Optimizing Flow in Simulated Environments for Worker Productivity

Emergent Research Forum

Thomas A. Chapman  
University of Mississippi  
tchapman@bus.olemiss.edu

Brian J. Reithel, Ph.D.  
University of Mississippi  
breithel@bus.olemiss.edu

Abstract

The challenge of motivating employees to be productive while maintaining their satisfaction level remains a significant issue in the workplace. Previous research on immersive experiences and gaming suggests that the individual’s state of mind is essential to creating a greater level of engagement. The most frequently studied state of full engagement is referred to as a “flow experience”. This paper reviews significant prior research on flow experiences and computer-based gaming. That background is used to develop a new model of the factors that may impact an employee’s engagement in business-related workflow tasks. An experimental approach is proposed to demonstrate the efficacy of the paper’s conceptual model. The outcomes of this study will offer important guidelines to user interface designers and managers about the factors that should be incorporated into modern workflow systems to heighten employee engagement, motivation, and satisfaction.

Keywords: Flow experiences, workflow systems, employee motivation and satisfaction, user interface design.

Introduction

In 2014, the video game industry worldwide brought in close to $100 billion in revenue. This figure represents a 25 percent increase over the 2012 figure of $79 billion. The Gartner Research Group forecasts that the worldwide video game industry will reach $111 billion by 2015 (Gartner 2014). Video games are a powerful technology, which continue to attract sustained and active participation from individuals across a wide range of demographic categories.

While gaming is continuing to grow, the challenge of motivating employees to be productive while maintaining their satisfaction level remains a primary concern in business management. This suggests that some important lessons may be learned from video game design principles that may be applied to the design of everyday business applications.

Perhaps the reason video game design principles do not enjoy more influence in the business world is due to a cultural preconception that video games are strictly a leisure activity and thus represent an unproductive use of one’s time. However, if we consider video games as simulated environments, it helps us see past the negative connotation in the term “gaming”. In that light, it is easier to see that video games are highly effective at keeping individuals engaged and productive, in the sense that players work to complete the objectives that are presented to them within that environment.

How then are video games so effective at keeping individuals engaged and working for long periods of time? Traditionally, the thinking among video game producers has been that the resolution of the graphics plays a vital role in the production of a convincing virtual environment, which in turn leads to an engaging gaming experience. It is generally surmised that the presence of high definition (HD) graphic images should facilitate a greater sense of engagement by stimulating more of the visual senses of the user. However, HD graphics, while visually appealing, may not necessarily hold the key to user engagement (Skalski & Whitbred 2010).

Rather than examining the presence of HD graphics, therefore, it is perhaps better to look at the mechanics of the gameplay itself and the psychological underpinnings of the gaming experience.
Literature Review


Csikszentmihalyi began to study flow experiences after he became fascinated by artists who were so immersed in their work that they neglected to sleep or eat. He went on to study flow experiences in artists across a wide variety cultures, including studying Native American artists from the Navajo Indian reservation in New Mexico. In his book, he describes the flow experience as one in which all sense of time and struggle seems to disappear as the individual becomes completely engrossed in the challenges of the task they are performing. Some of the terms that his subjects used to describe their mental state during a flow experience include “strong,” “active,” “creative,” “concentrated,” and “motivated” (Csikszentmihalyi 1990). A flow experience is an intrinsically rewarding sensation. It can be addictive and often individuals will go to great lengths in order to maintain a flow state. The end product becomes an excuse for the process (Nakamura & Csikszentmihalyi 2002). The connection between video games and flow experiences has been well researched (Chen 2007; Wan & Chiou 2006; Choi & Kim 2004; Sherry 2004).

Video games and flow theory are a natural fit because video games fit many of the criteria that Csikszentmihalyi states are necessary to induce and maintain a flow state. For instance, video games have concrete goals that are clearly defined within the virtual environment. Video games also provide clear and immediate feedback, which a player can use to dynamically adjust his or her performance towards completing the game's objectives (Sherry 2004).

