



## **HOW DOES THE PERCEIVED PERSONALITY TRAITS AFFECT A PLAYER'S CHOICE OF NON- PLAYER CHARACTERS?**

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# Abstract

The personality traits of NPC characters are key elements in the complex interactions within games. This study, based on the Big Five personality theory, aims to explore how the perceived personality of NPC characters influences player choices. In the initial phase of the experiment, we designed two original NPC characters based on theories such as the Big Five personality model and presented them to the participants through textual stories and visual images. Subsequently, they were given imagined game tasks that we designed, and they had to choose the NPC character they were more inclined towards in each task. Through analysis, we found connections between certain Big Five personality traits of NPC characters and different tasks. We also discovered discrepancies between the intended personality design of the characters and their actual perceived personalities, with variations observed in the exhibited differences of each personality. In conclusion, the perceived personality traits of NPC characters have various influences and connections to player choice behavior.

**Keywords:** non-player character design; player ' s choice; Big Five; personality perception

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# 1 Introduction

With the development of the electronics industry, electronic games are becoming increasingly popular among people, and more and more researchers are dedicating themselves to the design of electronic games. According to the Newzoo Global Games Market Report 2022, it is estimated that there will be 3.2 billion gamers worldwide in 2022, and the global gaming market is expected to generate \$196.8 billion in revenue. The report predicts that the gaming market will continue to grow in the coming years. Games are becoming an indispensable part of people's lives.

On the one hand, game device development directly improves the player's gaming experience by improving hardware conditions, such as developing high-performance computers to provide higher quality game graphics, or developing portable game consoles for players to carry around. On the other hand, game content design improves the gaming experience through game mechanisms, art style, game UI, and so on. This article focuses on non-player character (NPC) design, exploring the possibility of NPC's impact on enhancing the gaming experience.

Rogers (2018) suggests in their research that NPC characters play a crucial role in enhancing players' immersion and enjoyment. Particularly, the level of interaction with companion-type characters is closely related to players' identification with the game. Today's game design increasingly emphasizes NPC design, aiming to enhance immersion and realism in the game. The term "flow" is considered the optimal psychological state of engagement, referring to a person's immersive experience (Jin, 2012). Researchers such as Pretty et al. (2023) and Jin argue that although the concept of flow is widely used in the field of electronic games, not all gaming experiences trigger a state of flow. Especially in narrative-driven games, players' emotional experience tends to be more important. Narrative-focused game genres include text-based games and RPGs, among others, which often rely on plot and characters. In other words, to foster player identification and enjoyment, game designers need to design emotional experiences that provide immersion for players.

In fact, NPCs play important roles in many types of games. Examples of NPC dependence in games include RPGs, survival games, text adventure games, simulation games, and more. For example, NPCs in role-playing games can be merchants, quest givers, enemies, etc. In survival games, they can play other survivors or beasts, etc. Author Bartle (2004), based on multi-user dungeons (MUDs) and other games, categorizes NPC missions into eight basic types:

- 1)Buy, sell and make stuff
- 2)Provide services
- 3)Guard places
- 4)Get killed for loot
- 5)Dispense quests (or clues of other NPCs' quests)
- 6 )Supply background information (history, lore, cultural attitudes)
- 7 )Do stuff for players
- 8 )Make the place look busy

NPCs were originally used to enrich the game world, provide goals and tasks, increase game challenge and interaction, and players often only obtained game world information from NPCs. With the development of games, many players no longer only interact with NPCs as tools to pass levels, but even have emotional attachments to NPCs, pursuing NPCs with more depth and charm. It can be said that the interaction between NPC characters and players is the root of "emotional experience." Based on existing research, most games involving adaptive player-NPC interactions focus on the following three aspects:

- 1) Unlocking narratives: In their experiments, Fraser et al. (2018) and other researchers utilize emotion detection and emotional dialogue management to enhance the conversational experience.
- 2) Eliciting specific emotions in players: Jalbert and Rank (2016) found a close connection between players' physiological information responses and NPC characters' perception of players' physiological information.
- 3) Implementing dynamic combat strategies: Zhadan (2018) and others explore the implementation of dynamic combat strategies in games.

The purpose of this thesis is to explore how to design non-playable characters (NPCs) and their personality traits by studying character creation methods, and to investigate how players perceive characters. The thesis uses the Big Five personality model as the overall standard for evaluating NPCs. In the research process, we explore the necessary factors and various conditions for creating a character and shape original NPC characters for a game. We then let participants perceive the NPCs and collect data to analyze whether the test subjects perceived the personality of our characters as intended and why. Finally, participants will be asked to evaluate which character they prefer in various game situations. In conclusion, this research will help further understand the role of NPCs in games and how to improve game immersion and realism by designing NPCs' personality traits to enhance players' gaming experiences.

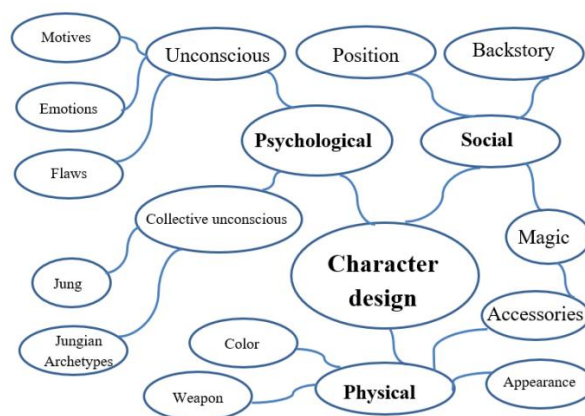
## 2 Background

### 2.1 Theoretical Background and Related Work

This section covers relevant theories and work related to character design methods and perception of character personality. We believe that in order to understand how characters are perceived, it is necessary to first understand how characters are created. This section also includes an introduction to the Big Five personality model, which serves as the measuring standard in our experiment.

#### 2.1.1 How to Create a Character

According to the theory of Soundararajan (2015), the three basic elements that make up a character are Psychological, Physiology, and Sociology (as shown in Figure 1). Psychological includes the content related to the character's mental state or personality, such as emotions, motives, character traits, habits, strengths and weaknesses, intelligence, etc. Physiology includes all the external characteristics related to the appearance of the character, such as the use of weapons, hair and skin color, clothing color, etc. According to the perspective of Yulianti and Martyastiadi (2020), it is suggested that the physiological dimension is intricately linked to the character's personality, as it is shaped by factors such as nature, habits, and emotions. Sociology includes the character's stance, social status, and other factors that are not directly related to the character itself. Yulianti and Martyastiadi believe that the sociology dimension is closely related to the background of the story. In other words, the sociological part that makes up a character requires a background story. Exploring these three factors from both internal and external perspectives can provide a more comprehensive description of the reasons behind the formation of each trait of a character.



**Figure 1** The elements of character design composition

In practical research, based on these three elements, Yulianti and Martyastiadi designed cartoon characters for the indigenous people in a certain region of Indonesia to promote the development of the local animation industry. The Physiology part was based on the short stature and dark brown skin tone of the local people, as well as ethnic-style clothing and accessories to design the appearance of the characters. The Psychological part focused on expressing the generally sincere and cheerful personality traits of the people in the region through the animated characters. This design was also based on the local people's belief in ancestors and the inheritance of sincere and open qualities as a way of life. In the Sociology part, the characters designed by the author symbolized the unique habits of the local women,

who presided over various ritual activities and worshipped their ancestors and gods through dance and song. Similarly, author Worasamutprakarn (2021) used a similar method to create a series of traditional characters in Thai mythology. First, the author analyzed the physiological and psychological characteristics of the gods based on mythological texts and images, compiled each point into a feature set table, and then created a three-dimensional mind map (such as Figure 1) to efficiently and quickly design multiple characters and complete a series of mythological god designs.

According to the theory proposed by Hu (2022), the author suggests using "perceptual words" to describe a character when using text perception. These perceptual words are various basic adjectives related to the character's temperament, appearance, personality, etc. The author divides them into six dimensions: Overall feeling, Ability Trait, Personality Charm, Design elements, In a situation like this, and Image design. All descriptions are done using adjectives. These six dimensions are similar to Soundararajan's theory, for example, Image design is obviously related to Physiology, while Ability Trait is related to Psychological factors. However, some of these dimensions are further subdivided and innovated based on Soundararajan's three factors. We believe that these dimensions can be added to the branches of a mind map, such as the example in Figure 1. Therefore, we find that the more branches this mind map has, the more realistic and vivid the characters designed based on it will be.

Bicalho (2020) also explored how to create characters. The fundamental purpose of Bicalho's experiment was to create all the NPCs in an adventure game, whose basic behaviors and reactions to the player would vary according to each NPC's personality. However, it is obviously very time-consuming to design each character individually, so the author designed a model with six dimensions to standardize the actions of the characters in batches. These six dimensions include time, wealth, dignity, politeness, collectivism, and rationality. The standard that determines the high or low values of these dimensions is called "trustworthiness". Trustworthiness is influenced by any of the above dimensions. These dimensions also have similarities with Soundararajan's three factors, such as collectivism belonging to Psychological.

### **2.1.2 The Instrument of Big Five**

The Big Five is a well-known personality test model created by John (1999). It maps and determines a person's personality traits. It focuses on five personality traits, namely Openness, Conscientiousness, Extroversion, Agreeableness, and Neuroticism. In the field of personality traits, the Five-Factor Model is the most popular typology and has been extensively studied to investigate its association with online games (Braun et al., 2016). According to the author's description, the basic definitions of the five dimensions are as follows:

- 1) Openness: refers to a person's degree of openness to experience. Individuals with high openness tend to seek new experiences and engage in self-reflection, while those with low openness tend to be more traditional.
- 2) Conscientiousness: reflects how conscientious and organized a person is. Individuals with strong conscientiousness are usually cautious and reliable, and have perfectionist traits. Those with low conscientiousness tend to have less defined goals and are less driven by success.



