paSSPORT
Suggestion System for Players basen On peRsonaliTy

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Abstract

As the gaming industry develops, competition has become a today's reality for most game developers and publishers. New ways to attract players and improve their gaming experience are being researched and developed, one of them being the adaptation of game content during gameplay. This adaptation is often based on player behavior or on player's personality. In this work our objective is to improve the players gaming experience by helping him make decisions within the game. To make this possible, a game was created featuring a companion that would assist the player whenever he asks. These advices where based on the player's personality using the Conscientiousness dimension and its corresponding facets of the *Five Factor Model*. After the evaluation of our solution we could not conclude that this approach would work for all the spectrum of the Conscientiousness dimension. Most of the subjects evaluated did not ask for a recommendation. However, for the participants that did ask for advice on which quest they should take, we got positive results for people that scored low on this dimension.

Keywords: Player Models, Games, Personality Models, Adaptive Games.

1 Introduction

The gaming industry has grown significantly in the past decade, not only because people all over the world, from all ages and genders, are playing and enjoying games (according with Jane Macgonigal[1] over then a billion worldwide play video games) but also because the industry groups together many different job disciplines and creates many job opportunities all around the world.

1.1 Motivation

According to the Entertainment Software Association (ESA)[2], in the United States, in 2013, 58% of the country population plays video games, where 55% are male and 45% are female[1]. This shows us that, despite more than half of the USA is playing video games, there is still a very large set of people that video games have not yet reached. There may be an interest in the video gaming industry to reach these people, as more people usually means more money, but, how could they reach them? First of all, maybe we should ask ourselves why do people play games. Csikszentmihalyi[[5] proposed a new concept that he called Flow. Flow is a state that happens when a person is in complete focus in an

activity that comes with a high level of enjoyment and fulfillment. Csikszentmihalyi developed many theories on how to get people in their Flow state, but the most inspiring of them all is perhaps his definition of the Flow Zone, which not only can be applied to video games but to all sorts of activities that a human being can enjoy, being that work or hobby.

Currently the gaming industry is also progressively looking more into player models. An example is the game WildStar[3], developed by Carbine Studios, where the player, aside from the class and race of his character, also needs to choose a path in which his character will be more rewarded for completing certain quests. For example, if the player chooses the path of a warrior he will get specific quests that will be in accordance with that path. This may not seem very different from what the player chooses in games like World of Warcraft[4], but in WildStar they clearly stated that they have taken player models into account while designing this player paths. This show us that the industry is taking in account that there are many different players and they enjoy games in different ways from each other. By looking into players personality games can try to adjust

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[1]http://www.ted.com/conversations/44/we_spend_3_billion_hours_a_wee.html
[2]http://www.theesa.com/
[3]http://www.wildstar-online.com/uk/
[4]http://us.battle.net/wow/en/

themselves into players' needs making the experience more enjoyable.

1.2 Problem Description

The main objective of this work will be, therefore, to create a system that can aid players to choose the best options in games like WOW, so that they can have the best experience possible. The goal of this work will be to try to maximize players enjoyment and help gamers not fill so overwhelmed by all the choices they can make. We, therefore, aim to provide a better gaming experience for the overall of players.

With the above in mind, we will create a RPG genre game were the player will need to make certain decisions. In this case the player will need to choose which quests to take in order to have the best recommendation possible for the guild that will guide his future to later join the army. To help him with his decisions, a companion was created. This companion would only give advice if asked to. For this, we designed seven quest that the player would need to choose, where he could only pick a maximum of three. With this work we wish to improve the player's experience during gameplay.

By choosing the quests that the player thinks he would like the most and by following the recommendations of the companion when he feels that he needs help in his decision, we expect to boost the gaming experience of each individual player.

In the next section we will be focused on related work, on section three we will discuss our solution for improving the players enjoyment in more detail and on section four we will discuss the results of this experiment. The final section is reserved for conclusions.

2 Related Work

2.1 Flow in games

Normally there are eight elements in flow, according to Csikszentmihalyi's research[5]. These elements are challenge, an activity must require skill, action and awareness, that need to be merged, goals, which need to be clear, feedback, focus, the player needs to focus on the task at hand, a sense of control, loss of self-consciousness and the transformation of time. It is important to also notice that not all of these components are necessarily needed for someone to experience flow at least some of them should be present.

In his thesis, Chen[3] proposed a design methodology to maximize flow in games during the process of game design. Developers can expand the game Flow coverage by including a wide spectrum of gameplay with different difficulties and flavors, they also can create a player oriented active dynamic difficulty adjustment (DDA) system that would allow different players to play on their own pace, or they can also embed those DDA choices into the core of the gameplay mechanics and let the player make their own decisions throughout the game.

Sweetser and Wyeth[6] proposed a new concept to evaluate flow in games. They called it the Game-Flow criteria that consist in eight different elements, concentration, challenge, skills, control, clear goals, feedback, immersion, and social interaction.

Although this GameFlow criteria can give us a prediction in how games will perform, Sweeter and Wyeth concluded that some of those criteria are very difficult to measure through an expert review, being only possible with play-testing with players of various skills and would need to be observed in order to determine if they were really immerse in the experience or not. In this form, the GameFlow criteria could be used as a guide for an expert review or as the basis for constructing a good play-testing session.

We can conclude that flow is a very important factor in understanding why we play games as its primary goal is to entertain through motivation which can be directly related to the definition of flow itself.

2.2 Player Models

Player modeling is the study of computational models, being its primary goal to understand how each individual player experiences interaction with a game. Has we have seen, the diversity of the masses are a big problem for game developers. As each individual has his own taste, engaging all the different players can prove to be quite a challenge.

2.2.1 Four Bartle Types

The Four Bartle Types model is based on the observation and analysis of people's behavior during gameplay. This model defends that there are four different types of player: killers, achievers, explorers and socializers. The killers tend to like to compete themselves with other players and prefer fighting them compared with fighting non-controllable characters (NPCs). Achiever players like to gain "points", level up, get better equipment or other concrete measurement of success present in the game. Explorers like to, as the name suggests, explore the game world, discover new areas, create maps and learn about hidden places. Players that fall in the type of the socializer prefer the social aspect of a game, so they like to interact with other players and, in some occasions, NPCs.

2.2.2 The Four Keirsey Temperaments

David Keirsey identified four main temperaments from the Myers-Briggs sixteen types of personality models. The Myers-Briggs types (MBT) are a psychological test made to measure the psychological preferences in how people perceive the world. The four Keirsey temperaments are, therefore, the artisan, the guardian, the rational and the idealist. Much like the previous model, Keirsey temperaments can be mapped in a four quadrant graph.

2.2.3 The Big Five Factor Model

The Five Factor Model is a theory that divides a person personality in five dimensions or traits. These five traits are Openness to Experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism. This dimensions, also known as the O.C.E.A.N., that do not overlap and seem to be found through a wide range of participants of different ages and culture. Each of those traits are divided into six different facets, that are specific and unique aspects of the broader personality trait. Openness to experience distinguishes creative intellectual people from realistic pragmatic ones. Conscientious people have a tendency to control their impulses, they prefer to plan rather than having a spontaneous behavior. The extraversion trait deals with the desire for external stimulation. Agreeableness deals with cooperation and social harmony. And finally, the neurotic trait reflects how strongly one experiences negative emotions. VandenBerghe[7], a Creative Director out of Ubisoft Montreal, made a correlation between the Big Five motivational factors to game design elements.

Those domains can be used to measure how satisfying games are, what kind of players would enjoy certain games better then others, what parts of the game are not satisfying and what kind of players could start or stop enjoying the game if certain changes would to be made.

Next is a detailed description of the *Conscientiousness* dimension and its corresponding facets, since this will be the only dimension used in this work.

Conscientiousness Conscientiousness concerns the way in which we control, regulate, and direct our impulses. Impulses are not inherently bad. Occasionally, time constraints require a snap decision, and acting on our first impulse can be an effective response. Also, in times of play rather than work, acting spontaneously and impulsively can be fun. Impulsive individuals can be seen by others as colorful, fun-to-be-with, and zany. Individuals who score high on the domain avoid trouble and achieve high levels of success through purposeful planning and persistence. They are also positively regarded by others as intelligent and reliable. On the negative side, they can be compulsive perfectionists and workaholics. Furthermore, extremely conscientious individuals might be regarded as stuffy and boring. Unconscientious people may be criticized for their unreliability, lack of ambition, and failure to stay within the lines, but they will experience many short-lived pleasures and they will never be called stuffy.

