The Experiential Dimensions of Two Different Digital Games

Jari Takatalo*, Jukka Häkkinen#, Jeppe Komulainen*, Heikki Särkelä*, Göte Nyman*
*Psychology of the Virtual –Group, Department of Psychology, University of Helsinki
#Audio-Visual Systems Laboratory, Nokia Research Center
{jari.takatalo@helsinki.fi, jukka.hakkinen@nokia.com, jeppe.komulainen@helsinki.fi, heikki.sarkela@helsinki.fi, gote.nyman@helsinki.fi}

Abstract

A framework is introduced for measuring user experience in virtual environments (VEs). It has been developed in various VEs (e.g. CAVE[tm]) and applied here to two different digital games played with PC and two different displays. The framework integrates basic psychological constructs considered to be essential in creation of human experience in virtual environments. Included are perceptual-attentive, cognitive-emotional and motivational constructs. These constructs have previously been used in various presence and flow studies. In this study following four dimensions represent these constructs: Physical presence, Emotional involvement, Situational involvement and Performance competence. The results show how these dimensions vary across two different types of computer games played in two different displays. The role of the presence as a part of the human experience in VEs is also considered.

Keywords---**experience, presence, flow, entertainment**

1. Introduction

1.1. Experience

As we perceive the world around us we attend to features and events that interest us. These features make us think and consider our future actions [1]. They activate past memories in which the current situation is referred and reconsidered. Current features and events as well as past memories evoke emotional responses in our bodies, which are felt as different feelings. Feelings support our rational thinking process [2]. All perceptions, thoughts, memories and feelings that enter our awareness are shaping our experiences. The dynamical process of experiencing begins from the perception of an environmental feature or event. It evolves and continues as we change our focus and act upon our experiences [3].

Dynamical process depicted above is based on the trilogy-of-mind set of cognition, emotion and motivation [4]. This set forms our awareness and mind in consciousness and co-operates with perception, attention and memory in developing the subjective experience [3]. Understanding the psychological dynamics of the experience helps to consider the meaning and value as well as the quality and intensity of that experience to the person in particular situation [5]. Because of the complex nature of the human experience also the method to measure it should be multidimensional. The field of digital game research lacks this sort of an approach.

1.2. Presence-flow -framework

We have studied subjective experience in different virtual environments (VEs). Based on our previous work in high-tech CAVE[tm] Experimental Virtual Environment (EVE), a multi-dimensional framework of the human experience was developed [6].

Presence, i.e., the sense of being in a VE is a special psychological feature of the VEs [7] and thus the Big-Three [8] components (sense of space, feelings of realness and attention to the VE) of physical presence [9, 10] were included into our framework. The presence components were thought to cover perceptual and attentional aspects of the mediated experience.

To cover cognitive, emotional and motivational aspects in our framework we included constructs used in studies measuring the concept of optimal experience, i.e., flow [11]. Flow has been studied in various non-mediated and mediated environments, e.g., in WWW [12].

In the theory of flow, the development of an experience is based on the cognitive evaluation between users perceived skills and opportunities and challenges provided by the current situation [11]. The eight-channel flow model [13] integrates basic emotional components of arousal, valence and control [14] into this cognitive evaluation process. In the model these components are

considered outcomes of different skill-challenge situations, e.g., arousal is an outcome of a high challenge and moderate skill situation. The theory of flow [11] also covers motivation, i.e., personal relevance and interest of the user to the current situation.

Thus the framework was named as Presence-Flow – framework (PFF). Its three Varimax-rotated dimensions were composed of 13 scales measuring different aspects of the human experience in VEs [6]. Also other authors [15, 16] have acknowledged the need for such expanded frameworks to measure human experience in VEs.

1.3. Presence-involvement-flow -framework

In our current studies PFF has been developed to cover the special needs possessed by PC based gameworlds [17]. These gameworlds are technologically less advanced than the previously studied EVE, but the content they provide can be much richer.