3)Extroversion: refers to whether a person's response to the external world is positive or negative. Extroverted people are satisfied with interacting with the external world, while introverted people often prefer solitude and dislike socializing.

4)Agreeableness: represents a person's level of empathy towards others. People with high agreeableness appreciate and trust others, and are often friendly and enthusiastic. Those with low agreeableness, on the other hand, tend to be more controlling or competitive with others to meet their own expectations.

5)Neuroticism (emotional instability): this is a tendency towards negative emotions. Individuals with high neuroticism are often more prone to anxiety and distress, and may also be more prone to anger and guilt. They often overreact when faced with difficult events.

### 3 Problem

NPC design can provide players with emotional experiences, facilitate the state of flow, and enhance players' cognitive engagement with the game. To make NPC characters lifelike, designers typically create them based on three aspects: psychological, physiology, and sociology (Soundararajan, 2015). Players perceive these three characteristics through their interactions with the characters. Player interactions with NPC characters involve various choices throughout different events. When players remain constant, there are two variables in the interactive events: the NPC character and the event. Our experiment aims to explore how players (participants) make choices regarding events/characters in different role/event scenarios.

The core research question of this thesis is "How does the perceived personality traits affect a player's choice of non-player characters?" To test and answer this question, we believe that the following three steps are necessary. The first step is the need for fully understanding NPC characters. This refers to a complete understanding of the character's psychology, past experiences, skills, appearance, etc. Therefore, we plan to design original characters rather than using characters from existing works. So, our first sub-question is "How can character design effectively reflect the intended design of the character?", that is, how to portray the character and reflect the desired characteristics in their appearance or behavior. In necessary situations, elaborating on a character's growth experience in detail helps players perceive the traits of the character (Yulianti and Martyastiadi, 2020). Subsequently, in the testing phase, after participants receive the character and perceive it, they need to evaluate the character. The sub-question at this stage is "How do participants perceive the character's personality?", meaning we need to use a standardized personality assessment test to fairly measure participants' opinions. Based on the extensive application of the Big Five personality model in research on online games, we choose it as the assessment criterion (Braun et al., 2016). The final step is about participants' choices, that is, testing how participants make different choices based on characters with specific personalities under different conditions. We propose "What personality types of characters do participants prefer in different types of tasks?" We need to present some "tasks" for participants to choose and judge. These "tasks" could include different types of game tasks or different roles that the character plays in the plot. After completing the three steps, by examining the connection between the initial character design in the first step and the participants' task choices in the third step, we can answer the core research question of the thesis. The main objective of the research is to explore the relationship between perceived personality traits of NPCs and the choices made by participants.

Core question: How does the perceived personality traits affect a player's choice of non-player characters?

Q1: How can character design effectively reflect the intended design of the character?

Q2: How do participants perceive the character's personality?

Q3: What personality types of characters do participants prefer in different types of tasks?

## 4 Research Method

### 4.1 Procedure

To test participants' perceptions of the personality traits of the characters, we designed the experiment to be conducted in three stages. First, we designed two original characters. The second step involves recruiting participants for a questionnaire study that evaluates the personality traits of the two characters based on the Big Five personality model as the instrument. The third step is also included in the questionnaire survey, which is conducted after the evaluation of the personality traits of the characters in the second step. We designed six imaginary game tasks, asking participants to choose which of the two characters they would prefer to cooperate with. Lastly, there was an open-ended question to freely solicit opinions from the participants.

The questionnaire, as the main instrument of the experiment, was divided into three parts. The first part involved assessing the personality of the elf character based on text and images. The second part involved assessing the personality of the dwarf character based on text and images. The third part consisted of selecting preferred or favored characters in different game tasks, along with an open-ended question. Please refer to Appendix B for the questionnaire details. After completing the questionnaire and the aforementioned three steps, we randomly selected participants for interviews. Participant recruitment was conducted online, and interviews were also conducted online. The interview content was based on the text and images used to assess the two characters in the questionnaire. We presented factors related to personality traits in the text and images to the participants and asked them to identify which ones they noticed and which ones they did not.

### 4.2 Instrument

In the first and second parts of the questionnaire, it was necessary to provide participants with a standard to fairly assess the Big Five personality traits of the two characters. We used 15 questions in the questionnaire to test each character's five personality traits (see Appendix A). Each trait was tested with three questions, and the order was randomized. This instrument is based on the BFI-2-short personality test questionnaire developed by researcher Soto (2017), which was adapted from the complete 60-item Big Five personality test questionnaire and shortened to 30 questions. Since our participants had to read two pages of short stories and view character images, and considering the length of the questionnaire, we decided to extract 15 questions from this instrument for testing. The questions used a Likert 5-point scale, with "agree" being 5 points and "disagree" being 1 point.

### 4.3 Measures

After completing the experiment, the collected data can be categorized into three types. The first type is the data from closed-ended questions in the questionnaire. This includes measurements of perceived personality using the Likert five-point scoring and the choices made between the two characters in the imagined game tasks (binary choices). In other words, it includes all questions in the questionnaire except for the final question. The second type is the answers to the open-ended questions in the questionnaire (resulting in text responses), which will be subjected to qualitative analysis. The third type is the interviews

conducted with randomly selected participants. The interview content does not consist of open-ended questions but is based on the text and image details from the first and second parts of the questionnaire (assessing the personality of the two characters). The approach involves presenting factors related to personality traits from the text and images to the participants and asking them to identify which ones they noticed and which ones they did not.

Considering the potential impact of primacy bias on participant choices, we arranged for some participants to have the elf character presented first in their questionnaire, while the remaining participants had the dwarf character presented first. The order and content of other survey questions remained unchanged. At each step of the experiment, the results from these two groups of participants were separately collected, compared, and analyzed. In the end, we collected 9 questionnaires where the elf character was presented first and 16 questionnaires where the dwarf character was presented first.

#### **4.4 Interview Design**

After conducting the second and third part of the experiment, the data was collected and analyzed. The researcher had a predetermined ideal result in mind for the experiment. Regardless of whether the results were positive or negative, the researcher planned to conduct interviews with a sample of participants. The interviews were based on Table 1 and Table 2. The characteristics in Table 1 and Table 2 were summarized based on the text and visual images of the characters, with the ideal levels of each personality trait in parentheses.

The interviews were conducted offline. We randomly selected participants and scheduled individual meetings to inquire about their opinions. Each participant was interviewed for approximately three to four minutes. The interview method involved checking the content in the tables (Table 1 and Table 2) and taking notes on the participant's personal insights or specific perspectives.

First, the participants were asked to explain the basis for their choices and to indicate where they found this information in the images and text. Then, the participants were shown Table 1 and Table 2 and asked for their opinion on whether they had noticed the designer's intentions. Finally, the results of the interviews were compared with the ideal result, and an in-depth analysis was conducted.

**Table 1** Design intentions of the Elf

| Elf  |  |   |   |  |
|--|--|---|---|--|
| Psychological  |  |   |   |  |
| Openness (high)  | Conscientiousness (moderate)           | Extroversion (low)  | Agreeableness (moderate)  | Neuroticism (high)                     |
| not practicing traditional religion (not wearing traditional clothing) | unwilling to do dirty work             | avoid eye contact and conversation with others/afraid of crowded places | agree to cooperate with the protagonist/ do not approve of the protagonist's anatomy skills | easily get discouraged/talk to herself |
| Physiology   |  |   |   |  |
| Openness (high)  | Conscientiousness (moderate)           | Extroversion (low)  | Agreeableness (moderate)  | Neuroticism (high)                     |
| dress in a revealing manner  |  | hood/hunched body posture   |   |  |
| Sociology  |  |   |   |  |
| Openness (high)  | Conscientiousness (moderate)           | Extroversion (low)  | Agreeableness (moderate)  | Neuroticism (high)                     |
| keen on exploring the world/learn swordsmanship quickly                | have a sense of teamwork during combat | drink alone   |   |  |

**Table 2** Design intentions of the Dwarf

| Dwarf   |   |                                |  |  |
|---|---|--------------------------------|--|--|
| Psychological   |   |                                |  |  |
| Openness (low)  | Conscientiousness (high)  | Extroversion (high)            | Agreeableness (high)                                       | Neuroticism (low)                      |
| traditional dwarf medicine/believe in her own experience more than others | persist in giving directions to strangers                                     | willing to talk to strangers   | enthusiastic humor/ get along well with stranger travelers | tolerance of others' criticism (twice) |
| Physiology  |   |                                |  |  |
| Openness (low)  | Conscientiousness (high)  | Extroversion (high)            | Agreeableness (high)                                       | Neuroticism (low)                      |
| traditional gear totem decorations  |   | orange hair/ confident posture |  |  |
| Sociology   |   |                                |  |  |
| Openness (low)  | Conscientiousness (high)  | Extroversion (high)            | Agreeableness (high)                                       | Neuroticism (low)                      |
| inherit the family business   | take care of many younger siblings/as the leader of the dwarf expedition team |                                |  |  |

## 4.5 Analysis

After the experiment, the first type of data collected is divided into two parts. In the first part, participants used the Likert scoring system to evaluate the personality of the characters.

After collecting the data, we manually calculated the scores for each item. The calculation method involved directly calculating the average score for each item. In other words, a higher average score for a particular item indicates a closer alignment with the literal meaning of that item and a greater presence of characteristics related to that personality trait. For example, a higher score in the "extroversion" item suggests that the character is perceived as more extroverted. Similarly, a higher score in the "neuroticism" item implies that the character is perceived to possess more neurotic traits. The second part of the data involves analyzing the proportions of participants who chose different characters in the imagined game tasks.