In addition, video game designers try to ensure that their simulations are well balanced and that the goals of the game are always attainable. This notion of balance then is a personal sense that one's abilities are sufficient to achieve the challenges of given task. Such an awareness of the balance between skill and challenge is perceived as competence (Mitchell 1988) and individuals need to feel competent at a task in order to consider it enjoyable.

At a cognitive level, this balance between skill and challenge can be thought of in terms of a mental model that represents a person's understanding of some aspect of reality (Sowa 1984). In terms of video game play, skill is the degree to which an individual's mental model accurately represents the video game's embedded rules as well as the gameplay mechanics by which the virtual environment is manipulated (Weber et. al 2009). The acquisition of such models, therefore, is necessary to successfully manipulate the virtual environment and play the game.

The acquisition of mental models has also been shown to positively impact business operations. For example, research has linked the acquisition of shared mental models to improved team performance (Mathieu et. al 2000). Additional research has shown that the development of mental models, which accurately reflect the business environment, are a prerequisite of successful entrepreneurship (Hill & Levenhagen 1995).

In order to aid with the acquisition of the requisite mental models, modern video games are designed with features to help individuals learn the skills necessary to succeed in the virtual environment (Gee 2007; Shaffer 2006). Such features support the continued development of game-related skills at the lower levels in order to ensure that increased game difficulty at later levels is met with an improved player skill set. As Weber et. al note, this combination of increasing game difficulty, sufficiently matched to the gradual acquisition of the requisite mental models, offers an experience in which the challenge of the virtual environment is continually matched to the individual’s current skill level. As noted above, this type of situation is ideally suited for the creation and maintenance of a flow state.

Researchers began to apply flow theory to videogame play in earnest in the early 2000s (Bowman & Boyan 2008). Building off of early research, flow-related experiences have been directly studied in observational
settings using game consoles (Bowman & Sherry 2006; Mandryk et. al. 2006) as well as online gameplay (Rheinberg & Vollmeyer 2003; Weibel et. al 2007). In 2000, the cognitive absorption model was developed as a way to link the Technology Acceptance Model (Davis 1989; Davis et al. 1989) with enjoyment and flow theory (Agarwal & Karahanna 2000). However, research has not yet sufficiently linked actual business objectives to video game design as it relates to flow theory. Yet, the combination of video game design principles and flow theory has the potential to revolutionize software model and user interface design for standard business work processes.

Consider any standard business workflow and it is likely that it can be significantly improved by using established video game design principles optimized to move the user toward a flow-like experience. Take, for example, simple (but repetitive) data entry tasks which companies often pay temporary workers by the hour to complete. Now, imagine that same data entry task, optimized using established video game design principles, such that an employee could enter transactional data into groups by matching similar account numbers together so that as more transactions are matched, the employee earns additional “points”, leading to successive levels. Like all good game design, the points and levels do not have to translate to a substantive reward for the employee, they just need to help bolster employee engagement for the task at hand. The accumulation of the points and progression through successive levels is often sufficient motivation to induce the behavior (Werbach & Hunter 2012).

**Research Model**

**Assumptions**

The underlying assumption of this paper is that the intrinsic motivation of why people play video games can be described in terms of flow theory. As has been demonstrated, video games satisfy many of the criteria, which Csikszentmihalyi has stated in his research are necessary for the creation and maintenance of a flow state of consciousness.

