

Flow Experience in Second Life: The Impact of Telepresence on Human-Computer Interaction

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Abstract. Recent trends in computer-mediated communication research suggest that “flow theory” may provide new applications of understanding within the field human-computer interaction (HCI). Csikszentmihalyi [1] refers to flow as an optimal experience issuing in a feeling of psychological immersion, energized focus, absolute involvement, and change to positive emotions. This study hopes to facilitate an understanding of flow and telepresence as applied to immersive online virtual worlds such as Second Life (SL), where players may lose their sense of time and connection with their present reality of space. Our study tested two hypotheses: (1) that participants experience flow while playing SL and (2) that flow can be correlated with telepresence. Based on our findings, indicators suggest that flow was experienced in SL based on four controlling factors related to being present in a virtual world and that there are considerable correlations that can be drawn between flow and telepresence.

Keywords: computer-mediated communication, usability, flow, telepresence.

1 Introduction

Recent trends in computer-mediated communication research suggest that “flow theory” may provide new insights into understanding the field human-computer interaction (HCI). Csikszentmihalyi [1] refers to flow as a feeling of enjoyment and psychological immersion, energized focus, and involvement, often issuing in a sense of pleasure. Traditional cognitive approaches to research in HCI have tended to underestimate emotion and pleasure as a factor that can have a dramatic influence on user experience. Hoffman and Novak [2] were among the first researchers to apply flow experience to human-computer interaction (HCI) on the Web in the context of online marketing. By applying Csikszentmihalyi’s (1988) research to consumer navigation on the web, they proposed techniques to facilitate more flow opportunities to online users and to create increased repeat visits and longer times at each visit to the respective Web sites.

In the context of Web experiences, early inquiries asked questions such as how does the experience of flow compare to other applications of flow as outlined by Csikszentmihalyi [3], [4], [1]. For example, how do users experience flow in processes of online information-seeking, and what is the correlation between user skill level and their propensity to experience flow. Other researchers found that flow

and high levels of enjoyment and control in human-computer interaction correlated with higher online experimentation and exploration [5], [6].

As we will see, user experiences of flow on the Web are determined by high levels of skill and control, challenge and arousal, and focused attention, as well as enhancements through interactivity and telepresence. In particular, telepresence (the focal point of this study) provides a new dimension unique to online environments where users feel they are part of the action [7]. Moreover, telepresence has been shown to influence exploratory behavior in flow experience in online environments such as virtual communities [8]. For example, video gamers might experience being totally immersed in the interactive experience of the game, whereby they lose the sense of time, while experiencing positive emotions. Gamers perceive such situations as optimal experience, one that is highly valued. In such a state, the telepresence experience would translate players to a virtual location, in which they would lose their connection with real-time space.

Computer-mediated environments that facilitate the telepresence experience of flow have the potential to increase the degree of enjoyment, having wide implications for human-computer interaction. In particular, non-gaming social virtual communities may also facilitate a unique experience of flow that can provide insight into HCI theory and practice. Three dimensional environments like Second Life offer users virtual spaces for exploration and creativity. Each community experience can provide complex social interaction that is both graphic and audible, and includes chat rooms for social networking.

The proposed research addresses the shared concerns of past studies that provide a fundamental support of HCI and the flow phenomenon in identifying and better understanding the relationship between telepresence in virtual community experience and flow. What is being suggested is that as a result of flow, brought on through the virtual world experience, an illusion of “being there” or telepresence will occur. Hence, we ask, what are the determining factors influencing flow within a virtual world? And what is the relationship between the flow and telepresence experience? How do these factors and effects impact the HCI experience of gamers?

2 Flow Overview

The notion of ‘flow’ was introduced by Mihaly Csikszentmihalyi [3] as a technical term to describe the good feeling or “*optimal experience*” people have as a motivating factor in their daily activities such as work, sports, and artistic performance. Although Csikszentmihalyi’s research was part of the larger field of intrinsic motivation, his investigation of flow was contrary to the traditional utility-centric motivational theories of the time [3]. Csikszentmihalyi referred to flow as an experience people have when they “worked hard, not in order to get conventional rewards, but because the work itself was rewarding. ...” [3, p. 5]. Key to understanding flow is the concept of *autotelic*. Autotelic is the result of an activity or situation that produces its own intrinsic motivation, rewards, or incentives; and specifically without any outside goals or rewards. The experience of autotelic is a common feeling among all people that experience flow, where their attention is on a limited stimulus field. Csikszentmihalyi [9] states that in autotelic people “forget personal problems, lose their sense of time and of themselves, feel

competent and in control, and have a sense of harmony and union with their surroundings... and cease to worry about whether the activity will be productive and whether it will be rewarded” (p. 182).