- **Self-Efficacy:** describes confidence in ones ability to accomplish things. High scorers believe they have the intelligence (common sense), drive, and self-control necessary for achieving success. Low scorers do not feel effective, and may have a sense that they are not in control of their lives.

- **Orderliness:** This facet reflects the strength of a person's sense of duty and obligation. Those who score high on this scale have a strong sense of moral obligation. Low scorers find contracts, rules, and regulations overly confining. They are likely to be seen as unreliable or even irresponsible.

- **Achievement-Striving:** Individuals who score high on this facet strive hard to achieve excellence. Their drive to be recognized as successful keeps them on track toward their lofty goals. They often have a strong sense of direction in life, but extremely high scores may be too single-minded and obsessed with their work. Low scorers are content to get by with a minimal amount of work, and might be seen by others as lazy.

- **Self-Discipline:** Self-discipline is what many people call will of power and refers to the ability to persist at difficult or unpleasant tasks until they are completed. People who possess high self-discipline are able to overcome reluctance to begin tasks and stay on track despite distractions. Those with low self-discipline procrastinate and show poor follow-through, often failing to complete tasks-even tasks they want very much to complete. 12

- **Cautiousness:** s This facet describes the disposition to think through possibilities before acting. High scorers on the Cautiousness facet take their time when making decisions. Low scorers often say or do first thing that comes to mind without deliberating alternatives and the probable consequences of those alternatives.

We decided to use the NEO-Five Factor Inventory (NEO-FFI) which is a psychological person-

ality inventory with sixty items (twelve per domain) that measure and test the Big Five personality traits of a person. This test was created by Costa and McCrae[4] for people with more than seventeen years old and has been considered by many psychologists to be the best inventory for measuring traits within the Five Factor Model (FFM) of personality[5].

3 Experience

The main goal of this work is to create a system that can help players (specifically players with less gaming experience) to make decisions if they need help. This help would be given in the form of recommendations or suggestions, based on the players' personality. We used the Big Five Factor Model to infer the players personality and recommend the best option for that player in particular.

In this chapter, we introduce a methodology to help designers personalize and improve player's experience. In conjunction with other works, like the one of Capelo[2] for example, that can measure the player's personality within the game instead of making a series of questions prior to playing the game (like we did for this approach), game designers can improve the players overall experience throughout the course of their games.

To support that this system works, we divided the experience into three separate parts:

1. Evaluation of the player personality.

2. Experiencing the game.

3. Getting the final conclusion about the overall experience.

For this propose, we created a game from scratch using RPG Maker VX Ace[6]. RPG Maker is a very useful game engine for the creation of RPG's, as it provides useful tools like, a tile set based map editor, a simple scripting language for scripting events (in Ruby[7]), and a battle editor. It also includes initial pre made tilesets, characters, and events which can be used in the creation of new games. As it is very easy to insert new features to the engine, it is also very easy to include new graphics to the game, making it very accessible to create all sorts of experiences, although the engine is more focused, and therefore more useful, for the creation of 2D RPG games.

3.1 Game Design

In this case we decided to implement a game where a companion (in this case a fairy) would recommend important decisions to the player if he felt somehow lost and therefore felt the need to get some help. Next we will talk about the process of building the game as well as explain some of the decisions we make in the game story in order create a game that would fulfill our needs to achieve our initial objectives. The most important objective for us was to give good suggestions to players, that they would feel that they could always ask for help and that help would be the best suited for them.

3.1.1 Game Story

The game story was of some importance to our work as we did not want players to feel disengaged or not interested in playing our game. The objective of the player would therefore be to take a series of challenges (*quests*) and based on the ones he would choose, a guild would be recommended for whim that would best suit him and that would help him in his training to became a warrior in the princess army.

The game starts by presenting the player his companion, a fairy. In this first dialog, the fairy simply says to him where to go next, without the player asking for any advice, however, our propose is to enable the player to ask for this advice himself if he feel the need for it.

The player can explore his house a bit and then would meet his brother. He tells him that the he will need to choose a guild in which we will enroll to start his training so he can then enrol in the army. The guilds were designed to match each facet of the *Conscientiousness* dimension, except for *Orderliness*, which we explained earlier, was removed because we could not find a proper way to include this facet in the game as it was. After this explanation, the player proceeds to a new area where he will be explained what he needs to do to accomplish his goals.