In addition to presence and flow scales we included measures that were considered important in digital game context. Included were social as well as role building and drama/plot aspects in user engagement to the technology. Also various emotionally charged feelings considering the gaming event were included. These scales have been examined and factored in a larger sample collected from the WWW [17].

Based on these two data (n=68 [6] and n=164 [17]) an explorative four-dimensional framework was developed. The Presence-involvement-flow –framework (PIFF) measures Physical presence (and engagement), Emotional involvement, Situational involvement and Performance competence (and competing) in VEs (Figure 1).

2. Methods

2.1. Participants

80 participants were tested. They were mainly university students from the faculty of behavioral sciences and the department of computer science. There were 40 males (50 %) and 40 females (50 %). The mean age of the participants was 24.7 years.

The participants were selected by applying the background questionnaire. Based on the background questionnaire answers we excluded participants who did not like driving games, did not have any computer game playing experience or who reported playing computer games for six hours or more every day.

2.2. Technology

All experimental groups used the same computer (Pentium 4 CPU at 3.00 GHz – Total memory 512 MB DDR-SDRAM). The Display adapter used was Sapphire ATI Radeon 9600 - 256MB (8 x AGP) and Sound card Realtek AC97 Audio. There were two different display conditions 1) Olympus Eye-Trek FMD-700 near-eye display and 2) a 21 inch Sony Trinitron GDM-F520 CRT monitor from the viewing distance of 1 meter.

2.3. Task & procedure

Four different test groups were formed (20 participants each) and a 2x2 test design was used. Two of the groups played Need for Speed Underground, which is a 1st person 3D – driving game with lots of camera movement, horizontal changes and intensive flux. Microsoft sidewinder Gamepad was used to play NFS UG. Other two groups played Slicks n' Slide 1.30d,

Figure 1 PIFF - structure

which is a 3rd person, 2D – driving game with no camera movement and otherwise static environment. The participants used keyboard to play Slicks n' Slide. One of both NFS and Slicks groups used Olympus Eye-Trek near-eye display. The remaining two of both NFS and Slicks groups used Sony Trinitron CRT monitor.

The participants were instructed to proceed in his/her own pace and not to ask instructions during the game play, if possible. However, they were assisted if insurmountable problems (i.e. technical or otherwise immediate) occurred. The task lasted for 40 minutes after which the subjects filled the EVEQ- questionnaire.

2.4. Scales used in EVEQ

To measure user experiences an EVEQ – questionnaire was used. EVEQ is a developmental tool, which includes 146 items, which are mainly collected from the previous presence and flow studies. These items can be further summed into 23 scales to measure different experiential constructs (e.g., presence and flow components).

Each of these 23 scales includes 4-10 items. The scales have been factored individually in two different studies (n=68 [6] and n=164 [17]) to ensure both the one-dimensionality of each scale and the fitting of the items into a scale. In this study the items are summed according to these previous studies and the scores of the summed scales are compared. Next we shortly describe the content of the 23 scales that form the four main dimensions. Also the Cronbach's alfas of the four dimensions in this study are presented. To read more about the scales and items forming the scales the reader is referred to Takatalo [18].

1. Physical presence (α=.93)
Action (Objects and things could almost touch me, game induced real motion feelings)
Attention (Concentration on the game instead of the real world, time distortion)
Real (Gameworld was natural, live and vivid)
Spatial (Spatial awareness of a place, being part of the gameworld)
Being there (Visited a virtual place instead of being in a lab, journey to the gameworld)
Drama (Perception of a plot that affected behavior)
Enclosed (How much did the media support the different senses e.g. vision, hearing)

2. Emotional involvement (α=.89)
Mediarichness (e.g., how warm, close and sensitive the media was experienced)
Valence (Was the experience negative or positive)
Pleasant (Enjoyment, fun, time flew)
Impressed (Strong experience and excitement)
Involvement of the played game (The game was important, meaningful, interesting and appealing)
Playful (Free, flexible, natural, live)
Innovative (Creative, innovative, learning new skills)