The second type of data comes from the only open-ended question in the questionnaire. We collected the text responses and analyzed their content. The conclusions drawn from this analysis were used to support and explain the character's personality and the reasons behind the participants' character choices.

The third type of data comes from individual interviews. We presented the participants with the design intentions of the characters and identified the specific details in the text and images that conveyed those intentions. Participants were asked to identify the details they noticed. This step aimed to investigate the gap between the perceived character personality and the design intentions.

## **4.6 Participants**

We used Google Docs to design an electronic survey questionnaire and recruited participants online.

The recruited participants mainly came from a social platform in China and a residential area in Sweden. The questionnaire does not include any questions regarding personal factors such as age, gender, personality type, or nationality of the participants. This is because personal attributes are not variables or research objectives of our experiment in relation to NPC perception. We are solely interested in understanding how participants choose their characters when faced with different roles and events. For specific questions, we conducted separate interviews with individual participants. In the end, we collected 27 questionnaires, of which 25 were valid. There were 4 participants interviewed separately.

## **4.7 Ethical Considerations**

This paper focuses on the personality assessment of NPC characters. Participants were consulted and obtained informed consent before the questionnaire and interviews. The questionnaire was conducted anonymously, and the questionnaire answers and interview responses were ensured to be kept confidential and not disclosed or utilized.

## **4.8 Pilot Test**

Before starting the formal experiment, a pilot study was conducted to ensure the validity of the experimental design and reduce the possibility of errors in the subsequent formal experiment. We tested one participant and improved the questionnaire design based on the answers provided (without modifying the questionnaire framework and steps). During the experiment, we asked the participant to complete the questionnaire and compared the

results with the expected ideal experimental results. Regardless of whether the results were positive or negative, we asked the participant about their reasons for choosing certain answers and compared whether they were consistent with the expected results. For this part of the test, we only analyzed the first character (Elf). The test results showed that the openness of the first character was 3.34, conscientiousness was 2.67, extroversion was 3.00, agreeableness was 4.00, and neuroticism was 2.34. Openness, conscientiousness, and agreeableness were basically consistent with the ideal test results. However, the values of extroversion and agreeableness were slightly higher. The participant first believed that the experimental results were basically consistent with their own Big Five personality assessment questionnaire and direct cognition. We believed that the most significant factor influencing the results was stereotypes and personal understanding bias. For example, the first elf character often played a gentle and open role in various works, which gave people a preconceived impression of high levels of extroversion and agreeableness. Secondly, the description of agreeableness in the text was too few to be noticed or even misunderstood. Therefore, we made appropriate modifications for this. Regarding the issue of personal understanding bias, the characteristics we provided were noticed by the participant, but they interpreted them in their own way, which led to significant differences from our design intentions. We believe that this issue can be addressed by increasing the number of participants.

#### **4.9 Pilot Test Recommendations**

The participant also gave some special opinions. For example, regarding the third part, the participant believed that two characters could be divided into two groups based on their willingness to cooperate with the player. However, in a complete game story system, the proportion of these two types of characters appearing around the player needs to be reasonably controlled. For example, the participant believed that characters like elf with a mysterious color should appear less because they cannot provide players with a sense of security during gameplay and are more of a plot twist and suspenseful character.

# 5 Design Method

## 5.1 Create Characters

### 5.1.1 Character design concept

In the initial design stage, we referred to Worasamutprakarn (2021) 's cognitive tree diagram of character composition and the five factors of the Big Five personality traits. Worasamutprakarn believes that the three elements that make up a character are psychological, physiological, and sociological. So in the initial design phase, we created a table for each character that contained these three categories, as shown in Table 3 and Table 4. In the corresponding character for Table 3 and Table 4, psychological includes Personalities, Strengths, Habits, Hobbies, and Intelligence. Physiology includes the character's appearance, attire, accessories, weapons, and other visual characteristics. In the Sociology section, we designed the character's Position, Social status, Place of origin, Family, Religion, and other factors, which are the character's connections with the external society. Participants can evaluate the character's personality based on the external society's reflection of the character. Through these two tables, we can summarize the personalities of the two characters in detail.

**Table 3** The concept of Elf design

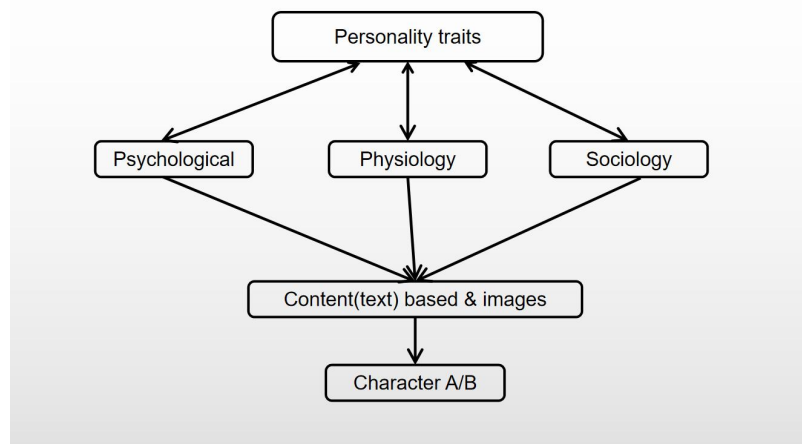
| <b>Character Elf</b>      |   |
|---------------------------|---|
| <b>Psychological</b>      |   |
| Personalities             | nerd, shy, rational   |
| Strengths                 | careful, good aesthetics, good upbringing   |
| Habits                    | picky (about chores), sleep late, poor communication  |
| Hobbies                   | passionate about collecting mementos  |
| Intelligent               | good professionalism (about weapon and fight)   |
| <b>Physiology</b>         |   |
| Color scheme              | blue, white skin, purple hair, golden eye   |
| Physical appearance       | slim ,lovely, wealthy   |
| Race                      | elf   |
| Weapon                    | ice sword (blue)  |
| Attack mode               | sword & ice magic   |
| Costumes                  | cloak   |
| Accessories               | silver armor with golden decorations  |
| <b>Sociology</b>          |   |
| Position                  | most of the time is neutral   |
| Social status             | high-ranking mercenary  |
| Place of origin           | an aristocratic family of elf   |
| Family                    | father, mother and a little sister  |
| Religion                  | Practiced the local religion of the elves with her family when she was a child. When she grew up, she did not follow any religion.  |
| Relationships with others | Good relationship with the pawnshop owner (That means players can save a lot of money).   |
| Backstory                 | She grew up in a forest far from human. As an elf aristocrat, her religious studies made her sick of staying in one place. One day she left home. Then there was an elf guardian in the human realm. But she left the Royal Guard a month ago. People who've seen her say they've seen her around the country a lot lately. |



**Table 4** The concept of Dwarf design

| <b>Character Dwarf</b>    |  |
|---------------------------|--|
| <b>Psychological</b>      |  |
| Personalities/temperament | traditional, extroverted, emotionally stable   |
| Strengths                 | careful, conscientious   |
| Habits                    | study ore  |
| Hobbies                   | party, cooking traditional food  |
| Intelligent               | good professionalism (about ore cave)  |
| <b>Physiology</b>         |  |
| Color scheme              | green eye, orange hair   |
| Physical appearance       | robust, lively   |
| Race                      | dwarf  |
| Weapon                    | iron shovel  |
| Attack mode               | physical attack  |
| Costumes                  | leather clothing   |
| Accessories               | rope, gemstone, traditional gear totem   |
| <b>Sociology</b>          |  |
| Position                  | dwarven kingdom  |
| Social status             | dwarf civilian   |
| Place of origin           | a common family of dwarf   |
| Family                    | father, mother and five brothers and sisters   |
| Religion                  | As the eldest daughter of the family she has been learning the techniques of dwarf since childhood in order to inherit the family business.  |
| Relationships with others | She has a great reputation in the dwarf civilian district. She has a good relationship with the owner of the remodeling shop.  |
| Backstory                 | She was born into an ordinary dwarf family and didn't have the opportunity to receive much education due to having too many younger siblings. She started learning the dwarf's techniques from a young age in order to inherit the family business and earn money for the family. Managing the family shop honed her eloquence, enthusiasm, and generous personality. However, she is not interested in the development and trends of the world. |

In designing the characters, we follow the design sequence outlined in Figure 2. Firstly, we establish the Big Five personality traits for the characters. Then, we explore the potential behaviors associated with each of the five traits in the domains of psychology, physiology, and sociology. Based on these possible behaviors, we integrate them with the game's established historical background and create written descriptions and visual illustrations. This approach provides a tangible framework for character design and allows us to understand the deviations between player perception and design intentions in subsequent experiments.



**Figure 2** The framework for character design.

### 5.1.2 Personality Hypotheses

When designing the characters, we had anticipated levels for each of the five dimensions. We expected (1) the elf character to have high openness, moderate conscientiousness, low extroversion, moderate agreeableness, and high neuroticism. On the other hand, we expected (2) the dwarf character to have low openness, high conscientiousness, high extroversion, high agreeableness, and low neuroticism. By comparing the subsequent experimental data with the expected results, the gap between the perception of the characters and the design intentions could be analyzed.

In the initial design phase, we aimed to make the two characters as different as possible in terms of the Big Five personality traits. Therefore, we made some adjustments to the characterization of the two characters based on each element of the Big Five model. For example, we wanted the elf character to be introverted while the dwarf character to be extroverted. So, we made the habit of the elf character to be poor at conversation, while the habit of the dwarf character to be fond of parties.

