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Jose Zagal

College of Computing and Digital Media DePaul University, jzagal@cdm.depaul.edu

Susy S. Chan

College of Computing and Digital Media DePaul University, schan@cdm.depaul.edu

Jingli Zhang

College of Computing and Digital Media DePaul University, jlzhang@cdm.depaul.edu

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Measuring Flow Experience of Computer Game Players

Jingli Zhang

College of Computing and Digital Media
DePaul University
jlzhang@cdm.depaul.edu

Xiaowen Fang

College of Computing and Digital Media
DePaul University
xfang@cdm.depaul.edu

Susy S. Chan

College of Computing and Digital Media
DePaul University
schan@cdm.depaul.edu

Jose Zagal

College of Computing and Digital Media
DePaul University
jzagal@cdm.depaul.edu

ABSTRACT

This research-in-progress paper reports on the development of an instrument for measuring flow experience of computer game players. Flow theory (Csikszentmihalyi, 1993) has been widely adopted in various research fields such as information systems (IS), human-computer action (HCI), and computer games. We argue that flow experience in computer game play leads to enjoyment and therefore can be measured as a dimension of enjoyment in addition to emotion. Development process of the instrument is discussed in this paper.

Keywords

Computer games, enjoyment, flow theory.

INTRODUCTION

As computer games become increasingly popular in people's daily life, they attract more scientific research in different fields on games. As a form of entertainment, the construct of enjoyment is central to research frameworks that examine interactions between computer games and their players. A validated survey instrument measuring enjoyment of computer game play seems critical to large-scale IS research on computer games. The objective of this research is to develop an instrument to measure flow experience of computer game players and to enrich the instrument developed by Fang et al. (2008) to measure enjoyment of computer game play. In order to make this instrument applicable to a broad range of games such as traditional video games and games played on a computer, we define computer game play as play of computer-controlled games. The following sections discuss prior research on enjoyment of computer game play, flow theory, the underlying framework, and the scale development process.

BACKGROUND LITERATURE

Our literature review examines prior research on measuring enjoyment of computer game play and flow theory.

Measuring Enjoyment of Computer Game Play

Two dominant methods—physiological measurement and survey questionnaires -- have been used by previous researchers to measure enjoyment of computer game play. A stream of studies have used physiological responses to objectively evaluate a user's experience with entertainment technology (e.g., Hazlett, 2006; Mandryk, Inkpen, & Calvert, 2006; Ravaja et al., 2004). The most commonly used physiological measurements include:

- Electromyography (EMG) is a measurement technology for recording the electrical activation of muscles
- Electrodermal activity (EDA) measures sweat gland activities that are directly related to physical arousal.
- Electroencephalography (EEG) measures brain waves in terms of frequency bands.

Although physiological measurements are objective and arguably more accurate, they must be applied in a laboratory environment and thus are not suitable for large-scale IS research.

In early studies on computer games, researchers used some simple measures of enjoyment containing only a few items (e.g., Ryan, Rigby, & Przybylski, 2006). Fang, Chan, Brzezinski, and Nair (2008) present the first validated survey instrument for measuring enjoyment of computer game play. However, this instrument was criticized by peers for its use of Nabi and Krcmar's (2004) tripartite model of media enjoyment. Vague definitions of the three constructs (affect, behavior, and cognition) in the tripartite model (Nabi & Krcmar, 2004) weaken content validity of the instrument. Moreover, the instrument developed by Fang et al only contains 11 items.

Fang et al. (2008) developed an instrument to measure enjoyment of computer game play based on the tripartite model (Nabi & Krcmar, 2004). This instrument measures affective, cognitive, and behavioral reactions during the game play. One weakness of this instrument is that it doesn't measure play experience and computer game players. In this study, we attempt to develop an instrument measuring flow experience of computer game players in order to enrich the prior instrument developed by Fang et al. (2008). In the following section, flow theory and studies adopting flow theory in various fields are reviewed.

