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Flow and Playing Computer Mediated Games - Conceptualization and Methods for Data Collection

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ABSTRACT
The purpose of this paper is to describe and argue in favor of a framework for a theoretically grounded research design, using a model of flow that differs from the ones used in existing research. This paper also argues in favor of a combination of data collection methods that should yield a broader set of data and has the potential to generate a deeper understanding of the user experience and of the flow concept itself. The rationale for doing further flow research is that existing research has had a focus on utilitarian tasks, while little or no research has been conducted on intrinsically motivated tasks e.g. playing computer mediated games.

Keywords
Flow, Computer Mediated Games, Computer Mediated Environments, Person-Artifact-Task (PAT) model, Engagement, Gameplay, Enjoyment, Immersion, Human-Computer Interaction.

INTRODUCTION
Over the past decade researchers in the human-computer interaction field have studied the concept of flow and flow experiences in interaction with information technology (IT) and computer usage (e.g. Agarwal and Karahanna, 2000; Chen, 2000; Ghani and Deshpande, 1994; Hoffman and Novak, 1997; Huang, 2003; Novak et al., 2000; Trevino and Webster, 1992; Webster and Ho, 1997). Flow as a concept provides a framework for modeling enjoyment, engagement, user satisfaction, absorption, immersion and other related states of involvement within computer mediated environments (CMEs). As more and more devices and applications are designed for entertainment purposes there is a need to study and measure enjoyment and flow while interacting with IT. The reason for further research in this area is that existing research has had a focus on tasks that can be considered utilitarian or work related while little or no research has been conducted on intrinsically motivated tasks such as playing computer mediated games (CMG). Games and their environments are dependent of the flow experience to attract players. This makes games a well motivated study object and will be used as an example in this paper. The approach described in this paper could give us clues as to how to design games and artifacts to be more conducive to flow. It could contribute to both the design of games, the design of artifacts upon which games are played and also to the design of artifacts or applications targeted for utilitarian use e.g. education or critical systems used by the military or police and rescue forces. Finneran and Zhang (2005) identify challenges when studying flow in CME: Conceptual challenges due to different and ambiguous models in existing research. Challenges concerning the difficulties in operationalizing the concepts influencing flow. Methodological challenges concerning difficulties in data collection due to the affective and dynamic nature of flow. The purpose of this paper is to meet some of these challenges and describe and propose a framework for a theoretically grounded research design, using a flow model that differs from the ones used in existing research. The paper also argues in favor of a combination of different qualitative methods for collecting empirical data.

The disposition of this paper is as follows; the next section will present the flow concept, a framework for modeling enjoyment and optimal experience. Section three introduces the PAT model (Finneran and Zhang, 2002, 2003), a model for conceptualizing the flow experience within CMEs. Section four presents a new conceptualization of flow and the connection between flow and the flow-like concept of gameplay. The fifth section presents and argues for methods for empirical data gathering. Finally section six presents the conclusions of the paper.
FLOW
The concept of flow is defined by Csikszentmihalyi (1990) as the ‘holistic sensation that people feel when they act with total involvement, an optimal state of consciousness characterized by a state of concentration so focused that it amounts to absolute absorption in an activity’. He describes it as a state a person comes into when s/he is so involved emotionally in a challenging, immersive activity that s/he loses sense of time. A person engaged in an activity and having an optimal experience, experiencing flow, will according to Csikszentmihalyi (1990), have clear goals, lose self-consciousness, exercise control and experience a distortion of time. A person’s “autotelic nature” (intrinsic motivation or doing the activity for its own means) is an essential contributor to a person’s capacity to experience flow. This indicates that a person is more focused on the progress of the activity than the end result (Csikszentmihalyi, 1990). The author differentiates the autotelic experience from the non-autotelic experience. The difference lies in that during the autotelic experience the focused attention is on the activity for its own sake, while the non-autotelic experience focuses on the effect of the activity. In order to experience flow, the person performing the activity must be able to perceive it as challenging, requiring skill, combine action and awareness, provide feedback, and full concentration on the task at hand (Csikszentmihalyi, 1990). The experience of flow is what people often name as the main reason for performing a specified activity.

