1 Introduction and Related Work

1.1 Describing the Flow State

This chapter gives a brief introduction to the topic of flow, as well as related fields of work. The following chapters will answer the questions asked for this exam.

The front-runner of *flow* is Mihaly Csikszentmihalyi, an Hungarian professor of psychology, who's work includes studies of happiness and creativity. He describes flow as an optimal experience, where one is in a state of control and balance: *"When the information that keeps coming into awareness is congruent with goals, psychic energy flows effortlessly."* [Csikszentmihalyi, 2008] He describes optimal experiences as *"[s]ituations in which attention can be freely invested to achieve a person's goals, because there is no disorder to straighten out, no threat for the self to defend against."* [Csikszentmihalyi, 2008] Flow is very much connected to challenge and skills. It can be compared to the challenge of climbing a mountain: each time a rock climber overcomes a great challenge, he is left as a more capable and skilful person [Csikszentmihalyi, 2008]. While climbing the mountain, he is in a state of flow — there is a perfect balance of what he is capable of and what is demanded of him. In other words, the difficulty of climbing the mountain fits the climber, so that it is neither too easy nor too hard. Figure 1.1 shows the *flow model*, which is often used when designing videogames. One should be challenged enough to not become bored. Likewise, the challenge cannot be too great compared to one's skill sets, since this will result in anxiety. In practice, one would fluctuate between these two states, but only touching them tangentially.

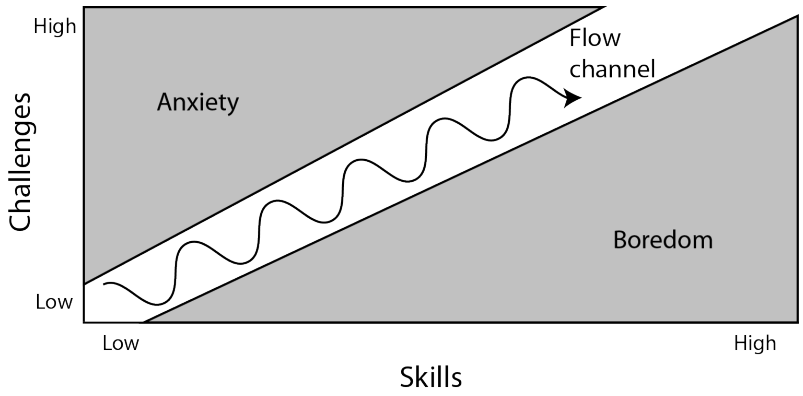

Figure 1.1. The flow state can be described as a balance between challenge and skills [Schell, 2008].

Csikszentmihalyi [2008] has found that people report extreme joy (sometimes described as "a feeling of ecstasy") in many different types of contexts. What has been found to be a common element of all those activities is that they are goal-directed and bounded by rules. They are challenging activities that can not be done without the appropriate skills [Csikszentmihalyi, 2008]. Additionally, they are situations with clear and immediate

feedback, say, a tennis match or a game of chess. With each action, it is clear whether or not one gets closer to accomplish one's goal(s). Furthermore, the experience of enjoying the flow state often occurs in activities outside ordinary life, e.g., games and sports. Flow has been described as *"[l]acking the sense of worry about losing control that is typical in many situations of normal life."* [Csikszentmihalyi, 2008]. It's a sensation where one often loses self-consciousness and the sense of time and place.

A key element in experiencing flow is that the activity has an end in itself. This is described as an *autotelic experience*, which means that doing something is an reward in itself. In other words, an activity should be intrinsically rewarding, where one doesn't expect external rewards, such as money or recognition by peers. Many things in life yield extrinsic rewards, i.e., we perform activities because we *have* to, not because we *want* to (e.g., having a boring day-job in order to earn money to live). *"[I]ntrinsic motivations are not necessarily externally rewarded or supported, but nonetheless they can sustain passions, creativity, and sustained efforts."* [SelfDeterminationTheory.org]

1.2 Characteristics of Flow State

Csikszentmihalyi and Nakamura [2002] describe two main conditions for entering the flow state: *perceived challenges that stretch, but don't overmatch, existing skills* and *clear goals coupled with immediate feedback about the progress being made.* Furthermore, flow is a subjective state that is said to have the following characteristics: [Csikszentmihalyi and Nakamura, 2002]

1. Intense and focused concentration on the present moment
2. Merging of action and awareness
3. Loss of reflective self-consciousness (i.e., loss of awareness of oneself as a social actor)
4. A sense that one can control one's actions; that is, a sense that one can in principle deal with the situation because one knows how to respond to whatever happens next
5. Distortion of temporal experience (typically, a sense that time has passed faster than normal)
6. Experience of the activity as intrinsically rewarding, such that often the end goal is just an excuse for the process