Flow Theory

Csikszentmihalyi (1993) investigates what creates optimal experience when conducting studies on the creativity of artists and musicians. Csikszentmihalyi expands his studies to people doing daily work or leisure and finds that enjoyment would be experienced if people are immersed in the same manner as those artists. Based on a series of field studies, Csikszentmihalyi (1993) creates the flow theory to examine the process in which certain behaviors make life more enjoyable. In this flow theory, he proposes eight major components for the phenomenology of enjoyment (Csikszentmihalyi, 1993): (1) A challenging activity that requires skills; (2) The merging of action and awareness; (3) Clear goals and feedback; (4) Concentration on the task at hand; (5) The paradox of control; (6) The loss of self-consciousness; (7) The transformation of time; and (8) Autotelic experience.

Since its inception, flow theory has been widely adopted in IS and HCI research. Webster, Trevino, and Ryan (1993) adapt flow theory to measure the user's playfulness in human-computer interactions and propose to measure flow in 4 dimensions: (1) control, (2) attention focus, (3) curiosity, and (4) intrinsic interest. Ghani and Deshpande (1994) use flow theory to describe the experience of individuals using computers in the workspace, and they measure two dimensions of flow, sense of control and the level of challenge received. Hoffman and Novak (1996) present a model of flow in computer-mediated environments (CME). The flow model involves "positive affect," "exploratory behaviors," and "challenge/arousal," which could be considered as elements of enjoyment. Subsequently Novak, Hoffman, and Yung (2000) conduct a large-scale online consumer survey to the structural model based on flow. Koufaris (2002) applies flow theory to online consumer behavior and measures 4 constructs of flow: concentration, challenge, skills, and perceived control. Finneran and Zhang (2005) argue that most existing flow studies in CME do not differentiate between factors that are related to the task and those related to the artifact. They propose a conceptual model for flow antecedents: the Person-Artifact-Task (PAT) model.

Flow theory has also been widely adopted in studies on games. Grodal (2000) explains that much of the fascination with video games can be attributed to the ability of players to control the game in terms of outcomes (i.e., deciding how the "plot" will unfold), the speed at which the game progresses, and mastery of the game or mastery over other players. Sherry (2004) argues that video games are likely to create flow state because they frequently (1) have concrete goals and manageable rules; (2) can be adjusted to players' capabilities; (3) provide clear feedback in terms of running scores, collections of artifacts, or progress reports; and (4) have visual and audio effects that helps screen out distraction and facilitate concentration. Sweetser and Wyeth (2005) construct a model, GameFlow, based on flow theory to evaluate player enjoyment in games. GameFlow model consists of eight constructs: concentration, challenge, player skills, control, clear goals, feedback, immersion, and social interaction. Smith (2006) argues that flow, a psychological state, contributes to the enjoyment of playing video games. Smith (2006) suggests that individuals derive enjoyment from the experience of flow, and the occurrence of flow can be stimulated by the use of interactive media. Cowley, Charles, and Black (2008) develop a framework, user-system-experience (USE), and argue that application of flow theory to games can improve understanding of the relationship between a player and the complex game system.

THEORETICAL FRAMEWORK

With the mounting research applying flow theory to studies of computer games (e.g., Cowley, Charles, & Black, 2008; Sherry, 2004; Smith, 2006; Sweetser & Wyeth, 2005), there seems a consensus that flow (Csikszentmihalyi, 1993) applies to computer game player experiences and it leads to enjoyment. Lazzaro (2009) suggests that both emotion and play experience contribute to player enjoyment in computer games. Therefore, we argue that measuring flow experience during computer game play will allow us to incorporate another additional dimension in measuring game players' enjoyment. In this study, we will develop a survey instrument to measure all eight elements of flow entailed in Table 1.

Element of Flow	Definition
A challenging activity that requires skill	Activities require the investment of psychic energy, and could not be done without the appropriate skills.
The merging of action and awareness	People become so involved in what they are doing that the activity becomes spontaneous, almost automatic. They stop being aware of themselves as separate from the actions they are performing.
Clear goals and feedback	An objective is distinctly defined. One knows instantly how well one is doing.
Concentration on the task at hand	Concentration on the task at hand; irrelevant stimuli disappear from consciousness, worries and concerns are temporarily suspended.
The paradox of control	One feels in control of his actions and of the environment.
The loss of self-consciousness	One feels the loss of the sense of a self separate from the world around it. One feels a union with the environment.
The transformation of time	Time no longer seems to pass the way it ordinarily does.
Autotelic experience	The key element of an optimal experience is that it is an end in itself. The activity that consumes us becomes intrinsically rewarding.