THE PAT-MODEL
In research where the flow concept has been used, different models and operationalizations of the flow concept have been applied (e.g. Agarwal and Karahanna, 2000; Hoffman and Novak, 1997; Huang, 2003; Novak et al., 2000; Trevino and Webster, 1992; Webster and Ho, 1997) Finneran and Zhang (2003) stress the point that the concept of flow and its operationalizations in existing research are very ambiguous. This causes a lot of confusion in research because of difficulty to ascertain which aspects of flow that has truly been measured. This is further discussed in Finneran and Zhang (2005) and they claim it to be one of the important challenges when it comes to flow research. In their work (Finneran and Zhang, 2003) present the person-artifact-task model (PAT) and argue that in order to be able to measure flow more correctly there is a need to break down the flow concept into three basic components. These components interact with each other, contributing to the experience that enables a person to reach the state of flow. The components are person, artifact and task.

The dynamic and complex nature of computer mediated artifacts (CMAs) is often overlooked and the adept handling of these artifacts is taken for granted, perhaps due to them being a natural part of people’s everyday life. This is a risky thing to take for granted when studying people’s experiences with CMEs. The point is that an activity involving a CME is a combination of the task (e.g. drawing a picture) and the artifact used for the task (e.g. illustration program). Consequently, the probabilities of having an optimal experience are dependent on the interaction between the person, the task, and the artifact. (Finneran and Zhang, 2003)

The PAT model was developed for two reasons. Firstly to give an understanding of the original flow concept by reviewing existing empirical flow studies and analyzing the characteristics of CMEs. The model functions as a conceptual framework and Finneran and Zhang (2003) generate propositions for hypotheses concerning factors influencing flow experience. Secondly, the intention to conceptualize the flow experience in conjunction with CMEs for researchers who, in approaching empirical work, strives to distinguish between artifact and task.

When studying existing research efforts using the flow concept (e.g. Agarwal and Karahanna, 2000; Hoffman and Novak, 1997; Huang, 2003; Novak et al., 2000; Trevino and Webster, 1992; Webster and Ho, 1997) We agree with Finneran and Zhang (2003), that existing research focuses on the person-artifact interaction and misses out on the task component and the persons interaction with the task. Finneran and Zhang (2003) argue that when talking about activities in CMEs, one need to break down an activity into task and artifact where the task is the main goal of the activity and the artifact is the tool for accomplishing the task.

A REVISED FLOW MODEL
Our model is a development of the existing flow models and it will make a distinction between task and artifact as stated by Finneran and Zhang (2005). It will also, as suggested by Finneran and Zhang (2005), take the individuals (persons) and their differences into consideration, not only concerning skills, but also their autotelic personalities. This model will take the overall view of the flow concept like e.g. Novak et al. (2000) and Csikszentmihalyi (1990) and merge it with the PAT models view of factors influencing the flow experience.

Many of the concepts in the flow models by Novak et al. (2000) and Csikszentmihalyi (1990) are the same. Some only exist in one of the models and others have the same meaning but different labels. The combination of concepts used in our revised flow model (Figure 1) will give the flow concept a broader coverage. The concepts are: skill, control, challenge, involvement,
clear goals, interactivity, autotelic nature, time distortion, arousal, telepresence, loss of self-consciousness, focused attention, merging of action and awareness, positive affect, exploratory behavior and autotelic experience. These sixteen concepts differ in character and are better understood if categorized in *flow antecedents*, *flow experience* and *flow consequence*. The flow antecedents are the preconditions, influences or characteristics needed to get a flow experience, which could lead to flow consequences. This categorization has been used in earlier research of flow in CMEs (e.g. Chen, 2000; Ghani and Deshpande, 1994; Trevino and Webster, 1992) and these categories have been empirically validated by Chen (2000).

**Figure 1. A revised flow model.**

This revised flow model (Figure 1) should be used as a framework to study intrinsically motivated tasks and the artifacts upon which these tasks are being performed. Figure 1 illustrates how the antecedents influence the person and the experiences s/he has with the artifact and task respectively. The interaction inside the antecedent’s rectangle has the possibility of leading to flow experiences (middle rectangle) e.g. time distortion. These experiences can then lead to possible flow consequences shown in the rightmost rectangle.

The definition and interaction of the concepts within the antecedent’s rectangle are shown below. (Since some concepts are used for both artifact and task the letter (A) for artifact and (T) for task will be added to the concept name):

**A-Skill**: A person’s perceived skill using the artifact e.g. earlier experience/use, for how long etc.

**A-Control**: The person’s observable control of the artifact and perceived control while handling the artifact. This concept is influenced by A-Skill and T-Skill.