### 5.1.3 The Actual Character Design

Later, we considered the need for "authenticity" in the experiment. That is to say, in a real game, players do not perceive a character solely based on a table provided by the game designer. When a player first meets a character in a game, they only have a rough idea of what the character is about, without knowing much more about them. As the plot and story progresses, the player gradually gets to know everything about the character. In our experiment, if we only showed the tables (Table 3 and Table 4) to the participants, they would not be able to truly perceive the characters. Therefore, we decided to write small stories for each character and create visual images in an attempt to show the characters' features through their dialogue and actions. In the actual experiment, what was presented to

the participants were the visual appearance pictures of the two characters and two short stories of no more than one page each, describing the characters. For detailed design, please refer to Appendix B.

**Table 5** Text and images of the character

| Elf  | Dwarf  |
|--|--|
|    |   |
| <p>This is a virtual adventure game. You are a player in the game. One afternoon, you arrived at a lively town. Passersby told you that the tavern had a bulletin board for commission tasks, and pointed out the way to the tavern for you. When you arrived at the tavern.....</p> | <p>This is a virtual adventure game and you are an adventurer. One day, you went to a ore cave for investigation. You were not very familiar with the terrain of the cave, and your fighting skill was not strong, so you were not very confident about this mission. During the investigation, you.....</p> |

In terms of the stories, we approached them from the player's perspective as the main character in the game. The stories describe the player's first encounter with the characters, their adventures together, and attempt to depict details of the adventure to realistically portray the characters. As for the visual images, in addition to basic physical features such as hair color and skin tone, we tried to include elements related to the psychological aspect of the characters. For example, we drew a hood for the elf character to express their introverted personality, or used confident body language to convey the dwarf's high extroversion.

In fact, when we initially designed the text related to the characters, we only used psychological, physiological, and sociological elements to portray the characters, as shown in Table 3 and Table 4. However, the purpose of the experiment was to investigate participants' perception of the characters' personalities. The psychological part of the text would reveal keywords related to the Big Five personality traits. For example, the word "shy" in the "personality" category is almost identical to the Big Five trait of "introversion". This is one reason why we changed the text format to small stories.

In the first step of character design, we tried to minimize the use of stereotypes as much as possible, except for necessary design elements. This is because according to Şengün's (2022) conclusion, stereotypes can influence players' perceptions of characters, such as dark-skinned characters being less likable. This may affect players' perceptions of the characters' personality traits.

## **5.2 Six Imaginary Tasks**

According to Sheldon's research (2014), in addition to the player character who usually serves as the protagonist, NPCs in games serve various roles such as antagonists, mentors, sidekicks, servants, trainers, and quest givers, etc. These roles together make up the game world and have their own functions in the storytelling part of the game. Therefore, we designed six imaginary game tasks, including: 1. The protagonist's assistant who is a partner in all tasks; 2. The protagonist's mentor at the beginning of the game; 3. The hidden antagonist in the game; 4. The teammate in a combat task; 5. The teammate in a collection task; and 6. The teammate in an exploration task. This step tests the influence of perceived personality traits on the player's choices and demonstrates the player's choices in different situations through examples. After the experiment, we also interviewed the participants to ask them about their reasons for their choices. Through this step, unexpected answers can also be obtained.

## 6 Result

### 6.1 Perception of Two Characters

We analyzed the 25 collected questionnaires. Since the Big Five personality traits consist of five dimensions, we calculated the average scores for each character for analysis. The personality items were rated on a scale from 1 to 5, with 1 being the lowest score and 5 being the highest. According to the scoring system, the scores can be categorized into four levels: 1-2 for the lowest level, and the remaining ranges are 2-3, 3-4, and 4-5.

#### 6.1.1 Perception of Elf Characters

**Table 6** Participants' perceived ratings of the Big Five traits for the elf character in three scenarios.

| The mean of the Big Five traits for character elf |          |                   |              |               |             |
|---|----------|-------------------|--------------|---------------|-------------|
|   | Openness | Conscientiousness | Extroversion | Agreeableness | Neuroticism |
| Overall (25)                                      | 3.17     | 2.63              | 2.12         | 3.48          | 3.48        |
| Elf first (9)                                     | 2.70     | 2.78              | 2.30         | 3.44          | 3.00        |
| Dwarf first (16)                                  | 3.35     | 2.54              | 2.02         | 3.50          | 3.75        |

Looking at the overall average scores, none of the five dimensions have scores falling in the 1-2 or 4-5 range. Therefore, it is difficult to determine whether a particular dimension is higher or lower than the expected value based solely on score intervals. When comparing the values horizontally, among the five average scores, we can observe that openness is moderate and lower than expected. Conscientiousness is moderate to low, similar to expectations. Extroversion has the lowest score, aligning with expectations. Agreeableness has the highest score, slightly exceeding expectations. Neuroticism has the highest score, consistent with expectations.

Based on this analysis, we can conclude that the elf character's conscientiousness, extroversion, and neuroticism align closely with expectations, while openness and agreeableness deviate significantly from expectations.

The data obtained after swapping the order of appearance of the two characters in the questionnaire is also included in the table. Comparing the scores between the two methods, it can be observed that, in the dimensions of openness, agreeableness, and neuroticism, participants who saw the dwarf character first gave higher scores compared to participants who saw the elf character first. In the horizontal comparison, for participants who saw the elf character first, their perceived scores for openness, agreeableness, and neuroticism deviate significantly from expectations, while conscientiousness and extroversion show minor deviations from expectations. For participants who saw the dwarf character first, their perceived scores for the elf character only significantly deviate from expectations in terms of agreeableness, while the other four dimensions show minor deviations from expectations. Overall, both groups of participants provided scores that were not highly consistent with expectations, particularly in the agreeableness dimension. However, it is evident that the scores provided by participants who saw the dwarf character first are closer to the expected values across all dimensions.

### 6.1.2 Perception of Dwarf Characters

**Table 7** Participants' perceived ratings of the Big Five traits for the dwarf character in three scenarios

| The mean of the Big Five traits for character dwarf |          |                   |              |               |             |
|---|----------|-------------------|--------------|---------------|-------------|
|   | Openness | Conscientiousness | Extroversion | Agreeableness | Neuroticism |
| Overall (25)  | 2.39     | 3.59              | 3.77         | 3.92          | 2.48        |
| Elf first (9)                                       | 2.11     | 3.85              | 3.81         | 3.63          | 2.22        |
| Dwarf first (16)                                    | 2.54     | 3.44              | 3.71         | 4.06          | 2.63        |

Looking at the overall average scores, similar to the elf character, none of the five dimensions have scores falling in the 1-2 or 4-5 range. Therefore, it is also difficult to determine whether a particular dimension is higher or lower than the expected value based solely on score intervals. When comparing the values horizontally, among the five average scores, it can be observed that openness has the lowest score, consistent with expectations. Conscientiousness has a moderate score, slightly lower than expected. Extroversion has a relatively higher score, almost in line with expectations. Agreeableness has a very high score, aligning with expectations. Neuroticism has a lower score, almost in line with expectations.

In summary, among the five dimensions perceived by the participants, openness, extroversion, agreeableness, and neuroticism are almost consistent with expectations. Only conscientiousness shows some deviation from expectations. This indicates that the dwarf character was well perceived by the participants, and they were able to understand the design intent through the text and images.

The data obtained after swapping the order of appearance of the two characters in the questionnaire is also included in. The experimental results indicate that the order of appearance of the two characters affects the judgments of openness, agreeableness, and neuroticism. Comparing the scores between the two methods, it can be observed that, in the dimensions of openness, agreeableness, and neuroticism, participants who saw the dwarf character first gave higher scores compared to participants who saw the elf character first. This pattern is consistent with the results for the elf character as well. In the horizontal comparison, for participants who saw the elf character first, their perceived scores for the dwarf character show significant deviations from expectations in terms of agreeableness, while the other four dimensions show minimal differences from expectations. For participants who saw the dwarf character first, their perceived scores for the dwarf character show slight deviations from expectations in terms of openness, conscientiousness, and neuroticism, while the other two dimensions are in line with expectations. Therefore, the scores from both groups of participants show minor differences from expectations, but still exhibit some disparities.

It is worth noting that compared to the perceived characteristics of the elf character, the dwarf character is perceived more accurately by the participants.

## 6.2 Participants' choices in the Character Selection Question

This section investigated the third part of the questionnaire, which consisted of six imagined game tasks designed by us. Participants were required to choose between the elf character or the dwarf character in each task. The six tasks are as follows:

'How would you use this character in a game?'

- 1) The protagonist's sidekick and partner in all tasks
- 2) The protagonist's mentor at the beginning of the game
- 3) The hidden antagonist in the game
- 4) The teammate in combat missions
- 5) The teammate in collection missions
- 6) The teammate in exploration missions

**Table 8** The proportions of participants' choices in the character selection question

| Proportion of imaginary game tasks                           |        |        |        |        |        |        |
|--|--------|--------|--------|--------|--------|--------|
|  | Task 1 | Task 2 | Task 3 | Task 4 | Task 5 | Task 6 |
| Overall (25)   | 17:8   | 8:17   | 13:12  | 14:11  | 9:16   | 12:13  |
| Elf first (9)  | 4:5    | 2:7    | 6:3    | 7:1    | 4:5    | 3:6    |
| Dwarf first (16)   | 13:2   | 6:10   | 8:8    | 7:9    | 7:9    | 9:7    |
| (The former is character elf, the latter is character dwarf) |        |        |        |        |        |        |

Table 8 shows the higher proportion of participants choosing the elf character, while the lower proportion represents those choosing the dwarf character.

Looking at the overall data, the majority of people prefer to choose the elf character as their companion, but they have a greater preference for the dwarf character as the mentor at the beginning of the game. The number of people who consider the characters suitable for playing antagonistic roles is almost equal. When faced with the choice of temporary teammates, most people prefer to undertake collection tasks with the dwarf character. However, when it comes to combat tasks and exploration tasks, the number of participants choosing the two characters is almost the same.

