MSP Exam Mini Paper: Flow and Intrinsic Motivation Inventory

Gustav Dahl, Study nr. 20113263

ABSTRACT

Flow is a an optimal state humans can achieve. It gives a sense of ecstasy, where one has intense focus on the present moment and loses sense of time and self-consciousness. To obtain this state, an activity must fulfil a set of requirements to give the best experience possible. There should be a fine balance between the participant's skills and the difficulty of the activity. Furthermore, goals and feedback should be immediate and clear. By using a set of questions, it is possible to measure flow. For this mini paper, eight test participants played a simple platforming game. Afterwards, they were presented with a questionnaire to examine their state of flow and intrinsic motivation. Due to the limited test sample, it is difficult to make any proper conclusions. One interesting aspect for future work is to analyze how flow can be scaled in a multiplayer game context where human opponents gradually increase their skill sets. Since players don't develop at the same rate, this can introduce unbalances that needs to be accounted for in the gameplay in order to obtain the flow state.

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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, whose 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 explains 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] Being in flow is explained as being *"completely involved, focused, concentrating."* It's a *"sense of ecstasy, of being outside everyday reality"* with *"no worries about self."* [Morrison, 2014]

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.

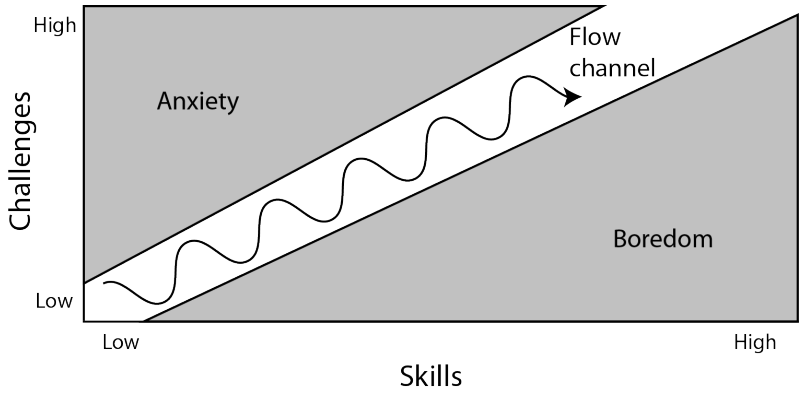

Figure 1.1. The flow state can be described as a balance between challenge and skills [Schell, 2008].

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 the 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 across cultures, genders and ages [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 levels, 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 focuses 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 my group's extended 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.

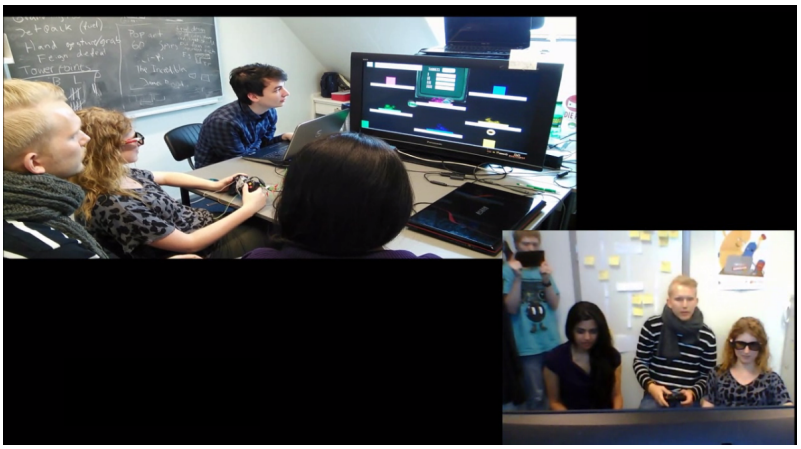

Figure 2.1. Three test participants playing the prototype with extended modalities.

Since it was a multiplayer game, one key area to explore is how participants felt in relation to each other. The social aspect is 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 into 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 (loss of awareness of oneself as a social actor)**
    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
   e) My goals were clearly defined
   f) The challenge and skills among other players were at an equally high level
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 while testing the prototype. This was due to the state of the game (together with the additional modalities) being a mix of a rough prototype and a simple Wizard of Oz setup [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 strapped 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 text field was included, so participants could give details on this question as additional comments.

As mentioned several times, flow is about finding the balance between challenge and skills. This is why the fourth category includes 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. Also, this area will be examined further in the following questions concerning intrinsic motivation. In general, it was decided not to make the questions about flow and IMI overlap too much, since it was deemed more important to have few, but significant, separate questions to cover the biggest area possible.

2.2.2 Questions Related to Intrinsic Motivation

For the IMI part, a selection of questions were asked. These have been inspired by [SelfDeterminationTheory.org, Unknow Year]. Again, participants rated themselves on a scale from 1 to 5, where 1 was "strongly disagree" and 5 was "strongly agree". Like with the flow questions, they have been organized here by their overall topics (written in bold).