Flow is a complex concept and one that is difficult to operationalize because of a range of qualifiers, what Csikszentmihalyi [4] describes as the nine dimensions of flow, which include: 1) clear goals, 2) immediate feedback, 3) personal skills well suited to given challenges, 4) merger of action and awareness, 5) concentration on the task, 6) sense of control, 7) loss of self-consciousness, 8) altered sense of time, and 9) the experience of becoming “autotelic,” i.e., doing an activity for its own sake or its own intrinsic reward.

Csikszentmihalyi states that for people to experience flow in play, the outcomes must be real, meaningful, and fateful. Moreover, the results must be significant, dependent, and “determined by individual volitional action; the act must be intrinsically rewarding, occasioned by a merging of action and awareness, an absence of self-consciousness...” [3, p. 52-53]. Eventually, flow eludes us through an intensely self-satisfying “*experience of enjoyment*,” with boredom being at the opposite end of the spectrum. With today’s competitive media industry, interactive products that support game play and virtual experiences that do not usher users in the optimal experience of flow quickly become a bore.

3 Telepresence and Virtual Worlds

Sherry [10] argues that humans evolve in response to “felt needs and contextual factors. In the case of enjoyment of media, an individual’s decision to use a particular medium is largely, though not completely, a function of the individual’s expectation of potential enjoyment resulting from use of that medium” (p. 329). For example, there has been a recent trend of research on online three-dimensional gaming environments and virtual worlds [11],[12],[13],[10],[14],[15]. In part, these studies have focused on how to better facilitate flow for users using massively multiplayer online role playing games, e.g., *World of Warcraft*. While seemingly just as immersive as these games, non-gaming social virtual environments may also provide flow experiences for its users. These non-gaming virtual worlds (NGVW) are broadly classified as meeting spaces, places for virtual exploration and creativity, or simply 3D chat rooms. The most popular NGVWs are Second Life, Active Worlds, Multiverse, There, Lively (from Google), BrandWorlds, Worlds.com, and Kaneva. Each is able to provide a virtual social community life designed to be scalable and support many online users.

Research on flow suggests further inquiry is required to clarify which variables are part of the flow experience for users of virtual worlds, including the direct influence on intentions or behavior [16]. With the emergence of the WWW, renewed calls for research into flow in the context of virtual worlds has increased. A review of the literature by Rodriguez-Sanchez and Schaufeli [17] suggests a definition of flow as an *optimal experience* is composed of absorption, enjoyment, and intrinsic interest. In addition to these three, recent literature also suggests that flow can generate immersive experiences of telepresence in online virtual environments, i.e., feelings of being present in a virtually located environment where users experience being part of the action.

Finneran and Zhang [18] state that in a computer-mediated environment, “telepresence is an essential factor for enabling the person to remain concentrated on the computer-based task” (p. 484). Agah and Tanie [19] define any technology that can produce a telepresence experience as a system that “provides the user with the feeling of being present in a remote location through the use of images, sounds, and (at times) touch” (p. 107). In a conceptual model devised by Hoffman and Novak [2], flow is defined in terms of a computer-mediated activity with a seamless sequence of responses, which is enhanced by interactivity and telepresence. In their study, they showed that “focused attention leads to arousal and telepresence, which both lead to flow” [2, p. 56]. Hence, vividness and an intense focus on the computer-based task, has much to do with enhancing the “feeling of telepresence, however, without a reasonable responsiveness, telepresence can never occur” [17], p. 485).

Draper and Blair [19] further concur with the need for a heightened level of attention, when they state that telepresence arises from “commitment of attentional resources to the remote task. The more resources a user devotes to the task, the greater the identification of the user with the task and the stronger the sense of telepresence”. Csikszentmihalyi [1] at the same time argued that the experience of flow, and the respective heightened enjoyment occurs more readily when there is a balance between an individual’s skill and the difficulty of the task or activity. Most striking is how much flow and telepresence share the characteristic of concentration on task. As Draper and Blair [19] argue, both demand a level of concentration void of any “distracting stimuli to the point of loss of awareness of self as separate from the task” (p. 1030).

While flow is being increasingly researched in the context of online gaming [20], [9], [21] few address virtual worlds with respect to “non-gaming” [22][23][24], and none, from our study, that focus specifically on flow and telepresence. As such, the relationship between flow and telepresence as related and distinct phenomena deserve further inquiry.

As such, studies continue to suggest that flow experience is a significant cognitive state in online virtual community behavior. Hence, the focus of this pilot study is to first determine those factors influencing flow experience in a 3D virtual community (e.g., Second Life) and, second to prove that telepresence is associated with those factors. Therefore, hypotheses include: (1) Second Life participants experience flow and (2) Flow experience is positively correlated with Second Life experiences of telepresence.

4 Methodology

4.1 Participants

Participants for this study were recruited from five of the largest websites dedicated to Second Life discussions, totaling 5000 plus members. Our survey ran during the summer 2008 and reached the goal of 80 participants who completed all questions.

4.2 Treatment and Data Analysis

In this study we used an online questionnaire to gather our responses, choosing a multiple choice survey instead of an open interview. Based on this method we were

able to collect much more data, in a shorter period of time, and with primary goal to reach as many respondents as possible. The online questionnaire was composed of 39 (Primary and Demographics) questions. The primary online questionnaire was composed of 23 multiple-choice questions based on information gained from formative studies in online gaming [2], [11], [14], [21]. Specifically, we designed our questionnaire by reviewing the work of other web, gaming, and virtual reality studies on flow experience. The questionnaire is composed of two categories to provide specific insights about the relationship between online virtual communities, flow, and telepresence (See Table 1).

Table 1. The primary questionnaire was composed of two sections, with the mean score of user findings. The questionnaire asked how often the participants experienced each of these items.

Flow Experience in Second Life		Mean
1.	I feel anxious while online	1.8
2.	I feel bored while online	2.1
3.	I feel in control while online	3.7
4.	I feel completely involved	3.7
5.	I feel focused while online	3.8
6.	I feel comfortably challenged while online	3.5
7.	I lose track of time while online	3.9
8.	I feel at ease while online	4.0
9.	Time really flies when I'm online	4.0
10.	I feel confident while online	3.9
11.	I feel engaged while I'm online	3.9
12.	When I'm online it feels "effortless"	3.3
13.	I feel aware of my online surroundings	4.2
Telepresence in Second Life		Mean
14.	I think of being online as an extension of the "Real World"	3.3
15.	I feel aware of my surroundings in SL	4.1
16.	My interactions with the online environment seem very natural	3.9
17.	I feel like all of my senses are engaged while online	3.2
18.	Moving around in the environment seems very natural	3.8
19.	I feel like I'm actually moving through the virtual world	3.5
20.	I can anticipate the responses to my actions online (I kick a ball, it moves)	3.7
21.	I can examine objects from multiple viewpoints	4.5
22.	I experience little delay from my actions to the expected outcomes	3.4
23.	I feel like I am really "there" in the virtual world	3.7

The first 13 questions address issues related to user flow experience in their general participation in the virtual community of Second Life. Questions 14-23 were more specific about flow experience related to telepresence while using Second Life. The secondary section of the questionnaire was composed of four sections related to level of experiences with Second Life, general online experience, general computer experience, and demographic information. The questionnaire was delivered using the online survey service Survey Monkey.

Participants had to rate Flow- and Telepresence-related questions, evaluating the degree of their experiences respectively. Several negative statements were included

into the questionnaire to balance mostly positive statements. We set a threshold for Flow and Telepresence as a score of 3 on every positive scale (2 for the negative questions).

Data was analyzed using factor analysis (Principal Components Analysis with Varimax rotation). Thus, our research was entirely quantitative. Processing of research results involved four stages: 1) Statistical analysis of the questionnaire items (calculation of the means for each item), 2) Scale reliability analysis for two parts of the questionnaire, flow and telepresence, 3) Explorative factor analysis, targeted at stemming all the parameters into factors, and 4) Analysis of demography and parameters referring to online gaming experience in the samples.