Table 1. Elements of Flow (Csikszentmihalyi, 1993)

INSTRUMENT DEVELOPMENT PROCESS

In this study, we adopt the instrument development method suggested by Moore and Benbasat (1991) which consists of three stages. The first stage is item creation. Its purpose is to create pools of items for different constructs. The next stage is scale development. The basic procedure is to have panels of judges to sort items from the first stage into separate categories based on the similarities and differences among items. In the final instrument testing stage, the instrument is tested through a few rounds of surveys.

In the following sections, we will discuss the three stages involved in development of the instrument measuring enjoyment of computer game play based on flow experience: item creation, scale development, and instrument testing.

Item Creation

The objective of this stage is to ensure content validity. We followed these steps:

- 1) A review of relevant studies was conducted to compile tested scales and items that measure flow experience.
- 2) All the items identified in the existing instruments were categorized according to the Csikszentmihalyi's (1993) eight elements of flow. Similar or identical items were consolidated. Table 2 lists the numbers of items for all eight flow elements and their sources.
- 3) Items considered not applicable to computer game play were removed.
- 4) New items were created for those flow elements with fewer than 3 items.
- 5) Wording of the items in the pool were modified to reflect the context of computer game play.

As a result, 38 items were created.

Scale Development

The goals of this stage are twofold: to assess the construct validity of the various scales being developed, and to identify any particular items which may still be ambiguous. Experienced computer game players are recruited to sort the 38 items created in "Item Creation" stage into eight categories corresponding to the eight flow elements: 1) A challenging activity that requires skills; 2) The merging of action and awareness; 3) Clear Goals and Feedback; 4) Concentration on the task at hand; 5) The paradox of Control; 6) The loss of self-consciousness; 7) The transformation of time; and 8) Autotelic experience.

Instrument Testing

The goals of this stage are to assess the reliability of the scales and to ensure the construct validity. An online survey will be conducted to test the instrument developed in Stage “Scale Development”.

Flow Element	Number of Items	Source
A challenging activity that requires skill	1	Ghani, 1994
	2	Haworth, 1995
	12	Novak, Hoffman, and Yung, 2000
	11	Sweetser and Wyeth, 2005
	4	Guo, 2004
	2	Koufaris, 2002
The merging of action and awareness	7	Novak, Hoffman, and Yung, 2000
	4	Sweetser and Wyeth, 2005
	9	Guo, 2004
Clear goals and feedback	5	Sweetser and Wyeth, 2005
	8	Guo, 2004
Concentration on the task at hand	3	Webster, Trevino, and Ryan, 1993
	4	Ghani, 1994
	4	Guo, 2004
	6	Sweetser and Wyeth, 2005
	1	Moneta and Csikszentmihalyi, 1996
	2	Peterson and Miller, 2004
	3	Lu, 2009
The paradox of control	3	Webster, Trevino, and Ryan, 1993
	2	Ghani, 1994
	4	Egbert, 2003
	2	Koufaris, 2002
	4	Novak, Hoffman, and Yung, 2000
	6	Sweetser and Wyeth, 2005
	1	Sherhoff and Csikszentmihalyi, 2003
	1	Peterson and Miller, 2004
	3	Mathwick, 2004
	3	Wu, Li, & Rao, 2008
	4	Guo, 2004
	7	Guo, 2004
The loss of self-consciousness	7	Guo, 2004
	2	Novak, Hoffman, and Yung, 2000
	9	Guo, 2004
	2	Wu and Chang, 2005
The transformation of time	2	Wu and Chang, 2005
	1	Sweetser and Wyeth, 2005
Autotelic experience	4	Guo, 2004

Table 2. Items from Existing Instruments

NEXT STEP

As of now, we have finished the first stage “Item Creation” and are starting the “Scale Development” process. We plan to present results from scale development and some preliminary results from the survey at the conference.

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