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# Personality Assessment Video Game Based on The Five-Factor Model

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## Abstract

Traditional personality assessment uses questionnaires to determine someone's personality. Although the common Big Five and MBTI tests are deemed to be accurate, those questionnaires don't precisely project a person's true personality. This method lacks reliability because of its self-report approach which can cause some biased responses. To resolve this problem, we are determined to find a better personality assessment method. Video games offer an immersive way for people to freely make a choice without fear of the consequence. Our objective is to implement the Big-Five Factor Markers to a game and find out whether it is possible to create a game that can predict someone's personality as well as how it performs when compared to the traditional method. We developed a simple role-playing game where the player faces 12 choices based on the IPIP Big-Five Factor Markers and behave freely according to their individual propensities. Each choice made by the player will increase the corresponding personality's score. To analyse the game's performance, we conducted a study among 10 students. Each participant was asked to complete the game and fill out a 50-item Big Five personality questionnaire. We found out that the game showed promising results as it is similar to the results from the questionnaire. Even though it only has 12 game variables, the game is able to averagely predict a person's personality. With further research done, it is highly possible that we can make a more complex game with more game variables to predict the personality more accurately.

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## 1. Introduction

Over the years, questionnaires have been the go-to method for people to figure out their personality traits. The reason for this is that questionnaires are easy to use and distribute, so researchers can get a lot of data in a short amount of time. Although the questionnaire provides benefits in the form of saving time and cost, this method of personality assessment can be improved in terms of its accuracy and excitement as well as interest for the participant. This study aims to make a better personality test, which is through game. We developed a game that is able to predict personality based on how the player plays and what choices they made in the game.

Games are the most immersive and engaging entertainment out there. Participants get to be themselves and choose what the characters do. That way we can see their real personality, their real choices, through their behavior in the game. There are two aspects that are important in the game development, the personality aspect and the game aspect. Personality describes someone's style of thinking, feeling, and acting when facing a physical and social environment. Every person has their own unique approach or ways of achieving their goals that can be categorized into several behavioral habits. According to scientists, there are five major personalities that underlie other personalities. These five main traits are Openness, Agreeableness, Extraversion, Conscientiousness, and Neuroticism, which is known as the Big Five Personality<sup>[1]</sup>. This Big Five Indicator is what we will use to evaluate a person's personality.

The second one is the game aspect. Game is the most immersive media in the world. When people play games, it is easy to feel as if they are there. This is called spatial presence, which is the feeling of being spatially located in the mediated environment<sup>[2]</sup>. There is also an added bonus that you control the character, not just watch or read it. This spatial presence is the key point in games. If the participants feel like they are there, it is more likely that their behavior and the choices they made are also from the real them. And if their choices are more accurate, then the personality test will also be more accurate. I.e. The more the test will show what the participants will actually do and not just what they want to think they will do.

## 2. Literature Review

### 2.1. Personality traits

Personality usually is associated with individual differences that can shape someone's behavior and activities. Personality trait does not mean a single thing or a distinct behavior, but rather some behavioral patterns of individuals throughout their daily activities and how they approach activities and problems in their lives<sup>[3]</sup>. One of the ways in determining someone's personality is by using the Five-Factor Personality Test which divides people only into 5 categories. This test is scientifically accurate in differentiating people due to each categories' sub-aspects. The Big Five has more predictive power compared to other assessments. Each personality trait ranges from 0 to 100 that each person will get uniquely according to their personalities<sup>[4]</sup>.

A lot of researchers have researched the connection between people's personality traits and their day to day aspects. For example, applying the big five personalities to games<sup>[5]</sup>, the influence of the Big Five personalities on finding information<sup>[6]</sup>, the relationship between the big five personalities and the energy and well-being of a person<sup>[7]</sup>, the relation between the Big Five personalities and loneliness<sup>[8]</sup>, the connection between the big five personality and academic motivation in higher education<sup>[9]</sup>, the association between the big five personalities and cognitive ability<sup>[10]</sup>, and the connection between personality traits with individual's innovativeness and satisfaction with life<sup>[11]</sup>.

The paragraph above proves that the big five personality does exist in each individual and affects day to day decision making. Hence, it is crucial to be familiar with the Big Five personality traits. These traits can be determined by using various questionnaires, such as IPIP NEO-PI<sup>[12][13]</sup> and HEXACO-PI-R<sup>[14]</sup>, though this method might be tedious and not time efficient. Hence, our group decided to use game-based assessment as a new method in figuring out someone's personality.