Furthermore, it is a basic assumption of this research that individuals want to work and be productive. This assumption is supported by Csikszentmihalyi’s own findings, which found that the individuals he studied had an increased likelihood of a flow experience when they were productive at work than when they had excess leisure time at home (Csikszentmihalyi 1990). Figure 1 from Csikszentmihalyi’s 1997 book *Finding Flow* is illustrative of this finding.
Research Questions

The purpose of this research is to answer questions about optimizing the work experience in a simulated environment for purposes of maximizing worker engagement (flow) and productivity. Therefore, the pertinent research question to be answered is:

*Under what circumstances can a flow-like experience be induced and maintained while performing business-related tasks in a simulated environment?*

Variables and Proposed Relationships

In order to answer that question, it is necessary to manipulate three variables, which arise from Csikszentmihalyi’s original research on flow theory. He proposed that there must be three conditions present for a flow state to occur and be maintained. Those three conditions are: (1) There must be a clear set of goals and progress, (2) The task must have clear and immediate feedback, and (3) there must be a good balance between the perceived challenges of the task and one’s perceived ability to complete the task (Csikszentmihalyi 1990).

Therefore, if the dependent variable is the length of time that the participant experiences a flow-like state while performing business related tasks in a simulated environment, then the three variables that need to be manipulated are as follows:

- **IV1 - The perceived clarity of what is required to complete the task at hand**
- **IV2 - The perceived level of feedback given to the individual regarding his or her progress towards completing the task at hand**
- **IV3 - The perceived attainability of performing the task at hand**

Figure 2 shows a graphical representation of the proposed relationships that the independent variables have towards the dependent variable.

![Conceptual Model of Variables and Proposed Relationships](image-url)
The perceived clarity of the task should show a positive relationship to the length of time that the subject experiences a flow state while performing a task in the simulated environment.

**Proposition 1:** As the perceived clarity of the task to be performed in the simulated environment increases, the length of time that the individual experiences a flow state will increase.

The perceived level of feedback that is given to the participant regarding his or her progress towards completing a task should show a positive relationship to the length of time that the subject experiences a flow state while performing that task in the simulated environment.

**Proposition 2:** As the system provides greater feedback to the user during the performance of a simulated task, the length of time that the individual experiences a flow state will increase.

The perceived attainability of the task at hand should show a positive relationship to the length of time that the subject experiences a flow state while performing that task in the simulated environment.

**Proposition 3:** As the perceived attainability of the task to be performed in the simulated environment increases, the length of time that the subject experiences a flow state will increase.

**Method**

A pre-test will be administered in which participants use the test environment in order to determine the optimal values for each of the three independent variables listed above.

The main research study will consist of an experimental design using a 2x3 factorial matrix in which the degree of task clarity, system feedback, and task attainability will be varied between low and high levels. Each cell will require twenty-five participants; therefore, a total of 150 participants will be needed. The researchers chose undergraduate students in business classes at a large state-funded university in the southeastern United States. In addition to the inherent convenience, students are deemed an acceptable population group for this study because many of them will be entering the business world in a few short years and will often find themselves engaged in workflow-type tasks. Furthermore, more than any other generation, students who are of university age have been raised on visual media and are therefore accustomed to viewing tasks in that way.

Participants will be presented with a common business workflow problem whereby they will tasked with sorting objects in a virtualized environment according to predefined rules. In accordance with the literature cited above, the task will become gradually more difficult as the participants acquire the mental models necessary to accurately manipulate the environment and complete the task.

In order to test the propositions above, the clarity of the task will be manipulated by varying the instruction set associated with the task. The feedback that the system provides will be manipulated by incorporating pleasant visual and auditory feedback when an object is correctly sorted and unpleasant visual and auditory feedback when the object is incorrectly sorted. The attainability of the task will be manipulated by varying the time constraint in which the participant must complete the task.

During the study, the subjects’ level of attentiveness to the screen will be monitored via cameras embedded into the computer systems. After the subjects have completed the tasks, the researchers will review the videos and use a coding process to record the apparent engagement level during each task. At the conclusion of each participant’s session, he or she will be administered a brief survey designed to assess their subjective view of their experience.

**Discussion**

The connection between the immersiveness of video games and flow theory has been well researched. What is less well researched, however, is whether actual business tasks that are performed within a simulated
environment can lead to a sustained flow experience. If the study demonstrates that simple business tasks can be accomplished with more engagement by optimizing the length of time in a flow state, then the possibility for more similar results in more complex business processes can be studied.

References:


