

[28] Ravaja, N., Saari, T., Turpeinen, M., Laarni, J., Slaminen, M., & Kivikangas, M. (2006). Spatial presence and emotions during video game playing: Does it matter with whom you play? *Presence: Teleoperators and Virtual Environments, 15*, 381-392.

[29] Bailenson, J. N., Beall, A. C., Loomis, J., Blascovich, J., & Turk, M. (2004). Transformed Social Interaction: Decoupling Representation from Behavior and Form in Collaborative Virtual Environments. *Presence: Teleoperators & Virtual Environments, 13*, 428-441.

[30] Bailenson, J. N., & Yee, N. (2006). A Longitudinal Study of Task Performance, Head Movements, Subjective Report, Simulator Sickness, and Transformed Social Interaction in Collaborative Virtual Environments. *Presence: Teleoperators & Virtual Environments, 15,* 699-716.

[31] de Greef, P., & IJsselsteijn, W. A. (2001). Social presence in a home tele-application. *CyberPsychology and Behavior 4*, 307-315.

[32] Biocca, F., Burgoon, J.K., Harms, C., Stoner, M.. Criteria and scope conditions for a theory and measure of social presence. E. Lansing, MI: Media Interface and Network Design (M.I.N.D.) Lab. 2001.

[33] Schroeder, R. (2001). *The Social Life of Avatars*. London: Springer.

[34] Biocca, F., Harms, C., Burgoon, J. (2001). Toward a more robust theory and measure of social presence: Review and suggested criteria. *Presence, 12*, 456–480. 2003.

[35] Argyle, M., & Dean, J. (1965). Eye contact, distance, and affiliation. *Sociometry, 28*, 289-304.

[36] Goffman, E. (1956). *The Presentation of Self in Everyday Life*. New York: Anchor Books.

[37] Hall, E. T. (1959). *The Silent Language.* New York: Doubleday.

[38] Mehrabian, A. (1976). *Public Places and Private Spaces: The Psychology of Work, Play and Living Environments*. New York: Basic Books.

[39] IJsselsteijn, W.A., de Kort, Y.A.W. & Poels, K. (in preparation). The Game Experience Questionnaire: Development of a self-report measure to assess the psychological impact of digital games. Manuscript in preparation.

[40] F. Biocca, C. Harms, J. Gregg. *The Networked Minds Measure of Social Presence: Pilot Test of the Factor Structure and Concurrent Validity*. E. Lansing, MI: Media Interface and Network Design (M.I.N.D.) Lab. 2001.

[41] Poels, K., de Kort, Y.A.W., & IJsselsteijn, W.A. (2007) "It is always great fun!" Exploring dimensions of digital game experience using focus group methodology. *Future Play 2007* Conference, November 14-18, Toronto.

[42] Magerkurth, C., Engelke, T., & Memisoglu, M. (2004). Augmenting the Virtual Domain with Physical and Social Elements: Towards a Paradigm Shift in Computer Entertainment Technology. *ACM Transactions on Computers in Entertainment, 2*, No. 4, October 2004, Article 5b.

[43] Sommer, R. (1967). Small group ecology. *Psychological Bulletin, 67* (2), 145-152.

[44] Huizinga, J. Homo Ludens, *A Study of the Play Element in Culture*. Boston: Beacon Press. 1950.