### 2.2. Big five implementations

In the past, numerous researchers have analyzed the relationship between Big Five personality traits in existing games through their behavior in said games like Minecraft<sup>[15]</sup>, World of Warcraft<sup>[16]</sup>, League of Legends<sup>[17]</sup>, Battlefield

3<sup>[18]</sup>, and Skyrim<sup>[19]</sup>. Their personality also affects the game design that they like or enjoy playing<sup>[14]</sup>. All those findings show that there is a significant correlation between a person's personality and their gaming behavior. For example, players in Minecraft who have high openness, conscientiousness, and agreeableness in their big five personality test all avoided unprovoked killing in-game<sup>[15]</sup> or in Battlefield 3 the players with high conscientiousness will have a lower play style and deaths per second<sup>[18]</sup>.

These correlations are usually found by using the Pearson Correlation, as it provides ease of use. It analyzes the connection between questionnaire data and gaming data. Another way to analyze the correlation is by using the Linear Mixed Effects (LME) model. It considers both fixed (gaming aspects) and random effects (demographic). Researchers have also used the Cross Correlations to check the similarity between two variables or dataset. To test the variance of the data, researchers usually use Partial Least Square Structural Equation Modeling<sup>[20]</sup> or Covariant Based Structural Equation Modeling<sup>[21]</sup> to make the model of the relationship. Some people also tried to make a prediction model based on existing games. Researchers tried to find the pattern of a player's gaming behavior by using pattern mining<sup>[22]</sup>. Other researchers have also tried to predict a person's personality based on their in-game behavior while finishing an objective by using HMM<sup>[13]</sup>.

### 2.3. Game-based personality test

With the correlation between personality and gameplay, people start to wonder if they can turn personality tests into a game. A few researchers actually attempted to create a game as a means of determining a person's personality traits. One of them is Zulkifly<sup>[23]</sup> that made a game where the design and levels of the game are based on the questionnaire of NEO-PI-R. For example, the question "Jump into things without thinking" that measures Conscientiousness can be made into a game design where the player must think about:

- How they approached a puzzle
- How often they used the map function
- How long they spent deliberating on moves during their turn
- How often the player paused the game

Another example is McCorda, Harman, and Pur<sup>[24]</sup> that made a text-based game to determine a person's personality. Each scenario has three options which represent a certain Big Five trait with different levels (low, mid, and high). These choices are created to resemble the IPIP-Items, so every choice the player made will correlate with the corresponding trait. The results will be gathered from the sum of all the chosen options. Even a simple paper-based card game about telling a story from a card when turned into a game indicates an increase in accuracy. The player gets to experience the exploration, social and achievement elements before they are asked to tell the story, which will prepare them for the task. This proves that gamification of a personality test indeed has a positive effect on the test results<sup>[25]</sup>.

Yet, previous researchers do not take into account the immersion of the game. Immersion is a type of concentration that occurs in an alternate pseudo-reality that affects the way people interact with the narratives in said realities as well as the time spent while also getting satisfaction and excitement from them<sup>[26]</sup>. This means that the more players are immersed in the games, the more they are prompted to stay true to themselves and not be inattentive.

There are various aspects that affect the player's immersion from the game design itself to the current life situation of the player. Transkanen<sup>[27]</sup>, said that the key to make an immersive game is to increase its interactivity. This can be achieved by implementing engaging sound, visual and flow alongside characters that connect with the player through the game screen. The game must be able to tell a story with engaging characters while using the right sound, visual, and flow. Contrary to popular belief, making a game from 2D to 3D or from 3D to Virtual only improves the immersion a little bit<sup>[28]</sup>.

Several researchers have succeeded in making an immersive personality test game. Navarro<sup>[29]</sup> created a personality test from several mini-games that implement some real-life aspects. For example, the game contains a navigation that is similar to a phone notification, to guide the player from one game to another. When the navigation appears, all the participants unconsciously reach out for their real phone. It means that the game has successfully created a real-life scenario that immersed the players into the game. It proves that the player's in-game choices are based on their real-life personality.

### 3. Methodology

#### 3.1. Participants and procedures

The participants were 10 students ranging from the age 15 to 20. Prior to the assessments, participants were asked about their gaming habits. Most of them have had some RPG gaming experiences or at least were aware of RPG games. Participants played the game from start to finish before taking the Big-Five personality questionnaire. The results were extracted and compared to see the similarities or differences. Additionally, participants were asked about their experiences on both assessments and which result represent their personality better

#### 3.2. Materials and instruments to measure the personality

In order to fulfill the research purpose, a simple RPG game was created. The development process consisted of constructing the questions, designing maps, and composing the methods to extract all the results. During the game creation, we were unable to achieve a high level of immersiveness and a high variety of game variables due to the time constraint. As a result, the game implemented freedom of choices in the form of a simple walk and solve style game.

There will be a total of 12 choices made by the player. All of the questions are based on IPIP Big-Five Factor Marker. These choices will increase their respective points in each of the five factors. For example, when one of the villains, Alex, betrayed the player, participants may choose to kill or arrest Alex. Choosing to kill Alex will increase the Neuroticism factor percentage while sparing and arresting Alex will increase the Agreeableness factor percentage. Every time the player chooses an option that corresponds to a factor, the percentage of that factor will increase by 25 percent. Four choices were given to represent each factor, so the percentage range for the factors is from 0% to 100%.

The questionnaire was assessed using a 50 item Big-Five Personality Test made by Open Psychometry based on IPIP Big-Five Factor Marker, developed by Goldberg (1992). Each item is rated from 1 (Disagree) to 5 (Agree). It takes most people 3-8 minutes to complete.



Fig. 1. Player's starting point. In this part of the game, the player is stuck in a sewer and need to find a way back to the street level

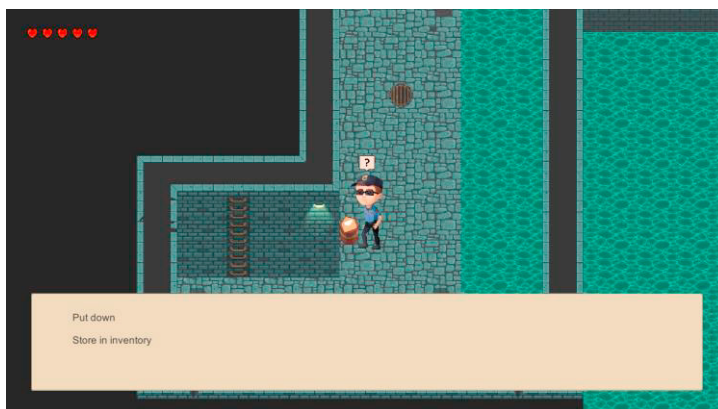


Fig. 2. Player can choose between keeping the note and leaving it behind

Figures 1 and 2 show the development of the game. Players can interact with certain objects in the world. There will be dialogue and choices that players can make to advance in the game. For example, players can find the exit faster with the given directions or they can explore the whole sewer, finding their own exit.

### 3.3. Game

We designed the game scenarios to let players experience various situations that would provide a comprehensive view of their behavior. The story consists of two parts, a tutorial and the main story. The game starts with a tutorial in the police office where a rookie cop named Grace is on her first day at work. The participants learn about the basic control to perform different actions. This game is played on a computer which utilizes the keyboard. To move around, players can use the arrow keys, to interact with surroundings, players can use the ‘Alt’, ‘C’, and ‘Space’ keys. Participants also learn how to use the map and their inventory.

The story continues with Grace and her mentor, Alex, who are going to guard a festival in the city along with other cops. There is a rumor going on about an evil scientist named Peter that is trying to rob the whole city. While going to the destination, suddenly a bomb goes off. Grace gets stuck in the sewer below and must find her way back to the top.

The main story revolves around defeating Peter who masterminded the brainwashing technique on police officers. The player must go through various obstacles, take out the brainwashed officers, and save the city. A short summary of the storyline is as follows.

- Escape the sewer and brainwashed officers
- Save civilians that are captured
- Go to the town’s radio station to find out the source of the broadcast
- Defeat the traitor
- Stop the broadcast at the radio tower
- Defeat Peter the mastermind