1. **Interest/Enjoyment**
    a) I thought this was a very interesting activity
2. **Perceived Competence**
    a) I think I did pretty well at this activity, compared to other players
    b) After working at this activity for awhile, I felt pretty competent
    c) This was an activity that I couldn't do very well
3. **Effort/Importance**
    a) I put a lot of effort into this
4. **Pressure/Tension**
    a) I felt more close to the other players after playing the game
    b) I felt pressured while doing the activities
    c) I did not feel at all nervous about interacting with other players
5. **Perceived Choice**
    a) I felt like I had choice about interacting with other players
    b) I felt like it was not my own choice to do the activities
6. **Value/Usefulness**
    a) I believe this activity could be of some value to me
7. **Relatedness**
    a) I trusted people less after playing the game
    b) I'd like a chance to interact with the other players more often

These questions are a little more varied, with the goal of examining the test participants' overall experience with playing the game. Compared to the previous flow-related questions that focused on one's personal experience (looking inwards), the IMI questions emphasize player-to-player interaction (looking outwards). Since the context is a multiplayer game, it was important to investigate how the players feel about each other. Despite it being a competitive game where the goal is to beat the other players, it's also a social game where people, hopefully, bond with each other and feel more connected after playing. This is why the questions ask players about topics such as *interacting with other players*, *feeling more close after playing the game* and *trusting players less after playing the game*. The last question was asked, since for the full project (that was going to be developed after this prototype), the game would be based on deceptive mechanics similar to bluffing in the game of poker.

3 Data Collection

For the extended project, eight participants tested the prototype (five males, three females; average age 23). It should be noted that it was considered as an early test, since it was still in a very early stage of development.

Figures 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9 show the results from the tests. Since the tests also included other elements in the questionnaire (such as collecting data on demographics, emotions, as well as specific questions about the gameplay), not all of the questions mentioned in Section 2.2 have been included. Otherwise, the questionnaire would be too long, with the risk of participants growing tired and not taking the questions seriously.

The scale was shown as follows:

- 1 = Strongly disagree
- 2 = Disagree
- 3 = Neither agree nor disagree
- 4 = Agree
- 5 = Strongly agree

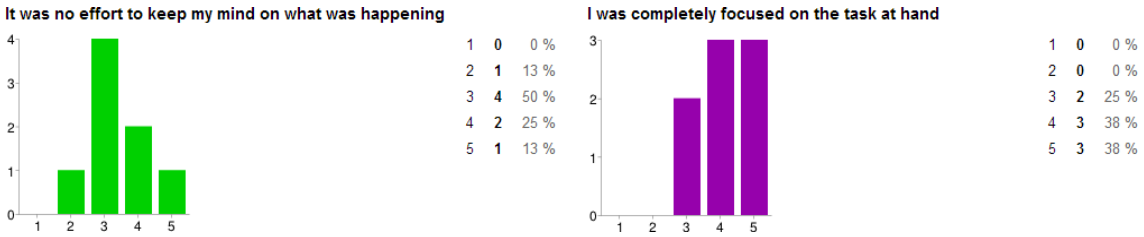

Figure 3.1. Flow results.

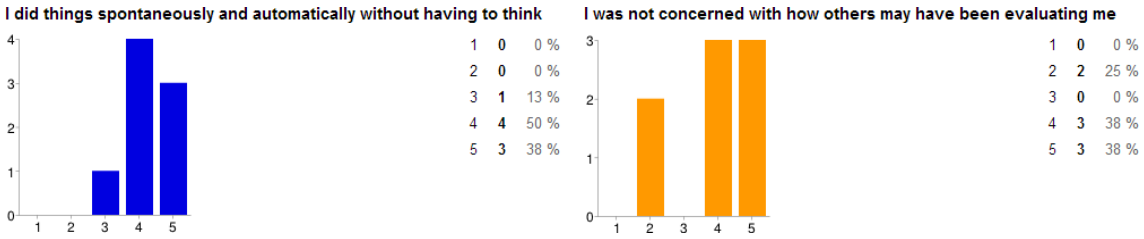

Figure 3.2. Flow results.

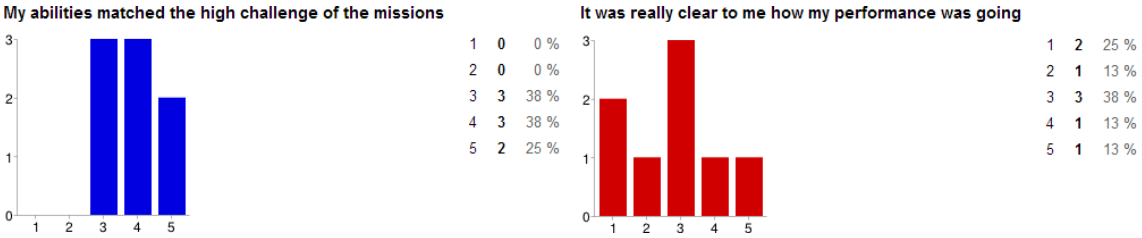

Figure 3.3. Flow results.

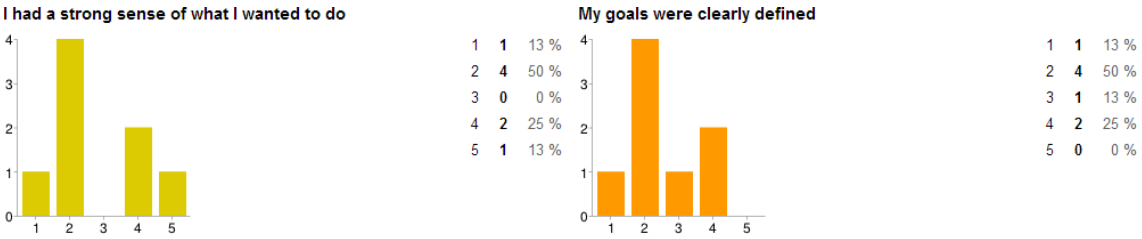

Figure 3.4. Flow results.

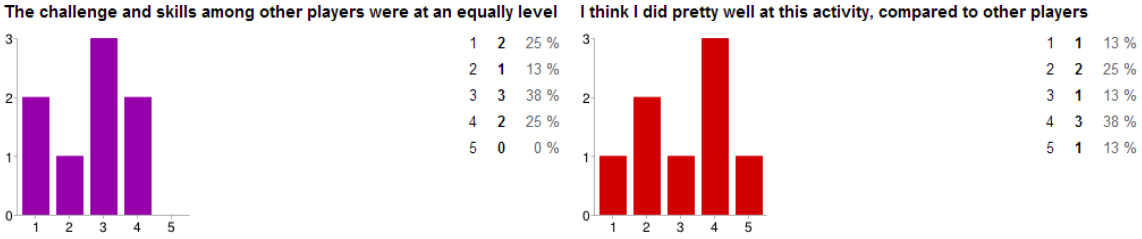

Figure 3.5. Flow and IMI results.

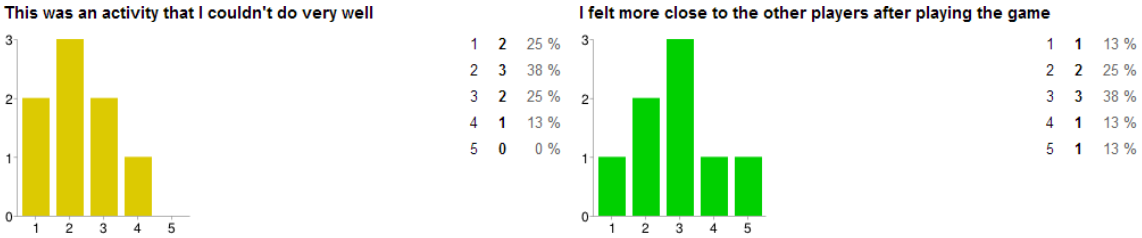

Figure 3.6. IMI results.

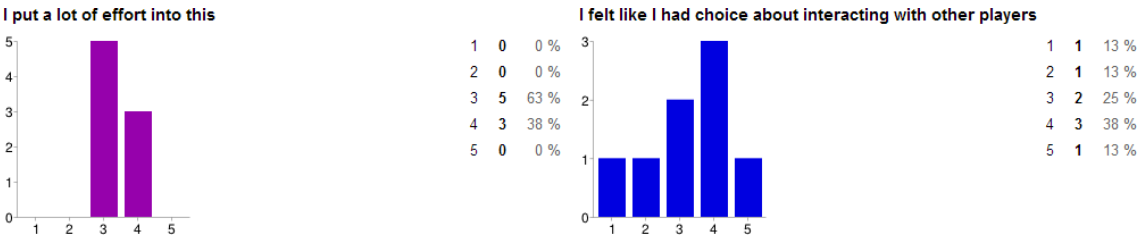

Figure 3.7. IMI results.

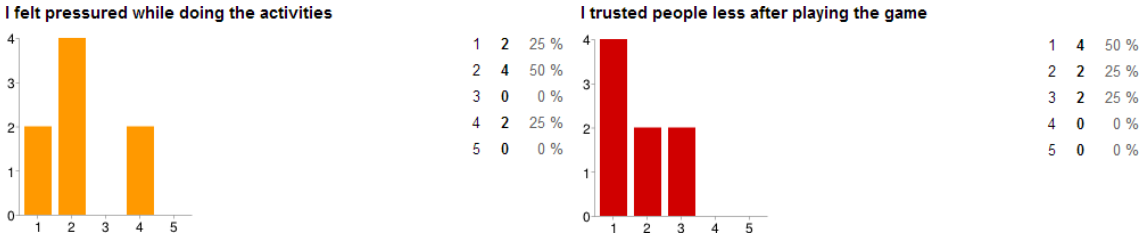

Figure 3.8. IMI results.