**A-Challenge**: The challenge a person perceives as presented by the artifact in using the artifact. This concept is influenced by A-Skill.

**T-Challenge**: The challenge a person perceives as presented by the task. This concept is influenced by T-Skill.

**T-Involvement**: The motivation of a person to engage in performing the specific task. Concerning how much time the person is willing to put into the task, the energy the person puts into learning the task, the expectancy of rewards, and the person’s willingness to concentrate.

**T-Clear Goals**: The person’s reason/s for performing the task.

**T-Control**: The person’s actual handling of the task (observable through handling and completion of the task or sub tasks within the task), and perceived control while performing the task. This concept is influenced by T-Skill and A-Skill.
T-Skill: The person’s perceived skill with the task e.g. earlier experience/use, for how long/how many times etc.

Interactivity: The person playing a racing game (task) on a console (artifact) uses the gamepad to interact with the game. The person pushes the steering device to the left, the car in the game turns to the left and it is shown on the screen. This experience is perceived by the player. The player is interacting with the task through the artifact and the task responds to the person’s actions through the artifact.

An example of how the concepts in the conceptualization interact could be as follows: A person trying to cope with both the challenges from the artifact and the task will lead to focused attention which in turn could lead to telepresence, time distortion and loss of self-consciousness. Getting involved and motivated in combination with clear goals and challenges could lead to getting the person aroused and influence the focused attention. This in turn could lead to the merging of action and awareness. These experiences could become a flow experience that could lead to flow consequences like positive affect, exploratory behavior and autotelic experiences.

Gameplay and flow
The example task used in this paper is that of playing CMGs. There are many different definitions of the word game, see for example (Merriam-Webster, 2003; Caillois, 2001; Crawford, 1982), but the different uses and definitions show an accent on an intrinsically motivated activity involving interaction, conflicts and goals and an activity that is intrinsically motivated.

To understand the concept of game and to see the connection to flow we should look at the concept of gameplay which can be described as the concept that makes a game fun, engaging and attractive to a player. According to Prensky (2002) gameplay is what keeps a player motivated and engaged through out an entire game or a level and that it is the decision making, doing and thinking that makes a game fun or not (see Figure 1, involvement). This is also evident in what Rouse (2001) and Crawford (1982) state as the essence of gameplay which is interactivity. In the case of CMGs this would be how the game or game-world reacts to the choices the player makes and the ways that the player is able to interact with the game or game-world (see Figure 1, control and interactivity).

To get good gameplay the game should be easy to learn but hard to master. Furthermore the game should provide the player with both long-term and short-term goals (see Figure 1). Gameplay is what keeps the player constantly interested in playing with a constant variation and engaging activities (challenges in Figure 1). (Prensky, 2002) This line of thought can be seen in Crawford (1982) when he suggests that gameplay is a combination of cognitive effort that the game requires and the pace of the game. The interaction and balance between cognitive effort and pace is important i.e. the demands on the player are direct and simple but at a fast pace or vice versa.

Another definition of the essentials in a game (as a correspondent to gameplay) is that of Malone (1980). The essential characteristics of good computer games and other intrinsically enjoyable situations can, according to Malone (1980), be organized into three categories; challenge, fantasy and curiosity. The challenge is partially the goals that the game provides. As the player’s skills improve, reaching sub goals becomes more difficult which challenges the player throughout the game until reaching the main goal. Reaching these goals and overcoming the challenges might heighten the player’s self-esteem. (Positive affect in Figure 1) Malone (1980) distinguishes between two types of fantasies. Extrinsic fantasy depends on the skill of the player and if this skill is used correctly (i.e. right or wrong answer to a question). Intrinsic fantasy depends on the skill of the player as well, but the skill also depends on the fantasy. Since the problems are presented in terms of elements in the fantasy world. (Malone, 1980) His third category is curiosity which is evoked in a player by providing variation of the environments complexity. The author expresses the difference between the challenge as the things a player can do and complexity as what the player can understand. He presents two kinds of curiosity; sensory and cognitive. Sensory curiosity involves the attraction in sensory stimuli like light and sound, audio and visual effects. The cognitive curiosity is met by making the game responsive; providing feedback that should be surprising or sometimes constructive. (See Figure 1, challenges)

From these definitions one can see that the concepts incorporated in gameplay correspond to flow in that many of the concepts are localized in the antecedents’ column in Figure 1 above (e.g. clear goals, skill, challenge, interactivity, involvement. The heightened self-esteem (Malone, 1980) of the player would find its place in the consequence column as the equivalent to positive affect. Heightened self-esteem could also result in the player achieving a sense of control in or over the game. This would then put control in both the antecedents’ column and in the consequence column in Figure 1.