The player would then arrive to a place where a elder man is standing next to a portal. This man can recommend a guild for him to choose, based on the quest he has accepted. The portal will lead him to a place where he can choose his guild when he feels his ready. This part of the story is not directly related to our solution, as it is more focused on the fairy suggestions for the player, however we decided to include this in the game because we wanted to give the player a sense of purpose for choosing certain quests.

The next area is where he will need to choose three out of seven possible quests. In this area there are seven wells, corresponding to the seven quests that the player can preform. After the brother explains how to enter a quest, the fairy then gives an

[5]http://www.personal.psu.edu/j̃5j/IPIP/
[6]http://www.rpgmakerweb.com/
[7]https://www.ruby-lang.org/

overall of what the player may expect from all the quests.

After this, the game introduction is over and the player will need to choose which quests to accept or choose a guild. Choosing a guild can be done at any time, even if the three quests are not completed. He can also ask the fairy which guild he should choose or which quest he should accept next. The quests recommendation are the main focus on our work, the rest was put there to serve the purpose of the story, despite being related to the player personality as well.

3.1.2 Guilds

The guilds, as said before, were designed to give a purpose to the game story (the player will need to enrol in quests so he can have an idea of what guild to choose, and by the end if he still does not, he can always ask for the elder recommendation that will be based of the quests taken during the game). Therefore the guilds also needed to be somewhat related to the player personality as well. We created a guild for each facet of the *Conscientiousness* dimension in the five factor model.

The next table shows the different guilds available as well as the facets that they correspond and the in game description of each one of them.

GUILD	DESCRIPTION
Arisi	*Self-Efficacy*: "They feel that they are in total control of their lives and that they will always achieve success."
Buiz	*Dutifulness*: "They are very responsible and loyal people."
Kals	*Achievement-Striving*: "They drive to be recognized as successful which keeps them on track toward their high goals."
Ara	*Self-Discipline*: "They are always very focused on their tasks and they always stay on track."
Lort	*Cautiousness*: "They always think before acting. They may take their time to make a decision but when they do, it's always very well thought."

Each of the guild descriptions where based on the facet that they correspond. In the game the fairy could also recommend the best guild for the player. This guild would be chosen by the higher facet score that the player would have on the *Conscientiousness* dimension.

3.1.3 Quests

In our solution we decided that all the facets should be present in at least one of the quests created. Each facet spectrum was divided into three equal parts so it would be easier to identify who scored lower, higher or average in a certain facet. This division was made so we could better categorize a player. Let us see, for example, the *Dutifulness* facet, being x the score of the person in this facet (from 0 to 100):

$$\text{dutifulness}(x) = \begin{cases} 1 & \text{if } x < 33 \\ 2 & \text{if } x < 67 \\ 3 & \text{if } x \geq 67 \end{cases}$$

If a player would get a 1 in the *Dutifulness* facet it would mean that he has a low score in that facet. If he would get a 2, that would mean that he has a average score on that facet. Finally, if he gets a 3, that means that he has a high score on that facet. This equation would be the same for all the facets on the *Conscientiousness* dimension.

Quests were then created with a specific facet in mind. However, we noticed that, after the quest design was finished, in most cases, more facets could be identified within that quest. These other facets may, or may not, be as preponderant as the originally thought facet, so we decided to attribute weights to each one of them on each quest. After calculating how much the player would like to perform each quest, the best one would be recommend for him if that quest had not yet been started. After the player finishes or accepts that quest, the second best quest calculated would be recommended. This recommendation would only be available if the player asks for it, as the objective of this companion is to help players only if they need assistance on where they should go next.

The next table shows us an overview of each quest and which facets are associated with them. The +(*plus*) sign means that facet is more present than the other for that quest and therefore has more weight when we are calculating which quest the player should go next.

QUESTS	FACETS
Quest 1	+ Self-Efficacy + Achievement-Striving Cautiousness
Quest 2	+ Achievement-Striving + Self-Discipline Dutifulness
Quest 3	+ Achievement-Striving + Self-Efficacy Self-Discipline

QUESTS	FACETS
Quest 4	Self-Discipline Dutifulness
Quest 5	Obligation
Quest 6	Self-Efficacy Self-Discipline Cautiousness
Quest 7	+ Cautiousness + Self-Discipline Dutifulness

When the player would approach a well, corresponding to a certain quest, the fairy would give him a brief description of what that quest would be about. Inside each well there were always a quest giver that would explain to the player, with a more detailed report on what the quest would be all about. Only then, the player would accept, or not, the quest.