After swapping the order of appearance of the two characters in the questionnaire, a vertical comparison between the two groups of participants reveals that only in the selection of mentors and teammates for collection tasks do the choices of both groups align closely with the overall trend. However, for other tasks, there are differences between the two groups. Notably, in Task 1, participants who saw the dwarf character first predominantly chose the elf character as their companion, while participants who saw the elf character first did not show such a high proportion of this choice. Additionally, in the selection of combat tasks, participants who saw the elf character first were more inclined to choose to fight alongside the elf character, while participants who saw the dwarf character first provided a more balanced distribution of choices.

### 6.3 The only Open-ended Question

At the end of the questionnaire, we asked an open-ended question, "In comparison, which character do you dislike the most? Why?" This question was optional to answer. Among the data we collected, we received the following responses. We collect the responses and compile them in Table 9, extracting key words from the participants' texts in the rightmost column. Subsequently, we can conduct analysis, such as Big Five personality traits, based on these key words.

**Table 9**

| Disliked character | Reasons  | Key words   |
|--------------------|--|---|
| Elf                | I have a dislike for the elf character. I find her personality to be inadequately developed, resulting in a lack of connection and consequently making it challenging to develop a fondness for her.   | personality to be inadequately developed a lack of connection                                       |
|                    | The elf character gives me a sense of being overly "perfect" for a game character, which comes across as somewhat artificial. She possesses a privileged family background, exceptional swordsmanship skills, extensive knowledge, and adheres to "traditional female character traits".   | overly "perfect"/artificial/"traditional female character traits"                                   |
|                    | The character Elf appears to be rather inflexible, which limits the potential for the team to experience unexpected surprises.   | inflexible/limits the potential to experience unexpected surprises                                  |
|                    | Dwarf. Compared to the elf, she excels in communication and demonstrates a strong ability to distribute the spoils of war effectively.   | poor communication  |
|                    | I prefer the dwarf. Initially, based on the early part of the text and the initial impression from the image, the elf seems timid and introverted. However, as the story progresses, she reveals her talent and leadership abilities. While it is possible for these two qualities to coexist, personally, I find the transition a bit abrupt.   | the transition (timid and introverted - talent and leadership abilities) is a bit abrupt.           |
| Dwarf              | I didn't perceive strong leadership qualities in the dwarf character due to her ineffective handling of relationships with her subordinates and followers.   | weak leadership qualities/ineffective handling of relationships with her subordinates and followers |
|                    | The dwarf character, at times, displays stubbornness and reluctance to embrace new things. While she might agree to give my idea a try, deep down, she lacks genuine belief in me and seeks to prove herself right. Although she is generous and responsible, maintaining long-term mistrust will not bring us closer or foster better cooperation. Instead, it may result in wasting significant time and energy during our expedition. | stubbornness and reluctance to embrace new things/lacks genuine belief in the player                |
|                    | Character dwarf. When it comes to new things, there is often a strong sense of distrust and a tendency to be opinionated.  | distrust/a tendency to be opinionated   |
|                    | Dwarf. It can be challenging to establish a harmonious relationship with someone who values discretion..   | values discretion (excessively suppressing criticism from others can make one feel uneasy)          |

## 6.4 Interview Analysis

Here is the data related to individual interviews. The table was created based on the character traits provided in Table 4 and Table 5, combined with the choices of the four interview participants. The circles indicate that the participants noticed these characteristics in the text or images.



**Table 10** Participants' perceptions (Elf)

| Character Elf     |  | P1 | P2 | P3 | P4 |
|-------------------|--|----|----|----|----|
| Openness          | not practicing traditional religion (not wearing traditional clothing) |    | ○  |    |    |
|                   | dressed in a revealing manner  | ○  |    |    | ○  |
|                   | keen on exploring the world  | ○  |    | ○  | ○  |
|                   | learn swordsmanship quickly  |    |    | ○  | ○  |
| Conscientiousness | unwilling to do dirty work   | ○  | ○  |    | ○  |
|                   | have a sense of teamwork during combat                                 | ○  | ○  |    | ○  |
| Extroversion      | avoiding eye contact and conversation with others                      | ○  | ○  |    | ○  |
|                   | afraid of crowded places   | ○  | ○  |    | ○  |
|                   | hood   |    | ○  | ○  | ○  |
|                   | hunched body posture   | ○  | ○  | ○  | ○  |
|                   | drinking alone   | ○  |    |    | ○  |
| Agreeableness     | agree to cooperate with the protagonist                                | ○  | ○  | ○  |    |
|                   | do not approve of the protagonist's anatomy skills                     | ○  | ○  | ○  |    |
| Neuroticism       | easily get discourage  |    |    |    |    |
|                   | talk to herself  |    |    |    |    |

Table 10 collects data on the elf character. During the interviews, we collected individual ratings for each character. To keep the article concise, the following presents ratings from four participants and the deviations from the expected design. Based on the scores provided by the four participants, Participant 1's rating for agreeableness deviates from expectations. Participant 2's ratings for openness and neuroticism also deviate from expectations. Participant 3's rating for openness differs from expectations. Participant 4's rating for openness differs from expectations as well. Notably, none of the participants noticed the two incidents related to neuroticism, but their understanding of neuroticism aligns closely with the expectations.

From the table, it can be observed that openness and extroversion have the highest frequency of occurrence in both text and images. However, conscientiousness, extroversion, and agreeableness are the most prominently observed traits, reaching a proportion of 75%. In terms of conclusions, the most significant deviation from expectations among the scores provided by the four participants is in the openness dimension. The ratings for conscientiousness and extroversion from the four participants align closely with the expected values.

From this, it can be seen that while extroversion has a high frequency of occurrence, the wording of related events is ambiguous and not perceived by participants, resulting in its presence being ineffective. In contrast, when describing extroversion, the wording is more specific, and coupled with its high frequency of occurrence, it can be perceived.

**Table 11** Participants' perceptions (Dwarf)

| Character Dwarf   |  | P1 | P2 | P3 | P4 |
|-------------------|--|----|----|----|----|
| Openness          | traditional dwarf medicine                     | ○  |    |    | ○  |
|                   | believe in her own experience more than others | ○  |    |    | ○  |
|                   | traditional gear totem decorations             |    |    |    | ○  |
|                   | inherit the family business                    | ○  |    | ○  |    |
| Conscientiousness | persist in giving directions to strangers      | ○  | ○  | ○  | ○  |
|                   | took care of many younger siblings             | ○  | ○  | ○  | ○  |
|                   | as the leader of the dwarf expedition team     |    | ○  |    | ○  |
| Extroversion      | willing to talk to strangers                   | ○  | ○  | ○  | ○  |
|                   | orange hair                                    |    |    | ○  | ○  |
|                   | confident posture                              |    |    | ○  | ○  |
| Agreeableness     | enthusiastic humor                             | ○  | ○  | ○  | ○  |
|                   | get along well with stranger travelers         | ○  | ○  |    |    |
| Neuroticism       | tolerance of others' criticism (twice)         | ○  | ○  | ○  | ○  |

Table 11 collects data on the dwarf character. To keep the article concise, the following presents ratings from four participants and the deviations from the expected design. Based on the scores provided by the four participants, Participant 1's ratings for extroversion and neuroticism deviate from expectations. Participant 2's rating for extroversion differs from expectations. Participant 3's rating for extroversion also deviates from expectations. Participant 4's scores align closely with expectations for all traits.

From the table, it can be observed that openness, conscientiousness, and extroversion have the highest frequency of occurrence in both text and images. However, conscientiousness, agreeableness, and neuroticism have been noted with a very high proportion, all exceeding 75%. In terms of conclusions, the most significant deviation from expectations among the scores provided by the four participants is in the extroversion dimension. The ratings for openness, conscientiousness, agreeableness, and neuroticism from the four participants align closely with the expected values.

From this, it can be observed that the easier the description of the traits is to understand and observe, the closer the players' perception of the traits aligns with the expectations.

## 6.5 Statistical Significance Testing

We conducted t-tests to investigate the differences in perception of two characters among 25 participants. All five personality factors were involved. The results of the five dimensions are reported as p-values, and significance assessment was performed using the default alpha value of 0.05 in Excel. In other words, when the p-value is smaller than the significance level, it indicates a statistically significant difference between the means. The participants' scores ranged from a minimum of 3 to a maximum of 15. The scoring was based on the questions provided in Appendix A. Please refer to Appendix C for the specific data of 25 groups.

**Table 12** t-Test values

| Openness |       | Conscientiousness |       | Extroversion |       | Agreeableness |       | Neuroticism |       |
|----------|-------|-------------------|-------|--------------|-------|---------------|-------|-------------|-------|
| Elf      | Dwarf | Elf               | Dwarf | Elf          | Dwarf | Elf           | Dwarf | Elf         | Dwarf |
| Tails    | Type  | Tails             | Type  | Tails        | Type  | Tails         | Type  | Tails       | Type  |
| 2        | 1     | 2                 | 1     | 2            | 1     | 2             | 1     | 2           | 1     |
| p-value  |       | p-value           |       | p-value      |       | p-value       |       | p-value     |       |
| 0.004289 |       | <0.001            |       | <0.001       |       | 0.028855      |       | <0.001      |       |

The experimental results in Table 12 indicate that all five p-values are less than 0.05. This suggests that there is a statistically significant difference in the perception of the five personality traits between the two characters. According to the design intent of the experiment, the two characters have different levels of all five Big Five personality traits. This demonstrates that the design intent has achieved a certain degree of success, as participants perceived the differences in design intent and character personalities.