3. Situational involvement (α=.80)
Bored (Playing the game evoked boredom and anxiety)
Challenge (Perceived challenges provided by the game)
Arousal (Level of arousal evoked by the situation)
Interaction SMR (Evaluation of the interaction speed, mapping and range)
Involvement of the test situation (The test was important, meaningful, interesting, appealing and fun)

4. Performance competence (α=.62)
Social presence (Acting/ competing with others, other actors were aware of the user)
Skill (Experienced skill to play the game)
Control (Sense of control over situation)
Exploration (Ability to explore the environmental limits of the gameworld)

3. Results

3.1. The difference between the two games

The differences between the experimental conditions were measured with a one-way ANOVA. As it is shown in Figure 2, there was a significant difference in the Physical presence scores between the Need for speed (NFS) and Slicks players ($F(1,78) = 19.75$, $p < .001$). NFS provided a more real motion feelings; it was experienced more natural, live and vivid. It was able to provide users more spatial sense of space and place in which the action took place. It enclosed users better to the visual and auditive environment. Its plot was stronger thus supporting better users role build-up. NFS also supported users more in suppressing the surrounding environment. To summarize, NFS provided more complete transfer to the game world.

NFS was also emotionally more involving than Slicks ($F(1,78) = 14.05$, $p < .001$). It was experienced warmer and more sensitive as well as more pleasant than Slicks. Playing NFS was more impressing and exciting. It interested the users more than Slicks. It was also more fun and appealing. Playing NFS felt more free, flexible, innovative and creative as compared to Slicks, which was felt more constrained and monotonous. Thus, NFS provided emotionally more intensive playing experience

The playing situation of the Slicks was less involving than that of NSF ($F(1,78) = 10.82$, $p < .01$). Slicks was experienced more boring and frustrating. NFS was more arousing and it provided more interaction speed. Its interaction was also better mapped to the real world action and the range of its interaction was wider than that provided by the Slicks. Interaction technique

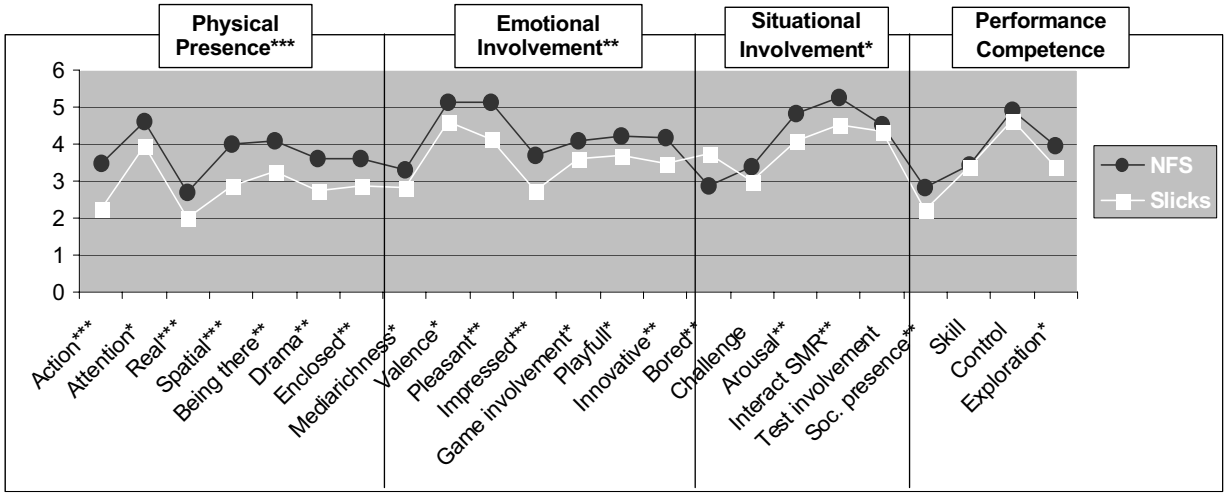

Figure 2 The PIFF profiles of the NFS and Slicks 'n' Slide (*indicates p>0.001, ** p>0.010, * p>0.050)**

used in NFS gave the players more realistic feeling and they felt that the game responded more naturally and intuitively to their actions (1st person). Slicks was less involving and motivating, thus decreasing the experienced meaning of the situation.