DATA COLLECTION METHODS
When it comes to data collection, different methods for measuring flow have been used in existing empirical research (e.g. the Experience Sampling Method (ESM) (Finneran and Zhang, 2005; Novak and Hoffman, 1997). What seems to be the most
important factor to a flow experience is the balance of the skills of a person and the challenges that the person is confronted with (Csikszentmihalyi, 1990; Finneran and Zhang, 2005). With this in mind the distinction between artifact related and task related skills and challenges are even more important. It is also important to have good knowledge of the test persons, their autotelic nature and their previous experiences or skill with the artifact(s) and the task(s) presented to them.

This section will first present an outline of the data gathering process and then present and argue for the different methods and stages of the mentioned process. The methods presented below will meet some of the challenges set up by Finneran and Zhang, (2005) concerning data collection. The proposed methods have the ability to elicit data in real time and get an understanding of the actual flow experience. The methods will further enable the test persons to use their own words expressing their feelings and experiences. The individual differences in the test persons is also covered by these methods.

**Two-stage empirical data gathering**

The data gathering process can be done in two stages. The first stage is performed in order to choose test persons for the second stage, consisting of experiments and interviews. The first stage will contain a self-efficacy test with the purpose to find the persons’ autotelic nature and potential in getting into flow experience. We believe that in order to get meaningful results from the experiments the persons to be tested must have some ability to experience flow but it could also be meaningful to see if the task and artifacts can give flow experience to a person with low ability to experience flow. This test can give additional information about individual differences and the person’s experiences with the artifacts and tasks that are to be part of the experiments.

The second stage is an experiment session. The test person is introduced to the task and told that the test session is video recorded etc. After each session, the test persons will be interviewed about their experiences and should also be able to see and respond to the video recording of his/her test session, to be able to comment on actions and reactions. A stimulated recall (SR) procedure will be used for this.

The result from each of the test-and SR-sessions will be compared to see how the task and the artifact influence the flow experience as well as the impact of individual differences.

**Self-efficacy test**

The self-efficacy test gives light to how people judge their own capabilities in taking courses of action that are required to accomplish specific tasks. Self-efficacy beliefs provide the foundation for human motivation, well-being, and personal accomplishment. This, because unless people believe that their actions can produce the outcomes they desire, they have little incentive to act or to persevere in the face of difficulties. (Pajares, 2002)

The self-efficacy test will provide information about the respondents’ previous skills with the artifacts and tasks presented to them in the experiments. The tests should also be designed to ascertain the respondents’ degree of having an autotelic nature. (See flow antecedents - person in Figure 1) These tests will be conducted as part of the selection process for finding suitable respondents and test persons. Persons who “score high” on the autotelic nature part of the test are suitable to take part of the experiments since their intrinsic motivation is important for the ability of experiencing flow. Also, a “control group” with people with lower scores and less experience with the tasks and artifacts will take part in the experiments to see if there will be any significant difference in the experiment results due to individual differences such as autotelic nature or skills.