## 7 Analysis

### 7.1 Analysis of 6 Tasks

Firstly we will analyze the gaps between character personalities and player choices. From the evaluations of all participants, it can be concluded that the elf character is characterized by high openness, low conscientiousness, low extroversion, high agreeableness, and high neuroticism. On the other hand, the dwarf character is characterized by low openness, high conscientiousness, high extroversion, high agreeableness, and low neuroticism.

#### 7.1.1 Task1: protagonist's sidekick

Based on the conclusions we can draw from Task 1, it can be inferred that players prefer characters with high extroversion and agreeableness as sidekicks. If we assume "companion" can be understood as "the character the protagonist likes the most," there are significantly more participants who prefer the elf character over the dwarf character. According to the responses to the openness question at the end of the questionnaire, "In comparison, which character do you dislike the most? Why?" participants may dislike the elf character because her introversion makes it difficult for them to fully understand and communicate with her. Some even perceive her as not being fully developed or as having a superficially perfect yet empty personality. In contrast, the enthusiasm and talkativeness of the dwarf character are appreciated by many participants due to their high extroversion. Additionally, the caring nature of the dwarf character is mentioned, and participants appreciate the high agreeableness trait. Furthermore, according to the definition provided by Warpefelt and Verhagen (2015), they consider the "companion character" to be the protagonist's most unique character, which can be a sidekick or ally. Unlike other friends, this type of character often accompanies the protagonist for a long time. Their initial definition included the point that "the companion character is also controlled by the player." Although authors like Pretty et al. and Bouquet et al. (2021) have updated the definition in their experiments, stating that the player may not necessarily have control over the sidekick character, these researchers still agree on the aspect of "the continuous presence of companion characters throughout the game." Additionally, such characters usually provide the majority of social interactions for the player, including narrative-related dialogues and general conversations. Therefore, we believe that to design a character as a sidekick, it is advisable to arrange more interactions and dialogues between the character and the protagonist. Highly proactive dialogues and frequent interactions are also characteristics of extroversion and agreeableness. However, the stubbornness and lack of adaptability of the dwarf character are also disliked by many participants. In other words, players dislike characters with low openness. The neuroticism dimension was rarely analyzed by participants, and it remains unknown whether this aspect would affect their choices.

However, it is noteworthy that the strengths of the dwarf character did not make her more likable. Her low openness was mentioned most frequently in the responses to the openness question. Some even believe that compared to the surface-level introversion of the elf, the internally low openness of the dwarf makes it more difficult to trust and rely on each other. Therefore, openness significantly influences players' likability of the character.

### **7.1.2 Task2: protagonist's mentor**

In Task 2, the majority of participants chose the dwarf as their mentor. From the openness question, it can be inferred that high agreeableness and high conscientiousness are essential personality traits for players' mentors.

### **7.1.3 Task3: hidden antagonist**

In Task 3, the proportion of participants choosing the hidden antagonist is similar. In response to the openness question, some participants mentioned that it is difficult to get along with the dwarf character due to their "restraint." In other words, even when interacting well with the character, it is often challenging to truly understand their thoughts. Low neuroticism can make people feel uneasy. Therefore, low neuroticism may lead players to perceive the character as a hidden antagonist. Brose, Rye, Lutz-Zois, and Ross (2005) found a negative correlation between forgiveness and hope with neuroticism. MacDonald et al. (2008) and Neto et al. (2014) indicated a negative correlation between neuroticism and hope and courage. These theories all suggest a positive correlation between high neuroticism and low moral sense. This point may suggest that characters with high neuroticism are more likely to be identified as antagonists. However, NORONHA and CAMPOS (2018) argues that aside from individuals who are fragile, depressed, and anxious, people with high neuroticism can also be restrained and peaceful. Therefore, this point cannot be conclusively determined.

### **7.1.4 Task4/5/6: combat/collection/exploration missions**

Most participants chose to cooperate with the elf in Task 4 (combat task), while the majority chose to cooperate with the dwarf character in Task 5 (collection task). These two tasks are very specific events, and based on the analysis of the characters' strengths, the elf excels in combat missions, while the dwarf excels in mining tasks. In Task 6 (exploration task), where the understanding of "exploration task" is relatively vague, the proportion of choosing the two characters is almost equal. Additionally, both characters are temporary teammates in these three tasks. Therefore, it can be observed that personality has little influence on players' choices in temporary tasks.

## **7.2 Gap between Perceived Personality and Design Intention**

### **7.2.1 Perception of the Five Personality Traits at Different Levels**

In the process of participants perceiving the characters, we noticed that some levels of perceived personality did not align with the expected levels. Only conscientiousness and extroversion matched the expectations for both characters.

According to the findings of NORONHA and CAMPOS (2018), extroversion and agreeableness are the best predictors of personality strengths. The author suggests that these two traits together define interpersonal relationship experiences. In comparison to our experimental results, the conclusion regarding extroversion is consistent. Therefore, we believe that extroversion is the personality factor that is most easily perceived by players and has the smallest gap between design intent and perception. Following extroversion, conscientiousness, agreeableness, and openness are also significant factors. However, in our experiment, the results for neuroticism were not ideal, and we believe that this factor may contribute to the deviation between design intent and player perception.

### **7.2.2 The Reasons for the Gap.**

We first observed that ambiguously worded trait descriptions were not easily noticed. For example, in Table 10, neither of the two neuroticism trait descriptions attracted attention from the four participants because they were not very specific. However, participants accurately perceived neuroticism, indicating that there may have been a deviation in our trait descriptions, and they may have perceived neuroticism from other events. On the other hand, specific events allowed for specific perceptions. For example, in Table 11, the two instances of neuroticism, where the dwarf tolerated criticism from others, were accurately perceived by the participants.

During the experiment, we did indeed have some mistakes and shortcomings. Setting aside the issue of a relatively small number of participants, solely considering the experimental content, although we attempted to portray the characters as much as possible through text and images, they still appeared to be lacking in specificity and detail due to the time constraints of the questionnaire. By comparing Table 10 and Table 11 later on, we discovered that in our experiment, neuroticism was the most challenging trait to fully express. In other words, portraying the neurotic traits of the characters may require a longer duration and progression of events. There were even cases where deliberate narrative shaping still failed to be perceived. On the other hand, extroversion is almost immediately perceived by both the main character and NPC characters upon their first encounter. Furthermore, this trait continues to be consistently displayed by the NPC characters throughout the storyline, with a relatively high level of perceptual accuracy. The perception of conscientiousness, agreeableness, and openness in the characters tends to unfold as the events of the plot progress. They are not overly frequent, but their occurrence is not too infrequent either.

## 8 Conclusions

### 8.1 Summary

In conclusion, this paper explores the relationship between NPC personality and game tasks based on the Big Five personality theory. As the designers of the characters, we utilized the Big Five personality model and the three components of character construction (Psychological/Physiology/Sociology) to design the characters. Throughout this process, we have discovered certain characteristics and challenges in character design, as well as the existence of discrepancies between design intentions and the actual design outcomes.

Based on the main research question "How does the perceived personality traits affect a player's choice of non-player characters?" several notable experimental conclusions can be drawn as follows:

- (1) Players prefer characters with high extroversion and agreeableness as their sidekicks. Conversely, characters with low openness traits are less favored by players.
- (2) When choosing their mentors, players tend to prefer characters with high agreeableness and conscientiousness.
- (3) Characters with higher neuroticism traits may be perceived as hidden antagonists.
- (4) In selecting temporary teammates for cooperation, players often prioritize the characters' abilities and strengths rather than their personalities.

Based on the deviations observed in the experimental results:

- (1) Participants' perception of dwarf characters closely aligns with their expectations, while there is a discrepancy in their perception of elf characters.
- (2) Extroversion is the personality trait that is most easily accurately perceived.
- (3) Conscientiousness, agreeableness, and openness are relatively easy to perceive.
- (4) Neuroticism is more difficult for players to perceive.

The three questions in the "Problem" section:

Q1: How can character design effectively reflect the intended design of the character?

When designers aim for characters to be perceived more prominently, there are several approaches: 1) Use more specific and accurate wording to describe the character's traits. 2) Repeat the description of a particular trait. 3) Increase the character's screen time.

Q2: How do participants perceive the character's personality?

In our designed experiment, participants perceive characters through text and character images. They are able to perceive the characters' appearance, speech, and behavior, among other aspects. We aim for them to closely resemble the characters in the game as much as possible.

Q3: What personality types of characters do participants prefer in different types of tasks?

Based on the experimental results, we have summarized the conclusion of this issue in Chapter 7.1. It documented the choices of participants across six tasks.

Furthermore, a more concise conclusion has been summarized in this chapter. Please refer to the response to the question "How does the perceived personality traits affect a player's choice of non-player characters?" for more details. Please refer to the response given earlier regarding the question "How does the perceived personality traits affect a player's choice of non-player characters?"

## 8.2 Limitations

Regarding our experiment, there are still some limitations. Firstly, one limitation lies in the discrepancy between design intentions and player perceptions. We believe that the essence of the two characters is based on the existence of text and images, which symbolize the actual process of interacting with the characters in the game. Players perceive the characters through the text, while design intentions are merely supported by the text and images that shape the characters. In other words, there is a distance between design intentions and the text/images that bring the characters to life. Therefore, it is difficult to determine whether the players' perception is closer to the actual characters or if the design intentions are closer to the actual characters. It is not appropriate to solely judge the players' perception based on design intentions. We need a more reasonable and fair method for character design or evaluation.

Secondly, we used the Big Five personality model as the instrument for our study. Currently, this model is widely used and considered to provide a relatively comprehensive assessment of personality. However, there is an inevitable gap between game characters and real individuals. We believe it is worth exploring whether there are better measurement standards that allow participants to record their perceptions of the characters. This could help us overcome the limitations of relying solely on the Big Five personality model in evaluating game characters.