1.3 Methods to Measure Flow

When a person is in flow, he operates at full capacity. This state has been reported accross cultures, gender and age [Csikszentmihalyi and Nakamura, 2002]. Before the 2000's, subjective experiences (such as flow) were viewed as falling outside the sphere of scientific research. After the flow model was introduced, several self-report tools have been developed to measure flow. These include semi-structured interviews, providing a holistic account of the flow experience; and questionnaires, asking participants whether they have had any flow experience and during what contexts (e.g., "I get involved" and "I get direct clues as to how well I am doing"). Multiple scale systems have since then been developed, such as the *Dispositional Flow Scale*, *Flow State Scale* and *Experience Sampling Method* [Csikszentmihalyi and Nakamura, 2002]. Whereas the first two consist of rating scale where participants have to retrospectively reconstruct and respond on past

experiences, ESM allows for getting direct feedback by letting participants carry paging devices on them. At randomly-chosen intervals they are asked to rate their current activity, giving a clearer picture of their flow state [Csikszentmihalyi and Nakamura, 2002].

The problem with ESM is that it risks interrupting the flow experience. That is why triangulation is needed. Several researchers are looking into ways of how to identify the flow state by looking at behavioural and/or physiological markers. Research suggests that enjoyment and involvement can be associated with significantly lower salivary cortisol levlels, implying lower stress levels and low blood pressure [Csikszentmihalyi and Nakamura, 2002].

Csikszentmihalyi and Nakamura [2002] find many areas promising for future research in regards to flow. E.g., neuropsychology; the nature of the attentional processes that foster flow; technology and the use of multi-tasking; autotelic personalities; addiction; and the use of flow in social environments. Furthermore, according to SelfDeterminationTheory.org, topics such as human needs, intrinsic motivation, psychological well-being, etc., can be applied to a range of fields, including education; healthcare; relationships; psychotherapy; psychopathology; organizations; sports and exercise; goals; health and well-being; and the environment. The Self-Determination Theory is a broad framework that studies human motivation and personality. It includes meta-theories for framing motivational studies, as well as formal theories on intrinsic and extrinsic motivation, in relation to cognitive and social development. It also focus on social and cultural factors [SelfDeterminationTheory.org].

2 Body of Argument

2.1 Intrinsic Motivation Inventory

For this exam, the following question has been chosen to examine:

> Question 6: Flow State and Intrinsic Motivation Inventory Questionnaires
> Design a set of questions based on Flow State and Intrinsic Motivation Inventory Questionnaires for your project/larger project as discussed in Lecture 8.
> Discuss the potential cross-overs of the two systems with the items you have chosen, the rationales behind the chosen items and the process for customization of the items to address the identified queries for your own project. Implement and/or design an experimental future set up for your project where you would implement these questionnaires and discuss expected/actual outcomes.

For this task, a paper entitled *Intrinsic Motivation Inventory (IMI)* has been provided. It's a multidimensional measurement device that can be used to assess participants' subjective experience related to a target activity in laboratory experiments [SelfDeterminationTheory.org, Unknow Year]. The paper will form the basis for the questionnaires that will be formulated in regards to our group's project.

According to Markland and Hardy [1997], the intrinsic motivation inventory has gained widespread acceptance as a way to measure intrinsic motivation in the context of sport and exercise. It determines an individual's level of intrinsic motivation as an additive function of a set of underlying dimensions. It assesses participants' *interest/enjoyment*, *perceived competence*, *effort*, *value/usefulness*, *felt pressure and tension* and *perceived choice*, while performing a given activity. The interest/enjoyment subscale is deemed to be the most important, since it deals directly with intrinsic motivation [SelfDeterminationTheory.org, Unknow Year].

The IMI model consists of a big number of questions; however, the full set is rarely used, and it seems that inclusion/exclusion of any one factor does not affect the properties of the remaining factors [Markland and Hardy, 1997]. They can easily be modified to suit a specific activity [SelfDeterminationTheory.org, Unknow Year]. E.g., an item such as "I tried very hard to do well at this activity" can be modified to a specific context, for instance a videogame, where it is replaced with "I tried very hard to do well on these puzzles in level 2".

2.2 Designing Questionnaire For Extended Project

For the extended project, a questionnaire was designed in order to gather information about the test participant's experience with the prototype developed during the course (see Figure 2.1). The prototype consisted of a simple platforming game based around three different modalities: eye-tracking, accelerometer, posture/voice analysis.

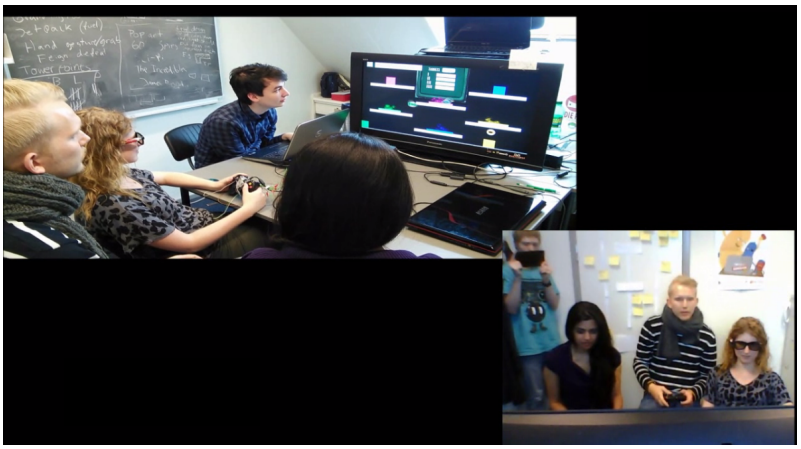

Figure 2.1. Test participants played the prototype with extended modalities.

