Involvement and Presence in Digital Gaming

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ABSTRACT
This study introduces a psychological measurement model for analyzing involvement and presence in digital game context. These two constructs are both theoretically and methodologically well developed in their own fields. The components forming these two constructs are psychologically relevant to our understanding of the evolvement of a user experience in digital gaming. The measurement model is tested with a large data (n=2182) collected from a web-based questionnaire and laboratory experiments among PC and console players. The results show that these two psychological constructs can be extracted from interactive game environments. It is also shown that involvement and presence are different dimensions of a larger psychological entity that describes the way the players adapt themselves psychologically into a game-world.

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Games, User experience, Measurement

ACM Classification Keywords
K.8.0 Personal Computing: General: Games; I.6.8 Gaming

INTRODUCTION
The audiovisual richness and highly immersive qualities of the digital games have put them beyond the traditional entertainment media such as TV and movies. Thus, there is a growing interest to understand and measure the physical as well as social features that constitute a novel gaming experience. According to Dewey [3], an experience has a clear beginning and an end and it has an effect on the one who experiences; emotions, assessment of one’s value system and even changes in behavior. Gaming experience meets these requirements and serves as a good example of an experience. This is also the basic framework that is used to characterize the gaming experience in this study.

This study concentrates on two experiential dimensions. The first dimension is the level of involvement, which is a certain level of relevance based on inherent needs, values and interests [18]. The second dimension is the sense of presence that is usually viewed as something that evolves from the player-game interaction. When present in a game, a player suppresses the outside world and constructs a mental model of the game-world [14].

Involvement and Motivation
In the field of buyer behavior studies, the involvement construct, is a central and a well developed concept to study motivational aspects [2]. It is defined as a continuum of unobservable state of motivation, arousal or interest towards a particular situation or stimulus [12]. Involvement defined in this way provides a good measure to evaluate the meaning and value of the game to the player.

Involvement includes two distinct but correlated dimensions: importance and interest [9]. Importance is dominantly a cognitive dimension concerning the meaning and relevance of the stimulus (e.g., matters to me), whereas interest is composed of emotional and value-related valences, such as “it was exciting” [13]. For instance, a flu drug is neither important nor interesting for a healthy person, it is important but not interesting for those having flu and it should be both important and interesting for those medical students taking an exam on drugs.

We perceive and attend to those environmental features that interest us [5]. If these features are both interesting and arousing they are likely to draw even more attention. Arousing stimuli is found to increases the allocation of attentional resources [6]. That is why attentional system is considered as a bridge between perception, cognition and action [10]. Focused attention is also one of the central components of the illusion of being there in the game-world, that is, the sense of presence [8].

Presence
Presence experience locates the player into a game-world, establishing a particular relationship between the player and the game [11]. Today’s games provide both physically and socially meaningful contexts [1], which are both included into a concept of presence [8]. The research on presence is founded both theoretically and empirically, and it provides a valid framework to study gaming experience [11].
Physical and Social Presence

Physical presence is divided into three components: attention (psychological immersion), perceptual realness (naturalness, ecological validity) and spatial awareness (transportation, engagement) [8]. This threefold construct has also been extracted in previous factor analytical studies [7, 14]. These three components are central in any human-computer interaction, which aims at creating a purposeful digital environment to the user.

Social presence has also three components: social richness (intimacy-immediacy), social realism and co-presence (shared space) [8], which correspond well to the social features of the digital games. Social richness is “the extent to which a medium is perceived as sociable, warm, sensitive, personal or intimate” [8, p.4]. Social realism refers to the sense of similarity between real and game world objects, people and events. In gaming the perceived drama and plot and engagement to own role in the storyline are considered important. Co-presence is the feeling of being and acting there in a game world together with other agents.

To build a measurement model for analyzing involvement and presence and to test it in digital game context, we collected a large sample from both the Internet and in the laboratory. We also included related components [8] into our model so that a more detailed structure of gaming experience could be formed. Included were evaluations of the different aspects of interactivity (e.g., speed, mapping, range and exploration), emotional arousal and immersive qualities of the game technology.

METHODS

Data Collection

The data used in this study (n=2182) has been collected from both during the laboratory experiments and an Internet survey using EVE –Experience Questionnaire (EVEQ-GP) [15, 16]. Both the paper and pencil and online version of the EVEQ-GP were composed of 180 items (1-7 Likert-scale and semantic differentials) measuring different experiential aspects related to human-computer interaction. Also 27 background questions were included. Participants filled in a questionnaire right after the gaming session, reflecting their subjective gaming experience.

Laboratory Studies

Two distinct lab experiments were conducted. In the first experiment 240 university students (120 males, 120 females) were examined in a 2x2 design in which two different driving games were played using two different displays. The two different displays used were a traditionally tabletop display and a modern near-eye display. Each participant played for 40 minutes, after which they were asked to fill in the EVEQ-GP.

In the second experiment 30 university male students were playing Halo: Combat Evolved. First the participants were allowed to practice the game and then they played two 40 minutes sessions. After the second session they were asked to fill in the EVEQ-GP.

Internet

An online version of the EVEQ-GP (VK2) was used to collect data from the Internet. Participants were asked to recall one particular gaming session and fill in the questionnaire keeping that session in mind. It was recommended to fill in the questionnaire right after a playing session. The application development software used to create VK2 was Lotus Domino Designer6.5. Domino Server ran on HP Proliant DL380.

The questionnaire was on-line one month in a home page of the Pelit (Games) –magazine (www.pelit.fi). Pelit is a PC-gaming magazine in Finland, with a leading circulation of app. 38 300 and registered online users app. 27 000. During the first week VK2 was on the main page and the remaining three weeks it was linked in a short news story, which was located in the news section. During one month in the Internet 1912 properly filled in questionnaires were received.

Data Used in this Study

The data collected from both the laboratory experiments and Internet survey was merged into a one large dataset of 2182 (1972 males, 210 females) filled in EVEQ-GPs. The mean age of the respondents is 21.5 years (SD=6.0). The average time of playing is 127 minutes (SD=111). Since the data includes participants from mobile gaming to those playing at home with a video projector the size of the display used ranges from 3” to 96” (M=19.2”, SD=4.4). 33% of the respondents play daily, 29.6% play at least every other day and 24.5% play often but not in every other day.

Most (31.5%) of the games played before filling in the questionnaire were First-person shooters (FPS) either online (15.0%) or offline (16.5%). Second popular (15.0%) genre was massive multiplayer online role-playing games (MMORPG) and third (13.1%) was single Role playing games (RPG) (13.1%). The most popular single game played was World of Warcraft (n=265), which is a MMORPG. All in all the data included app. 320 different games, giving a broad scope to a psychology of the digital games. Since the Pelit –magazine is focused on PC –games, 85.2% of the games were played with a PC and 14.8% with a console.

Measurement Model

To measure involvement and presence in digital gaming, we formed a measurement model [17] (see Figure 1) and tested it with our large dataset. The model included 83 items, which have been previously used to study involvement, the sense of presence, interactivity, immersive qualities of the technology and emotional arousal. In our previous study, these items have been grouped into one-dimensional scales [16] which are used in Figure 1 to simplify the model. To learn more about the origin and previous use of the items the reader is referred to [15, 16]. All
RESULTS

Measurement Scales

Measurement scales were extracted in a principal axis factoring (PFA) which included the 83 variables. A significant Bartlett’s test of sphericity and .963 Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy indicated a good factorability of the data. Analysis yielded 14 factors with an eigenvalue greater than 1. In order to obtain various theoretically meaningful constructs [4], an oblique direct Oblimin rotation (delta=0) was used. The inspection of both the pattern and structure matrices indicated that the eight factor solution was both theoretically the most meaningful and easiest to interpret. An eight factor solution explained 47.04% of the total variance (see Table 1). Figure 2 shows how the previously used scales were reorganized to form the eight measurement scales.

Factor scores with Bartlett’s method were computed for each measurement scale to further analyze their relationships. The standard errors of measurement of the scales were good ranging from 0.33-0.71. The reliability coefficients (Cronbach’s alpha) of the extracted measurement scales are presented in Figure 2.

The measurement scales were further analyzed in a 2nd order PFA. A significant Bartlett’s test of sphericity and .720 KMO indicated a good factorability of the data. An oblique direct Oblimin rotation (delta=0) was also applied to the 2nd order PFA. Interaction scale had a low communality and it did not load on either factor. Thus, it was removed from the model. The second order analysis revealed the latent true scores that were in the scope of this study: involvement and presence (see Table 1). Together these two distinct but correlated dimensions explained 50.76% of the total variance. Co-presence and importance loaded on both the factors.

DISCUSSION

The aim of this study was to form a measurement model and investigate involvement and presence in digital gaming. Involvement and presence are both theoretically and methodologically well developed in their own fields [7-9, 14, 18]. They are psychologically relevant in understanding the evolvement of a user experience in human-computer interaction. The measurement model was applied into a large and representative data gathered among the PC and console players in Finland.

The results show that involvement and presence dimensions can be yielded also from a gaming context. The structure of these dimensions is in line with previous studies [7, 9, 14]. It seems that social aspects of the game tie these two dimensions together. The game gets its meaning and relevance through social interaction.

The interaction scale did not load on either dimension. However, this cognitive evaluation of the game-world’s interactivity (e.g., the game reacted fast to my actions) is likely to be part of the gaming experience and should be reconsidered in future studies. The experienced motion feelings (e.g., I had real motion sensations) were part of the physical presence scale, integrating perceived feelings of action into a presence dimension [8].

Taken together the two dimensions of the model represent...
those psychological aspects that are relevant in adapting into an environment. They describe how players form relationship with the physical, social and narrative content provided by the game-world. Psychological adaptation should be seen as a crucial aspect in all HCI; bad adaptation will distract proper interaction and weaken the user experience.

The adaptation model also shows the complexity of the studied phenomena. To reach underlying factors such as involvement and presence requires multivariate analysis methods. The use of these methods will open a new way to study the user in the game-world. Multivariate models provide designers insight on user experience and help them to understand the impact of the various game features on the user. As the complex relationships between user psychology and various game features becomes clearer more adapting games and better user experiences can be designed.

REFERENCES
5. James, W. The Principles of Psychology. H. Holt and company, 1890.

<table>
<thead>
<tr>
<th>1st order factors</th>
<th>Name &amp; number of items</th>
<th>Eigenvalue</th>
<th>% of Variance</th>
<th>Description</th>
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<tbody>
<tr>
<td>1 Role Engagement</td>
<td>12</td>
<td>19.65</td>
<td>23.67</td>
<td>captivated and enclosed into the role provided by the storyline and narrative world instead of the real world</td>
</tr>
<tr>
<td>2 Attention</td>
<td>12</td>
<td>6.19</td>
<td>7.46</td>
<td>time distortion, focus on the game world instead of the real world</td>
</tr>
<tr>
<td>3 Interest</td>
<td>6</td>
<td>3.39</td>
<td>4.09</td>
<td>interesting, exciting as well as lively</td>
</tr>
<tr>
<td>4 Importance</td>
<td>8</td>
<td>2.72</td>
<td>3.27</td>
<td>meaning, relevant as well as close, personal and sensitive</td>
</tr>
<tr>
<td>5 Co-Presence</td>
<td>14</td>
<td>2.03</td>
<td>2.44</td>
<td>feeling of sharing a place with others, being active in there</td>
</tr>
<tr>
<td>6 Interaction</td>
<td>9</td>
<td>1.80</td>
<td>2.17</td>
<td>speed, range, mapping, exploration, predictability of own actions</td>
</tr>
<tr>
<td>7 Arousal</td>
<td>5</td>
<td>1.78</td>
<td>2.15</td>
<td>active, stimulated vs. passive, unaroused</td>
</tr>
<tr>
<td>8 Physical Presence</td>
<td>17</td>
<td>1.49</td>
<td>1.79</td>
<td>feeling of being transported into a real, live and vivid place</td>
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<th>2nd order factors</th>
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<th>Involvement</th>
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<tr>
<td></td>
<td>Eigenvalue</td>
<td>% of variance</td>
</tr>
<tr>
<td>2.23</td>
<td>1.32</td>
<td>31.90</td>
</tr>
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Table 1. Eigenvalues and % of total variance of the 1st and 2nd order factors and structure matrix of the 2nd order analysis.