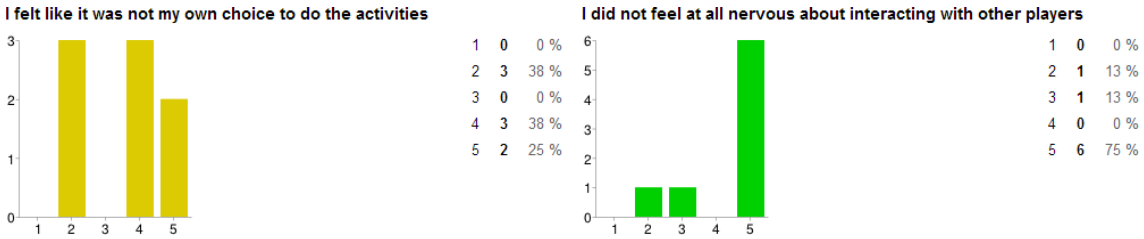

Figure 3.9. IMI results.

4 Analysis and Findings

To be able to analyze and conclude on any data statistically, one needs a larger sample size than what was achieved in this small test. A test is considered large when it has 30 or more samples [Crawley, 2005]. Since the test here only consisted of eight participants, it might be difficult to make any proper conclusions. However, I've chosen to look at some general tendencies, based on the data from the test. This will only look at data related to the flow and IMI models.

When looking at the flow-related data, it seems that participants had a decent amount of focus on the game. This is the first requirement to achieve the flow state, so it's important that participants felt present and focused on what they were doing. Overall, they graded themselves high on the statements *I was completely focused on the task at hand* and *I did things spontaneously and automatically without having to think.* However, they graded themselves on average on the *It was no effort to keep my mind on what was happening statement.* This might indicate that some things could be improved to obtain proper focus on the game.

Another important aspect is that participants lost their reflective self-consciousness, i.e., that they loss their awareness as being social actors. According to the *I was not concerned with how others may have been evaluating me* statement, this was a success, since most of the participants graded themselves high on this.

For the next statements that cover the aspect of feeling in control and feeling that one's skills match the given challenges, it seems that things could be improved upon. This is most likely due to the state of the prototype and its lack of feedback in certain areas. This was expected, since many of the elements worked using the Wizard of Oz method, where things in general feel slower and less responsive compared to a fully-fledged product. This made it particular difficult for participants to achieve any kind of flow-like state.

Due to the low amount of actual questions asked in the questionnaire about Intrinsic Motivation Inventory, it is hard to spot any significant tendencies. In general, participants responded very differently, often using the whole scale from 1 to 5, which could potentially mean that some of the questions were either confusing or didn't fit the game prototype very well. Some of the questions might have been too vague, especially when considering the early state of the prototype.

In general, it appears that participants didn't feel pressured or nervous. Also, it seems that the game didn't have an influence of how much/little participants trusted each other. This was to expect, since none of the deceptive game mechanics had yet to be put into the prototype.

Additionally, when asked to describe their experience with the game, participants responded with words such as *fun*, *challenging*, *hectic*, *immersive*, *social*, *active*, *creative*, *engaging* and *exciting.*

5 Conclusion, Discussion and Future Development

The concept of "being in flow" is quite interesting and something designers can potentially strive for by making use of intrinsic rewards, as well as aiming to implement systems that strive to fulfil the characteristics mentioned in Section 1.2. That being said, flow is a subjective feeling that can be hard to measure. It requires a lot of time and effort to achieve, as well as measuring, flow.

It was expected that it would be difficult to measure any kind of flow state in the span of the short prototype tested on the eight participants. There was simply not enough time to get any indications of participants feeling flow.

That being said, it would be interesting to how much additional time and effort would be needed for the participants to feel flow. For this to happen, it seems arguable that the prototype/game would need a lot more depth in its gameplay to obtain/maintain any kind of flow. An important element to consider is the difficulty of the gameplay: it has to scale with the players' abilities. Over time, people would become better at the game, meaning that they would gradually require greater challenges to not become bored. Since the game is in the multiplayer genre, the other players provide the difficulty. It would be interesting to see the development of this, since some players would grow faster than others. This would potentially create unbalance, where players are significantly better/worse than their opponents. One could imagine that the game would need additional systems to maintaning the balance between the players, e.g., by providing by providing handicapping compensations/advantages, in order for all players to feel equally engaged and challenged. More research is needed to examine how this would affect players' flow states.

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