No reliable conclusions have been reached regarding the influence of the order in which the characters appeared on perception. According to the judgments of the participants in Table 6 and Table 7, the values assigned to the Dwarf character were generally higher than those assigned to the Elf character. However, there is an issue of imbalance in the number of participants between the two groups, with one group consisting of 16 individuals and the other group consisting of only 9 individuals. We also raise the question of whether the exposure to a certain type of personality beforehand could potentially influence the participants' perception on a psychological level.

## 8.3 Discussion and Future Work

The issue of how the Big Five personality traits influence the choices of game players has proven to be challenging to address. This is precisely why we embarked on this research. Our experiment aimed to explore the clues players perceive in characters and design character development based on the Big Five personality traits. As discussed earlier, all of this was done to establish a connection between characters and events. In other words, we sought to understand how the same player, influenced by different character personalities in various events, would make judgments about the events after interacting with the characters.

In our future research, we can delve deeper into any of the three aspects: NPC character design, event design, and detailed design of NPC interactions. Regarding interaction design,



Sheldon (2012) suggests that characters can be divided into supporting roles and major roles. In a game, players often pass by less important characters, so only their appearance needs to be presented. Therefore, an in-depth research question would be to determine which aspects of the three components are more important for characters at different levels. For example, for a character involved in regular transactions, only clothing design (physiology) that makes the character easily recognizable may be sufficient. Alternatively, for two characters engaged in the same business, if their physiology remains the same, increasing the sociological aspect of design could indicate which character may hold a hidden secret, leading players to make different choices. Such design considerations can save production costs while maintaining the game's style.

Furthermore, a longitudinal comparison of character roles can be analyzed in conjunction with specific game genres. Different games require different types of characters, and if a game focuses too much on character development, it may result in prolonged gameplay and detract from the overall experience. However, for the majority of games, character development serves as a means to enrich the gaming experience and will continue to grow in importance in the future.

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# Appendix A -

## The instrument of character personality evaluation

1 disagree 5 agree

### **Openness**

1. The character is someone who is fascinated by art, music, or literature
2. The character is someone who has much creativity
3. The character is someone who is complex and a deep thinker

### **Conscientiousness**

1. The character is someone who is dominant, acts as a leader
2. The character is someone who doesn't have difficulty getting started on tasks
3. The character is someone who is reliable and can always be counted on

### **Extroversion**

1. The character is someone who is outgoing and sociable
2. The character is someone who is full of energy
3. The character is someone who is more active than other people

### **Agreeableness**

1. The character is someone who is compassionate and has a soft heart
2. The character is someone who is respectful, treats others with respect
3. The character is someone who assumes the best of people

### **Neuroticism**

1. The character is someone who worries a lot
2. The character is someone who tends to feel depressed and blue
3. The character is someone who is temperamental and gets emotional easily

## Appendix B -

### Personality Evaluation of 2 Original Characters

Hello! I am Anran Bao. This is a survey about the perceived personality traits of characters (NPCs) in games. The survey is divided into three parts, and it is recommended that it takes no more than 20 minutes to complete. The survey data will be collected and analyzed in my thesis, and will not be used for any other purposes. This survey is anonymous and based on the principle of voluntary participation, and all personal information of the participants will be kept confidential. Only I have access to and can use the survey responses. If you agree to the above conditions, then please continue. Thank you for your participation!

#### Character 01

This is a virtual adventure game. You are a player in the game. One afternoon, you arrived at a lively town. Passersby told you that the tavern had a bulletin board for commission tasks, and pointed out the way to the tavern for you. When you arrived at the tavern, the front of the bulletin board was crowded with people. The bartender told you that there would be fewer people in front of the bulletin board at night. But the bartender suggested that you should go now, as the simple and high-paying tasks would be taken by others before nightfall.

At this point, you noticed that everyone was pushing toward the bulletin board, except for a character sitting farthest away from the crowd. She was drinking a bottle of pink juice alone. Although she was wearing a big hood, she was slim and not tall, and you could tell she was a female. She had a sword with her and looked like an adventurer as well. Out of curiosity, you went over to talk to her.

"Hello! May I ask why you don't go and check the bulletin board? The good tasks will be taken by others soon," you said.

The girl shrank a bit after hearing this, and it took her a long time to slowly raise her head. She looked at you with a nervous look, quickly glanced at you, then looked away, stuttering, "Um... excuse me, are you talking to me?"

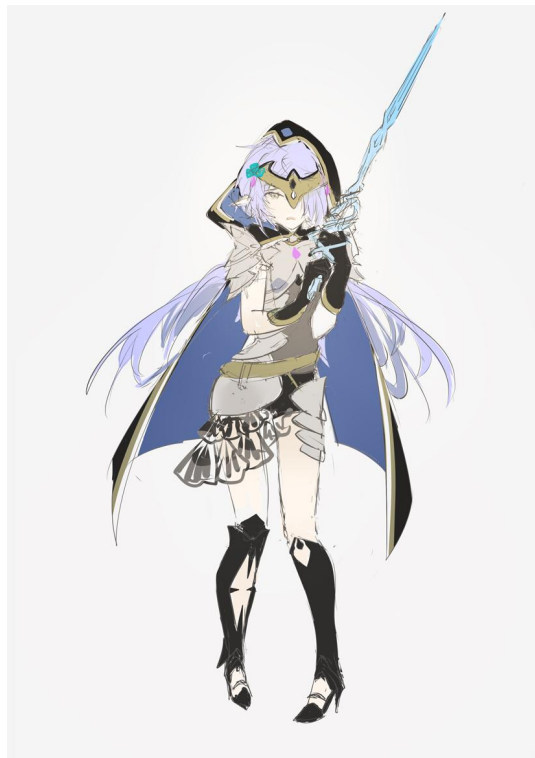
You saw that she was a young and cute elf girl with purple hair and golden eyes. She was wearing some expensive-looking armor. But unlike other elves, there were no traditional religious patterns from the elf on her clothes. Her pointed ears drooped without any spirit, and she seemed a little nervous and uneasy because someone was talking to her. You asked her why she didn't take the commission. She said that there were too many people on the bulletin board side and she wanted to wait until night. You were worried that the task she took on would be too difficult for her to solve alone, so you offered to cooperate. You both waited at the tavern until night, during which the girl muttered to herself with her head down. You didn't know what she was thinking. Finally, you received a task and agreed to set off together the next morning.

The next day, you waited at the agreed location until noon, when the girl appeared. You chose to be a little angry and mock her for oversleeping often. She didn't deny it and kept apologizing. Then you went to the forest to perform the task. You were very confused with the brand new map given by the employer and almost got lost. The girl didn't blame you and kindly helped you. She took the map and looked at it for a few minutes, and then easily found the location of the task for you. You were amazed at the girl's knowledge.

Not long after, the monsters described in the mission appeared and you fought alongside the girl. The girl wielded a blue ice sword and was agile enough to dodge the monster's attacks and unleash

ice magic with her sword. You realized your worries about her abilities and safety were unnecessary, as you found yourself unable to keep up with her level of skill. However, she perfectly complemented your attacks and didn't just focus on her own offense. In the end, you defeated the monster, and then you both had to dissect its body. The girl didn't join you in the dissection, instead sitting to the side, constantly frowning and covering her nose. You thought it wasn't fair, but didn't complain to her. She watched your clumsy dissection techniques for a while, then reluctantly said, "Let me do it." Her dissection skills were as good as her combat skills. After completing the task, she packed the mission items into her backpack. When she opened it, you noticed that there were many shiny mementos inside, but none of them related to elves. You knew that most elves were very devout in their religion, so you asked the girl about it. Her expression turned despondent, and after thinking for a while, she answered, "I... ran away from home. I don't want to spend my whole life reciting prayers."

Not long after, you traveled to another place and talked to an old man, who unexpectedly knew the elf girl. He used to be her swordsmanship teacher. He said that when he first met her, she didn't know anything about swordsmanship. But she was interested in it and learned quickly. Gradually, she gained some fame because of her swordsmanship skills. Initially, she accepted an invitation to be a guard in the palace. The old man told you that the girl was born into a wealthy noble family, but she seemed to really enjoy the life of humans. So last year, she quit her job and began a difficult journey of exploration and adventure to learn and understand more about the human world.



1. The character is someone who worries a lot

disagree 10 20 30 40 50 agree

2. The character is someone who is compassionate and has a soft heart

disagree 10 20 30 40 50 agree

3. The character is someone who is outgoing and sociable

|     |   |    |    |    |    |    |       |
|-----|---|----|----|----|----|----|-------|
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 4.  | The character is someone who is dominant,acts as a leader                     |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 5.  | The character is someone who is fascinated by art, music, or literature       |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 6.  | The character is someone who tends to feel depressed and blue                 |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 7.  | The character is someone who is respectful, treats others with respect        |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 8.  | The character is someone who is full of energy                                |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 9.  | The character is someone who doesn't have difficulty getting started on tasks |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 10. | The character is someone who has much creativity                              |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 11. | The character is someone who is temperamental and gets emotional easily       |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 12. | The character is someone who assumes the best of people                       |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 13. | The character is someone who is more active than other people                 |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 14. | The character is someone who is reliable and can always be counted on         |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |
| 15. | The character is someone who is complex and a deep thinker                    |    |    |    |    |    |       |
|     | disagree  | 10 | 20 | 30 | 40 | 50 | agree |

### Character 02

This is a virtual adventure game and you are an adventurer. One day, you went to a ore cave for investigation. You were not very familiar with the terrain of the cave, and your fighting skill was not strong, so you were not very confident about this mission. During the investigation, you encountered several other adventurers who came to explore the cave. Most of them were also not familiar with the terrain of the cave. Unexpectedly, during the fight with monsters, an earthquake

occurred and caused a collapse. The passage in the cave was disrupted, and your group got lost.