The next table show us the all the equations used to calculate each score for each quest:

QUESTS	EQUATIONS
Quest 1	$se = \text{self-efficacy}(x)$ $as = \text{achievement-striving}(y)$ $c = \text{cautiousness}(z)$ $Quest1 = \dfrac{(se + as) * 2 + c}{5}$
Quest 2	$as = \text{achievement-striving}(x)$ $sd = \text{self-discipline}(y)$ $d = \text{dutifulness}(z)$ $Quest2 = \dfrac{(as + sd) * 2 + d}{5}$
Quest 3	$as = \text{achievement-striving}(x)$ $se = \text{self-efficacy}(y)$ $sd = \text{Self-Discipline}(z)$ $Quest3 = \dfrac{(as + se) * 2 + sd}{5}$
Quest 4	$se = \text{self-efficacy}(x)$ $d = \text{dutifulness}(y)$ $Quest4 = \dfrac{se + d}{2}$
Quest 5	$d = \text{Dutifulness}(x)$ $Quest5 = \begin{cases} 0 & \text{if } d = 2 \\ 1.5 & \text{if } d \neq 2 \end{cases}$

QUESTS	EQUATIONS
Quest 6	$se = \text{self-efficacy}(x)$ $sd = \text{self-discipline}(y)$ $c = \text{cautiousness}(z)$ $Quest6 = \dfrac{se + sd + c}{3}$
Quest 7	$c = \text{cautiousness}(x)$ $se = \text{self-discipline}(y)$ $d = \text{dutifulness}(z)$ $Quest7 = \dfrac{(c + se) * 2 + d}{5}$

The variable *Quest1* give us the score of the likelihood of the player choosing that quest. We added *se* and *as* and then multiplied by 2 because the *Self-Efficacy* and *Achievement-Striving* facets have more weight in this quest than the *Cautiousness* facet. We also divide the sum of all facets, with their respective weights, and divide them by 5, so we could normalize the final result with the rest of the quests outcome, as not all have the same number, or weights, of facets involved. The same logic was applied in the other equations.

3.2 Elder Recommendation

When the player would feel that he is ready, or after he finishes the three quests, he would head to the area were the elder man is , ask for his guild recommendation and step through the portal to choose the guild he thinks he would like the most. The elder recommendation is given by taking into account what quests the player accepted and what quests he has completed and what facets those quests correspond to. The higher facet value would then be translated to the corresponding guild and that would be the recommendation. The player can step into the portal that would take him to an island where he could choose the guild he thinks he would like the most.

4 Results

The data was collect in a period of one week, where a link to the experience was provided trough social networks (mainly Facebook). We had a total of one hundred and seventy one participants enrolled for this experiment, however only thirty eight answered the forms about individual quests and from those, only thirty one finished the experience completely. However we used the data from the two batches, even if they did not complete the experience until the end, as we considered that their answers were also valid and can also be interpreted. The popula-

tion sample was composed of individuals with ages ranging from 19 to 53 years old and with a mean value of 26.52 years old and a standard deviation of 8,918. As said in previous chapters the personality of each person was obtained using a modified version of the complete IPIP NEO-PI form, where only items corresponding to the facets of the *Conscientiousness* dimension were used.

In this experience we divided the enrolled individuals into two groups. To one group we gave a version of the game where the fairy would give the best recommendations possible for the person playing the game and another where we gave a version that would do the opposite (the fairy would recommend the worst choices).

4.1 Game Flow

From the data we collected, we can say that the quests were well design in terms of flow. From the one hundred and four responses for the quests form, eleven were from quest one, sixteen from quest two, fourteen from quest three, sixteen from quest four, seventeen from quest five, fourteen from quest six and sixteen from quest seven.

In terms of challenge we concluded that some of the quest (like quests one, four and five) the results were not as good, maybe because those quests were designed to be small and, therefore, some players may have found that smaller quests were not so challenging.

In the next table we can see the mean value of enjoyment, standard deviation and the number of participants in each quest. The level of enjoyment was measured with a 7-point Likert scale, ranging from 1 to 7.