5 Results

5.1 Demographics

Of the 80 Second Life participants completing the online survey there were 32 males and 48 females. The age of respondents ranged from 18 to 65+, with the greatest group being 46-55 at 38% and the second largest group at 35% (36-45). Combined, they account for 73% of the sample tested. The highest reported amount of regular time spent per week was 25 hours among 17% of the participants, with the least reported number of hours being under three hours at 21% of the participants. Almost all participants spend more than 20+ hours per week in the Internet and using the computer. The majority of the participants stated work as the main reason for using a computer and 14 participants – or 17% of respondents – stated communication as their primary motivation for using a computer, with the internet usage reasons have similar ratio of work/communication motivation.

5.2 Factor Analysis for Flow and Telepresence

A reliability analysis of the flow and telepresence questionnaire data was conducted. The Cronbach's alphas for the flow and telepresence questionnaires were .73 and .84, with an average inter-item correlation at .18 and .34 respectively. We can conclude that the questions on Flow and Telepresence were satisfactory; also that there were no excessive questions, and all of the scales contributed to the resulting questionnaire.

Since our participants rated the frequency of flow and telepresence experiences in the questionnaire, we set the threshold of flow experience score of 3.3 for positive questions and 1 for negative (which never happens). The highest scores show that most of the participants acknowledge that they experience a feeling of being somewhere in the online world. Hence, the first hypothesis was supported by most of the data, i.e., most of the mean scores are 3.3 or higher. See Table 1.

We further support hypothesis one (participants experience flow when engaging Second Life) by conducting a principle components analysis (using Varimax rotation) on the two blocks of questions (1-13 and 14-23), representing Flow and Telepresence.

A Principal Components Analysis of the constructs yielded several factors with eigenvalues greater than 1.0 (67.24% of variance explained). We can conclude that

online experiences in Second Life were represented by four factors: Flow, Time Distortion, Control, and Easiness. Such results correspond with Csikszentmihalyi’s understanding of flow as well as recent flow studies. The loadings of constructs with these factors are represented in Table 2 (*left side of the table*).

The first factor, labeled Flow, explains 37.13% of total variance. Questions 5, 6, 11 have the highest loadings on this factor, expressing focused attention, engagement, and comfort for the participants’ level of challenges. The other two scales, having high enough loadings (4, 15) are questions dealing with control and involvement. The negative sign of the factor (i.e., “no-flow”) correlates with feelings of boredom (loading of -.57) and anxiety (loading of -.23). This corresponds with the theoretical understanding of flow [3] as well as results of flow experience research in e-commerce [2].

The second factor, labeled Time Distortion (loss of the sense of time), explains 11.63% of variance. Scales 7 and 9 have the highest loadings on this factor and express the fact that most of the participants lose track of time while online. The third factor, labeled Control, explains 10.54 % of variance. Two scales have the highest loadings on this factor; control and confidence. Together these scales form a pleasant feeling with a controlled situation or environment, which also characterizes flow experience. The fourth factor, labeled Easiness, explains 7.95% of total variance. Two scales contribute to this factor, questions #1 and #8. The first one has a high negative loading, meaning that the anxiety feeling represents the negative sign of the factor. The second one has a high positive loading, representing the feeling of easiness. One scale has a high enough loading of .41 to be considered as adding some meaning to this factor.

Table 2. Four Flow Factor Loadings and Three Telepresence Factor Loadings

4 Flow Factor Loadings					3 Telepresence Factor Loadings			
Scales /Ques.	F1: Flow	F2: Time Distortion	F3: Control	F4: Easiness	Scales /Ques.	F1 Inter-activity	F2 Perception	F3 Tele-presence
1	-0.16	0.13	-0.18	-0.89	14	-0.18	0.42	0.52
2	-0.66	0.10	0.21	-0.36	15	0.43	0.69	-0.12
3	0.30	0.10	0.83	0.00	13	0.88	-0.02	0.14
4	0.69	0.28	0.03	0.41	16	0.59	0.16	0.58
5	0.76	0.08	0.15	0.21	17	0.09	0.68	0.45
6	0.75	0.09	0.31	0.03	18	0.5	0.33	0.59
7	0.13	0.89	0.05	0.10	19	0.27	0.08	0.78
8	0.26	0.37	0.12	0.72	20	0.13	-0.08	0.67
17	0.21	0.81	0.19	-0.02	21	0.66	0.25	0.2
10	0.07	0.16	0.83	0.32	22	0.05	0.69	0.06
11	0.74	0.31	0.18	0.16	23	0.28	0.46	0.65
Explained Variance	3.12	1.87	1.69	1.78	Explained Variance	2.2	2.01	2.72
Prp. Total	0.26	0.16	0.14	0.15	Prp. Total	0.2	0.18	0.25

A Principal Components Analysis of the constructs in yielded three factors with eigenvalues greater than 1.0 (62.94% of variance explained). The loadings of constructs with these factors are represented in Table 2(*right side of the table*).