Just when you were trapped in the cave, you encountered a group of dwarves. They appeared from a cave on the other side. The leader was a typical dwarf girl, holding an iron shovel, with a strong accent, not very clean, and no different from the dwarves you had seen before. She was surrounded by other dwarf girls who seemed to respect and adore her very much. Seeing your embarrassed appearance, she showed concern and offered to help you very enthusiastically. She said she had been working in the ore cave since she was born and was very familiar with this kind of work. Because someone in your group was injured by a monster, she took out medicine to treat you. You found that she used very traditional dwarf medicine, which was no longer used outside because of its low efficacy and strong smell. So, someone started to complain about this medicine and had some criticisms of the dwarf race. The girl was a bit unhappy but didn't argue and still calmly gave you good medicine.

At night, she led other dwarves to prepare a rich meal for you and lit a bonfire, inviting everyone to have a party together. At first, you were a bit silent, but she was very talkative and always told funny jokes. You quickly became active. You knew that she was good at taking care of others because she had to take care of her five siblings since she was young. Because of her treatment, your mental state was pretty good that night. The next day when you woke up, the girl suggested to be your guide and most of you agreed to this decision. So you followed her to move forward in the cave. However, you soon encountered a problem. At a fork in the road, the girl relied on her experience and feelings to go in one direction, but you found that the mark on the map pointed to the other side. So, you raised this question, and found that the marks of the other map holders were the same as yours. When you asked the girl about it, she replied without thinking:

"Why bother to ask? Your map must be wrong."

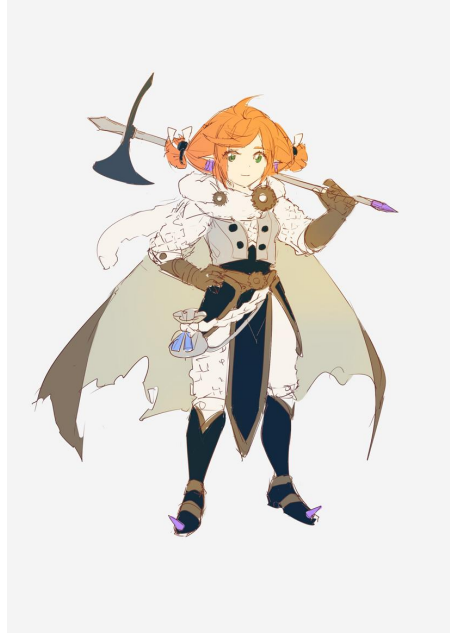
But this map was issued by a world-famous map-maker. When you explained this to her, she appeared a bit confused but insisted that her choice was correct. Other dwarves also unanimously recognized their leader and claimed that the girl had never gotten lost. You had a debate for a while. The other dwarves were very angry, thinking that you were ignoring the girl's goodwill. The girl was a bit unhappy at first, but then said more candidly:

"Okay, then follow your map."

So she followed you to protect you and let other dwarves take another route. After walking for a while, you unexpectedly met other dwarves at a fork in the road. It was then that you realized that both paths led to the same place. Your companions mocked the girl's leadership skills. The girl seemed a bit surprised but ultimately didn't get angry.

A few days later, you successfully completed the mission and collected a lot of supplies. When distributing the supplies, the girl took almost nothing and generously left most of the items to you. You found some herbs with better medicinal effects for the girl, but she refused them as she didn't really trust these unfamiliar herbs. As you were about to part ways, you asked the girl about her plans for the future. She told you that she needed to go back and continue running her family's shop to provide financial support for her younger siblings' education. She enthusiastically recommended her family's remodeling shop and left you a discount coupon, inviting you to experience the dwarves' refurbishing techniques in the future.





1. The character is someone who worries a lot

disagree 10 20 30 40 50 agree

2. The character is someone who is compassionate and has a soft heart

disagree 10 20 30 40 50 agree

3. The character is someone who is outgoing and sociable

disagree 10 20 30 40 50 agree

4. The character is someone who is dominant, acts as a leader

disagree 10 20 30 40 50 agree

5. The character is someone who is fascinated by art, music, or literature

disagree 10 20 30 40 50 agree

6. The character is someone who tends to feel depressed and blue

disagree 10 20 30 40 50 agree

7. The character is someone who is respectful, treats others with respect

disagree 10 20 30 40 50 agree

8. The character is someone who is full of energy

disagree 10 20 30 40 50 agree

9. The character is someone who doesn't have difficulty getting started on tasks

disagree 10 20 30 40 50 agree

10. The character is someone who has much creativity

disagree 1○ 2○ 3○ 4○ 5○ agree

11. The character is someone who is temperamental and gets emotional easily

disagree 1○ 2○ 3○ 4○ 5○ agree

12. The character is someone who assumes the best of people

disagree 1○ 2○ 3○ 4○ 5○ agree

13. The character is someone who is more active than other people

disagree 1○ 2○ 3○ 4○ 5○ agree

14. The character is someone who is reliable and can always be counted on

disagree 1○ 2○ 3○ 4○ 5○ agree

15. The character is someone who is complex and a deep thinker

disagree 1○ 2○ 3○ 4○ 5○ agree

### 'How would you use this character in a game?'

Here are some imaginary game tasks we provide. Based on the two characters provided above, please choose your preferred cooperative partner for each game task. Finally, you can discuss some opinions about the two characters.

1. The protagonist's sidekick and partner in all tasks

character elf○ character dwarf○

2. The protagonist's mentor at the beginning of the game

character elf○ character dwarf○

3. The hidden antagonist in the game

character elf○ character dwarf○

4. The teammate in combat missions

character elf○ character dwarf○

5. The teammate in collection missions

character elf○ character dwarf○

6. The teammate in exploration missions

character elf○ character dwarf○

7. In comparison, which character do you dislike the most? Why?

# Appendix C -

| t-Test values |          |       |                   |       |              |       |               |       |             |       |
|---------------|----------|-------|-------------------|-------|--------------|-------|---------------|-------|-------------|-------|
|               | Openness |       | Conscientiousness |       | Extroversion |       | Agreeableness |       | Neuroticism |       |
|               | Elf      | Dwarf | Elf               | Dwarf | Elf          | Dwarf | Elf           | Dwarf | Elf         | Dwarf |
| p1            | 10       | 4     | 8                 | 10    | 9            | 10    | 12            | 13    | 10          | 9     |
| p2            | 7        | 11    | 10                | 10    | 12           | 10    | 9             | 4     | 9           | 5     |
| p3            | 4        | 4     | 7                 | 13    | 5            | 13    | 10            | 12    | 7           | 3     |
| p4            | 6        | 3     | 9                 | 11    | 6            | 14    | 7             | 12    | 10          | 3     |
| p5            | 12       | 3     | 4                 | 15    | 5            | 15    | 14            | 14    | 10          | 8     |
| p6            | 9        | 7     | 9                 | 12    | 6            | 11    | 11            | 12    | 13          | 6     |
| p7            | 9        | 9     | 8                 | 10    | 6            | 9     | 9             | 10    | 7           | 8     |
| p8            | 9        | 5     | 7                 | 12    | 8            | 13    | 12            | 12    | 8           | 12    |
| p9            | 9        | 7     | 8                 | 8     | 5            | 6     | 10            | 11    | 8           | 11    |
| p10           | 12       | 9     | 10                | 10    | 10           | 7     | 10            | 10    | 12          | 11    |
| p11           | 8        | 9     | 8                 | 11    | 6            | 12    | 14            | 14    | 11          | 5     |
| p12           | 13       | 8     | 6                 | 10    | 4            | 6     | 11            | 9     | 14          | 12    |
| p13           | 10       | 12    | 8                 | 11    | 7            | 14    | 11            | 11    | 8           | 6     |
| p14           | 8        | 12    | 7                 | 14    | 7            | 11    | 11            | 11    | 15          | 7     |
| p15           | 10       | 6     | 5                 | 10    | 6            | 12    | 9             | 14    | 10          | 5     |
| p16           | 10       | 3     | 8                 | 10    | 5            | 14    | 12            | 12    | 10          | 8     |
| p17           | 12       | 5     | 8                 | 14    | 3            | 9     | 11            | 12    | 10          | 6     |
| p18           | 9        | 7     | 9                 | 11    | 9            | 12    | 9             | 11    | 9           | 6     |
| p19           | 12       | 11    | 6                 | 12    | 6            | 6     | 9             | 13    | 13          | 11    |
| p20           | 9        | 6     | 7                 | 10    | 7            | 13    | 12            | 12    | 8           | 12    |
| p21           | 13       | 10    | 7                 | 7     | 3            | 11    | 7             | 14    | 15          | 7     |
| p22           | 12       | 6     | 6                 | 8     | 3            | 14    | 11            | 10    | 14          | 6     |
| p23           | 8        | 8     | 11                | 13    | 7            | 15    | 11            | 15    | 13          | 5     |
| p24           | 3        | 3     | 3                 | 7     | 4            | 15    | 10            | 13    | 10          | 7     |
| p25           | 9        | 11    | 9                 | 11    | 8            | 12    | 10            | 10    | 7           | 6     |
|               | Tails    | Type  | Tails             | Type  | Tails        | Type  | Tails         | Type  | Tails       | Type  |
|               | 2        | 1     | 2                 | 1     | 2            | 1     | 2             | 1     | 2           | 1     |
|               | p-value  |       | p-value           |       | p-value      |       | p-value       |       | p-value     |       |
|               | 0.004289 |       | <0.001            |       | <0.001       |       | 0.028855      |       | <0.001      |       |