Since it was a multiplayer game, one key area to explore was how participants felt in relation to each other. The social aspect was important, as well as players feeling engaged with the game, i.e., being in a flow-like state. Therefore, a set of questions were designed to gain insights in the participants experience with the game. These have been based on SelfDeterminationTheory.org [Unknow Year], although with slight modifications.

2.2.1 Questions Related to Flow

For each question, participants were asked to rate themselves on a scale from 1 to 5, where 1 was "strongly disagree" and 5 was "strongly agree". For the sake of readability, the questions have here been ordered by the characteristics mentioned in Section 1.2. In the actual questionnaire, they were ordered randomly and without the headlines as shown in bold. Afterwards, a short description for each of the questions will be made.

1. **Intense and focused concentration on the present moment**
    a) It was no effort to keep my mind on what was happening
    b) I was completely focused on the task at hand
2. **Merging of action and awareness**
    a) I did things spontaneously and automatically without having to think
3. **Loss of reflective self-consciousness**
    a) I was not concerned with how others may have been evaluating me
4. **A sense that one can control one's actions**
    a) My abilities matched the high challenge of the mission
    b) I knew clearly what I wanted to do
    c) It was really clear to me how my performance was going
    d) I had a strong sense of what I wanted to do

5. **Distortion of temporal experience**
    a) Time seemed to pass away very quickly
6. **Experience of the activity as intrinsically rewarding**
    a) I loved the feeling of the mission and want to capture it again
    b) I found the experience extremely rewarding

For the first category about focus and concentration, it was chosen not to have too many questions, since it was deemed unrealistic to achieve an intense focus when testing the prototype. This was because of the state of the game, together with the additional modalities, being a mix of a rough prototype and a simple Wizard of Oz [Rogers et al., 2011]. There were a lot of minor nuisance factors (such as participants having to wear sunglasses in order to simulate an eye-tracking system), which made it hard to concentrate fully on the game. Also, due to an accelerometer and Arduino board being taped to the participants' game controllers, movement were restricted because of short cords.

The second category set out to investigate to what extend participants acted without thinking. However, due to the nature of the prototype, a lot of elements weren't made totally clear, which meant that a facilitator had to instruct and/or help participants.

For the third category, loss of reflective self-consciousness, it was important to examine how concerned the participants were with each other. Since multiplayer games emphasize social interactions, this was an important question to ask. However, it is not enough just to get a rating, since it doesn't say anything about whether being concerned is a positive or negative thing. Some might like the attention of their peers, while others might not. Therefore, a comment field was introduced, so participants could give details on this question.

As mentioned several times, flow is about finding the balance between challenge and skills. This is why the fourth category multiple questions to examine this area. Additionally, it is important that the participants' goals were well-defined. Feedback should also be immediate and clear.

For the fifth category, one question was asked to gain insights on if participants felt that they lost their notion of time. However, since each test session lasted for less than 10 minutes, not a lot of effort was put into this category.

For the last category, two questions were asked about intrinsic motivation. It should be noted that the test participants didn't voluntarily ask to take part in the test. Instead, they might have felt a minor pressure to participate. This can have had an influence in their intrinsic motivation.

Bibliography

Csikszentmihalyi, **2008**. Mihaly Csikszentmihalyi. *Flow: The Psychology of Optimal Experience*. ISBN: 0061339202. Harper Perennial Modern Classics, first edition, 2008.

Csikszentmihalyi and Nakamura, **2002**. Mihaly Csikszentmihalyi and Jeanne Nakamura. *Handbook of Positive Psychology*. ISBN: 9780198030942. Oxford University Press, 2002.

Markland and Hardy, **1997**. David Markland and Lew Hardy. *On the factorial and construct validity of the Intrinsic Motivation Inventory: conceptual and operational concerns*. Research quarterly for exercise and sport, 68, 20–32, 1997.

Rogers et al., **2011**. Yvonne Rogers, Helen Sharp and Jenny Preece. *Interaction Design: Beyond Human-Computer Interaction*. 0470665769. John Wiley and Sons, third edition, 2011.

Schell, **2008**. Jesse Schell. *The Art of Game Design: A book of lenses*. ISBN: 0123694965. CRC Press, first edition, 2008.

SelfDeterminationTheory.org, **Unknow Year**. SelfDeterminationTheory.org. *Intrinsic Motivation Inventory (IMI)*. Unknow Year.

SelfDeterminationTheory.org. SelfDeterminationTheory.org. *Self-Determination Theory*. URL `http://www.selfdeterminationtheory.org/`.