QUESTS	PART.	MEAN	STD DEV
Quest 1	11	5.09	1.30
Quest 2	16	4.69	1.82
Quest 3	14	4.93	0.92
Quest 4	16	5.06	1.18
Quest 5	17	4.06	1.78
Quest 6	14	5.21	1.25
Quest 7	16	5.13	1.50

4.2 Quests Result

The results on this section correspond to the form that players needed to answer after finishing each quest. The results correspond to a total of thirty nine different subjects that answered the form for one hundred and four quests. Some of the participants did not do all the three quests asked in the game.

From this results we noticed that a majority of the population did not follow the fairy recommendations in both variants of the game and that even

the ones who followed them, the variant they played did not seem to matter in terms of accepting or not this recommendations. Using the *Mann-Whitney U Test* with a significance level of 0.212 we concluded that the distribution of the enjoyment of each quest was the same across the two variants of the game.

We also concluded that maybe our solution works best for people who score low in the *Conscientiousness* dimension. Using the *Mann-Whitney U Test* for the level of enjoyment from low scores of the *Conscientiousness* dimension we obtain a result of 0.014 significance value which means that the distribution of the enjoyment is not the same across the variants of the game. However, the same is not true for average and high scores where we obtain significances of 0.783 and 0.872, respectively, which means that the distribution of enjoyment was the same across variants.

5 Conclusions

Creating a game that pleases everyone, even a non gamer, can prove to be quite a challenge. With our approach we tried to support that improving players enjoyment, with different personalities, within the same game could be possible. For this propose we used a genre of gameplay (RPGs) that could help us determine if such goal would be possible.

We started by assuming that players enjoyment in the game is directly related to his personality. To show this, we created a game were we tried to map the facets of the five dimensions on the Big Five Factor Model. Due to the complexity of creating a game with so many variants (in total, thirty facets) we decided to only implement a game were we considered the majority of the facets of the *Conscientiousness* dimension of the Big Five Factor Model(*Self-Efficacy, Dutifulness, Achievement-Striving, Self-Discipline* and *Cautiousness*) into player choices during a game. We needed to remove the *Orderliness* facet, because we could not place a quest were this facet could be present, without diverging from the game story. The choices of the player were translated into quests that the he would need to choose.

We created this game from scratch using the tool RPG Maker Vx Ace were the objective of the player would be to choose a guild to proceed in his training to finally belong to the princess army. To help him in his decision, he needed to choose three quests, from a total of seven, where his choices would influence the elders recommendation of guild for him. The objective of our system was to help the player with the choices for the three quests. For that purpose, we created a companion (a fairy) that would suggest the best quests for him based on their personality.

During the creation of the game, and specifically

the design of the quests, we made it so that all the facets that we wanted to test, were present in at least one quest. However, since it was very difficult to create a quest where only one of the facets was present, we decided to include multiple facets in the same quest but with different weights, since some facets may prevail relative to others.

Over the evaluation of the game, we divided our subjects into two groups. To one, we gave a version of the game where the fairy would give the correct recommendation of quests based on the player personality, and to the other we gave the opposite.

There is much room to improve the methods used to validate this work. One of the main problems with our experiment was the lack of a way to tell if the player had asked for the recommendation or not.

Overall we could not determine with certainty if the player experience was improved or not. The data collected was not conclusive in terms of the enjoyment for both variants. This may be due to the fact that the majority of the subjects did not ask for the companion recommendation. However, we did see that for low scores on the *Conscientiousness* dimension our approach worked best.

6   Future Work

For future work we can recommend to use our methodology with other genres of games and with other dimensions and facets. Maybe even use a different approach to measure the players personality, like the *Four Bartle Types* or the *Four Keisey Temperaments*.

References

[1] E. S. Association. Essencial facts about the computer and video game industry, 2013.

[2] I. Capelo. Glass: Adapting game content to player affective state and personality. 2013.

[3] J. Chen. Flow in games. April 2007.

[4] P. Costa and R. McCrae. The neo personality inventory manual. 1985.

[5] M. Csikszentmihalyi. Flow: The psychology of optimal experience. 1990.

[6] P. Sweetser and P. Wyeth. Gameflow: A model for evaluating player enjoyment in games. July 2005.

[7] J. VandenBerghe. The five domains of play: Mapping psychology's five factor model to game design, Online May, 2012.