NFS also evoked more social feelings towards the other drivers (competitors) and feelings of other drivers' awareness of the user. It also offered more chances to explore the boundaries of the gameworld. However, the two games did not differentiate significantly in the Performance competence –dimension ($F(1,78) = 3.84$, $p = .054$).

3.2. The effect of the VR –display

Next the two games were compared within the display conditions (CRT – VR). Within CRT –condition the players of the NFS experienced more Physical presence ($F(1,38) = 9.62$, $p < .01$) and Emotional involvement ($F(1,38) = 4.61$, $p < .05$) than Slicks players. The two games did not differentiate either in Situational involvement or Performance competence.

When the two games were compared in VR display –condition NFS players experienced more Physical presence ($F(1,38) = 10.54$, $p < .01$), Emotional involvement NSF ($F(1,38) = 9.42$, $p < .01$) **and Situational involvement** ($F(1,38) = 10.05$, $p < .01$) than Slicks players. The two games did not differentiate in Performance competence –dimension in VR –condition.

Within the Situational involvement dimension NFS played with VR was experienced more arousing ($F(1,38) = 7.20$, $p < .05$), interactive ($F(1,38) = 8.06$, $p < .01$), the test situation more involving ($F(1,38) = 4.08$, $p < .05$) and the game less boring that the Slicks ($F(1,38) = 11.34$, $p < .01$). In CRT condition NFS was only more arousing than the Slicks ($F(1,38) = 4.36$, $p < .05$).

4. Conclusion

This paper presents an explorative multidimensional method (Presence-involvement-flow –framework) to evaluate user experience in VEs and its application to measure and profile user experiences in four different experimental conditions. This method has been developed and tested in our previous studies [6, 17].

The results showed that four dimensions (Physical presence, Emotional involvement, Situational involvement and Performance competence) depicted and discriminated user experiences well in different experimental conditions.

The difference between the two games studied is obvious. Need for Speed is a fast paced three-dimensional 1st person racing game and Slicks is a simple two-dimensional 3rd person racing game that resembles simple electronic or mobile games. However, the experiential differences between the games are more complex.

Our results show the psychological profile of the driving game genre. They also depict the differences in this profile between two types of racing games within the genre. NFS evoked motivationally, cognitively as well as emotionally more intensive experience. The gameworld created by NFS seemed qualitatively more rich and positive and gave more pleasant and interesting experience. Also, the computer generated competitors and social scenes created an impression of a real social competition. All in all NFS meant more to user than simpler Slicks. Competence wise the two games did not differentiate, which can be explained by the fact that they both are easy to learn and the participants of the test were carefully selected trough background questionnaire and they were equally experienced rally game players.

4.1. The role of the presence in user experience

Presence is an important feature in measuring the human experience in VEs such as gameworlds. However, besides presence also other measures should be considered to reach the holistic human experience [16].

It is obvious that presence should be higher in 1st person games than in 3rd person games. But by simply measuring the presence we would not have recognized the effect of the VR –display to the gaming experience. As compared to the CRT –condition VR –condition caused the difference between the two games also in Situational involvement. This is an important dimension, because it measures perceived and evaluated environmental opportunities. As we are able to control these, we are able to increase, e.g., the quality and meaning of the experience.

The heightened Situational involvement in VR –condition can be partly explained by gender differences. But it is out of the scope of this paper to further analyze the effects of the background variables to these results.

4.2. Future

The developmental process of the PIFF continues. Although, its current structure profiles quite well the experience gained from the various VEs, the biggest challenge is to establish the structure and content of the framework. Also the background of the user should be studied more carefully to understand the experience a situation evokes. People see same situations in different ways and to increase knowledge of this evaluation process increases also knowledge of their PIFF –profiles.

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