The first factor, labeled Interactivity, explains 41.34% of total variance. The scale with the highest loading on this factor represents the feeling of control online. The other two scales with significant enough loadings on this factors state that participants' "interactions with the online environment seem very natural" and the feeling that "all their senses are being used". All these scales characterize the interactivity of the online experience: it is quite natural and participants feel absorbed in the activity and controlling the situation.

The second factor, labeled Perception (online absorption) explains 11.23% of variance. Three scales have high enough loadings on this factor: awareness of the online surroundings, delay between the participants' actions and expected outcomes, and a feeling of "all senses are being used while online".

The third factor, labeled Telepresence, explains 10.37% of total variance. The highest loading on this factor got the statement: "I feel like I am actually moving in a Virtual world". Five other scales have moderate loadings on this factor and contribute to its meaning of telepresence. All these scales describe the feeling of "being in the virtual world", the natural way of moving around in a virtual space, and interacting with objects.

5.3 Flow and Telepresence Correlations

In order to investigate the relationship between Flow and Telepresence scales we calculated Spearman's rank correlations. We list all correlations higher than .35 in the Table 3. As we can see, involvement in flow is correlated with a number of Telepresence scales, e.g., "being online as an extension of the Real World", "awareness of online surroundings", "natural way of moving in Second Life", "examining objects from multiple viewpoints", and "the feeling of being in the virtual world".

Table 3. Spearman's Rank Correlations: Flow and Telepresence scales

Scales of Flow and Telepresence questionnaires	Spearman rank correlations	p-level		Scales of Flow and Telepresence questionnaires	Spearman rank correlations	p-level
4 & 14	0.37	0.00		7 & 17	0.42	0.00
4 & 15	0.35	0.00		8 & 21	0.42	0.00
4 & 18	0.35	0.00		9 & 17	0.42	0.00
4 & 21	0.38	0.00		10 & 16	0.43	0.00
4 & 23	0.49	0.00		10 & 21	0.45	0.00
5 & 17	0.49	0.00		10 & 23	0.39	0.00
5 & 23	0.48	0.00		12 & 16	0.37	0.00
6 & 15	0.39	0.00		12 & 17	0.44	0.00
6 & 17	0.46	0.00		12 & 18	0.36	0.00

Overall, our tentative findings suggest that there are 18 points of high degree of flow experience that facilitates telepresence and visa versa using Second Life. The results of correlating flow and telepresence showed that:

- Focused attention in Flow is positively correlated with “all of senses being used” while online.
- Scale of challenges in Flow is positively correlated with the awareness of the online surroundings and the feeling of all senses being used while online.
- Time distortion is positively correlated with the feeling of all senses being used while online.
- The feeling of easiness online is correlated with the possibility to examine objects from multiple viewpoints.
- Confidence is correlated with the possibility to examine objects from multiple viewpoints, engagement, natural interactions, feeling of being effortless, and the feeling of being really “there” in the virtual world.

Summative scores of Flow and Telepresence were calculated for each study participant. The Spearmans’ rank correlation coefficient is equal .64, which is high enough to conclude that these experiences in Second Life are related. Thus, hypothesis two is supported by high correlations between the Flow and Telepresence summative scores.

6 Conclusion

Our study supports previous research that suggests that flow experience is a significant cognitive state in the online virtual community experience. From our findings, the results show that flow can be positively associated with degrees of immersion and telepresence in a 3D virtual community such as Second Life. First, our findings suggest that most participants experience flow while playing Second Life. Second, that considerable evidence supports hypothesis two that Flow can be correlated with telepresence. Based on the correlations between such important indicators of flow, we can conclude that there are some connections between flow and telepresence in Second Life, and that controlling objects can enhance a feeling of being present in a virtual world.

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