**Experiments and stimulated recall**

Research using surveys with questionnaires using Likert-type scales (Ghani and Deshpande, 1994; Novak et al., 2000; Trevino and Webster, 1992) are limited because they use closed-ended questions directed at a general case instead of a specific experience (Finneran and Zhang, 2005). I would therefore use semi-structured, in-depth interviews instead of the more traditional questionnaires. The reason for this is, as Pace (2003) argues, that most of the skills and challenges associated with the flow experiences are not directly observable and the power of using in-depth interviews lies in its ability to provide a more direct understanding of the respondents experience through the dynamic and flexible line of questioning. (Minichiello et al., 1995, in Pace 2003) The questions asked in the interviews for capturing the test persons’ perception of their flow experience will be arranged and derived from the flow model shown in Figure 1. The open-ended questions will need to specifically ask about for instance challenges from the task and challenges from the artifact to ensure that the respondent is clear on what is being asked. The problem of the respondents not understanding questions asked to them is evident in earlier research (e.g. Agarwal and Karahanna, 2000; Chen, 1999; Novak et al., 2000). Using interviews gives the researcher the opportunity to clarify questions to the respondent. The in-depth interviews will be used during the experiment sessions as part of the SR procedure.
The reason for using experiments instead of e.g. ESM is that it gives the researcher the opportunity to observe the test persons and their actions and reactions during a session. Actions and reactions that the test persons might be unaware of and therefore would be unable to report in an ESM. Experiments will be conducted with the test persons performing the task for instance. playing a game on an artifact e.g. console. Their test session will be video recorded and timed to ensure the possibility to ask them about e.g. how long they estimate that they have been performing the task in order to see if the have lost track of time. After the test session the test persons will be interviewed about their experiences and they should also be able to see and respond to the video recording of their test session, given possibility to comment on their actions and reactions. An SR procedure will be used to explore the cognitive process of the test person. (Lyle, 2003) The test sessions will be played back for the test person to view. The person should be asked to view the whole test session and, at own will, stop the tape at any time. The test person’s task is to identify situations that correspond to flow experiences or “flow pauses” and to comment on why they occurred or point out actions they where not aware doing during the session (loss of self-consciousness). The SR procedure will take place directly after the test session in order for the test persons to have the task experience fresh in mind and therefore be able to answer in a more “precise” way regarding their experiences (Lyle, 2003). Within the SR procedure a semi structured in-depth interview will take place to ask the test persons questions operationalized from the flow conceptualization shown in Figure 1. In a task performing session “waves” of flow experience might occur. With the help of video recording and SR the reasons for these “waves” could be seen and explained. (See Csikszentmihalyi & LeFevre (1989) and their discussion on quality of experience.)

Finneran and Zhang (2005) raise some concerns about experiments and their external validity. Since the experimental environment might take away the true context of the artifact and task, experiments might be weak, this because flow experiences are context-specific. What further weakens experiments is that according to Finneran and Zhang (2005), the person’s state of mind is probably different in their job situation or other real-world scenario than in the experiment environment. I would argue in favor of the experiment in research on intrinsically motivated tasks since e.g. a gaming session is different from other scenarios. Firstly the experiments could be conducted in an “everyday environment”. Secondly, the test persons should be “invited” to perform the task, which in this case is a hedonic one. This could yield a stronger degree of intrinsic motivation which would vouch for the right state of mind among the test persons. We believe it will be easier to do an experiment this way than to try to catch a “real-life gaming session” with ESM. Another advantage with the combination experiment/SR is that it gives the test persons an opportunity to use their own words to describe their experiences. This would yield a broader set of data which would help to illuminate the flow concept from different angles. Previous research shows interesting results when presenting quotes, describing flow, to test persons to see if they have had those types of experiences (Finneran and Zhang, 2005). We believe that it is important to let the test persons express their feelings and experiences in their own words. The test persons might not use the same words to describe their feelings/experiences and on interview they can help explain their use of various words which could lead to a deeper understanding of the users’ experience, and of the flow concept itself.

CONCLUSIONS

The challenges for researchers of the flow concept in CME, setup by Finneran and Zhang (2005), are the conceptualizations or re-conceptualizations of flow and the operationalization and data collection in empirical studies. They stress the need for distinguishing experiences with the task from experiences with the artifact and to take the individual differences between the test persons into consideration. Our model and proposed methods for empirical data gathering is an attempt to meet these challenges in order to get deeper understanding of flow experiences in CME in general, and in playing computer mediated games in particular.

The revised flow model presented in this paper takes both the individual differences between test persons and the difference in flow experiences with the artifact as well as the experiences with the task into consideration. The use of our model and the combination of qualitative data gathering methods should give deeper understanding of the flow concept in addition to the knowledge from existing research where more quantitative methods have been used.

A suggestion for further research, concerns empirical tests of the revised flow model showed in Figure 1, using the proposed methods. This type of research is important so that we better can understand how to design systems and artifacts that are more conducive to flow and inform the human computer interaction with information and communication technology (ICT).
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