### 4. Result and discussion

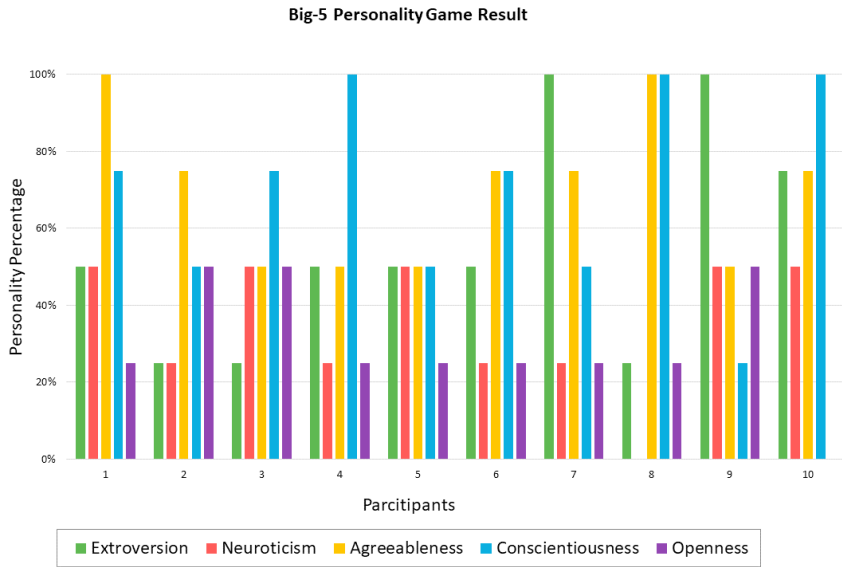


Fig. 3. Personality Game Result

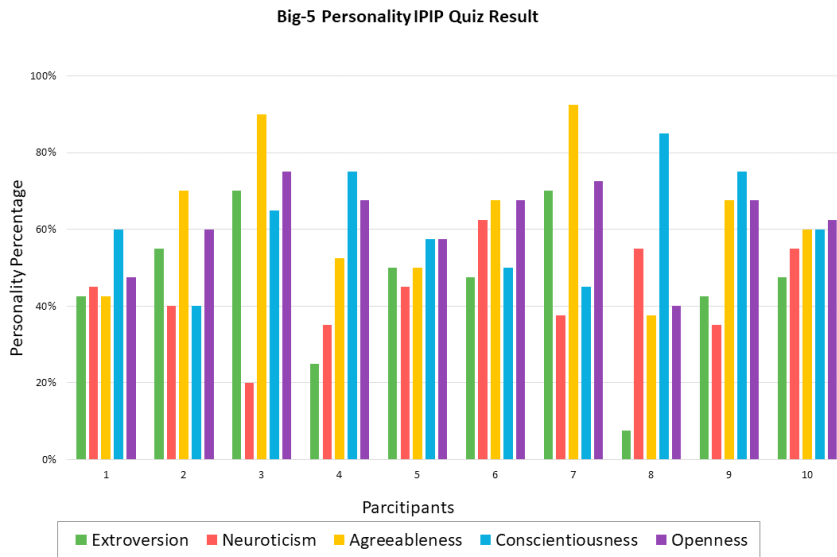


Fig. 4. Personality Quiz Result

All the game variables and questionnaire results were analyzed. After comparing results from both assessments, the game results were similar to the questionnaire results. For example, subject 5 has some similar results between the game and quiz test results with only slight error in the Openness factor which has a significantly higher percentage in the quiz results compared to the low percentage on the game result. But, that factor aside, the other factors have similar percentages with only less than 10% error in each one. This result proves that the game has a potential in predicting one's personality.

On the other hand, this game also lacks some main points. As shown in the result of subject 3, the percentage difference is very visible. Only one factor has a small percentage difference between the two different tests, which is the conscientiousness factor. Other factors are contradicting each other by either having a low percentage on one test and a high percentage on the other and vice versa. This problem is due to the fact that the game only focuses on the player's choices rather than the player's actual behavior. The choices are made based on IPIP questionnaires and directly implemented as the storyline. The amount of questions, which is only 12, is also insufficient to be made an accurate personality predictor. The player's personality could be assessed by adding some puzzles into the game and taking the player's behavior towards the puzzle when they have to be solved within a time limit.

The subjects were also questioned about the difference between playing the game and taking a questionnaire to predict their personality. A majority of them are really pleased with the game method and feel more in control of the situation and are not afraid to speak their minds. Whereas for the questionnaire method, they feel like the fact that they have to read through long sentences, which sometimes are too difficult to understand, is very outdated and boring. The time spent on doing the questionnaires are not effectively allocated, unlike when they played the game. This proves the enthusiasm of the subjects about the idea of a game being a personality prediction media.

In the future, another extensive research can be done to modify and perfect the game into a more accurate personality prediction media. One of the ways is to extend the medium by using machine learning in handling the behavioral assessment. Another feature that can be added is to give the players a chance to customize their characters for more immersion. If these features can be incorporated into the game, along with more extensive choices the use of machine learning for the puzzles in assessing players' behavior, a game with high accuracy in predicting personality can be created.

## **5. Conclusion**

The game proves that there is a lot of potential for games to predict one's personality. The results might not be the best, but by adding some features, incorporating new techniques and doing a more extensive research on the topic, the game can be improved. The feedback received from the subjects who had played the game and taken the IPIP questionnaire are positively aimed towards the game. The idea of playing a game to know one's personality was well received by the subjects. Using a game to predict personality is both more engaging and enjoyable for the player. In the advancement of deep learning and personality psychology, predicting a person's personality is not only possible, but also can be done in a more entertaining, less boring way.

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