Exploring Tailored In-Game Support Tools for Player Mood Repair Facing Negative Affect

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1 ABSTRACT

This study investigates the effectiveness of a personalized support system within a First-Person Shooter (FPS) game, designed to mitigate negative affect induced by intentionally frustrating gameplay. The game is developed using the Unity engine and incorporates a flying robot, a character companion, that provides emotional support. Two versions of the companion were implemented: one non-personalized with predefined events, and the other personalized based on the Big Five personality traits. An online mixed-method AB test experiment was conducted to evaluate and compare these versions, with 15 participants providing data on demographics, personality traits, and affective state pre- and post-gameplay. Results indicate that the personalized companion effectively stabilized players' moods, while the non-personalized version was associated with higher negative affect. Notably, a correlation was found between FPS proficiency and negative affect in the non-personalized group. The study also explored personality traits' susceptibility to emotional support strategies, finding correlations for Conscientiousness and Emotional Stability but not for Extraversion, Agreeableness, and Openness. These findings highlight the potential of personalized emotional support to enhance player mood, suggesting avenues for further research involving other personality models and game genres.

2 INTRODUCTION

Games are considered a medium with the potential to evoke complex emotions in players both positive and negative. Although most research focuses on positive emotions and links this phenomenon to fun, enjoyment, and good player experience, [8, 35, 50, 52, 75] the research on negative emotions are often overlooked. Negative affective gaming experiences are far less researched, as they are seemingly at odds with the focus on fun [50], positive affect and enjoyment [56]. Despite the scarcity of research on negative gaming affect, findings highlight its positive impact on player experience. Players reported appreciation for experiencing negatively valenced emotions, such as sadness [9]. However, there is limited research on the dark side of the negative affect in video games.

Studies show that players, who listed Massive Online Battle Arena (MOBA) games as their favourite genre, experienced less positive affect and more frustration compared to players of other game genres [44]. This is concerning especially since frustration has been linked to toxicity in previous studies [86]. Toxicity is a common term related to MOBA games

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with 83% of gamers reporting experiencing harassment [2]. As a consequence of being a victim of toxicity, players may experience psychological and emotional problems such as anxiety and low self-esteem [26, 29].

Additionally, even though the literature suggests that players often value negative emotional experiences [10, 20, 45], they might still experience emotional discomfort. For instance, the study on Walking Dead: Season 1, argues that players may not only witness traumatic events but can also inflict trauma on those around them [77]. However, it is unclear whether players themselves experience such instances as personally traumatic. To process these intense emotions and experiences, players often need time and distance from the game at the risk of jeopardizing engagement [37]. However, we argue that such intense negative emotions should not left untended. Especially in a world where mental health is worsening, [92] specifically for young adults and college students [41] who are the majority of the audience in games [89]. Therefore, providing proper emotional support to players while facing negative emotional experiences and regulating the emotional discomfort is vital.

This study focuses on providing personalized in-game emotional support when players deal with negative affect such as frustration. A First Person Shooter (FPS) game is selected to conduct this study for various reasons. Firstly, FPS games have been subject to various game research such as VR [58], social studies [69], and even prove to be beneficial in increasing the visual focus of players [4]. Similar studies have also utilized FPS games to regulate emotions during gameplay [93]. Employing a first-person perspective allows more direct interaction with the environment, intensifying the players' emotions. FPS games also ensure fast-paced high-stakes scenarios that heighten players' emotional states, which can amplify both positive and negative affect. As a result, FPS games are ideal candidates for this study where emotions and affective state are the focus. Therefore, an FPS game is developed following a doctor in a patient's body tasked to eliminate all the viruses to save the patient. A character companion accompanies the protagonist, providing gameplay and personalized emotional support. The gameplay is intentionally designed and balanced to be frustrating to enforce negative affect. The goal is to discover whether the personalized emotional support from the character companion effectively reduces negative affect and ensures increased positive affect compared to a non-personalized companion.

The participants first will undergo one demographic questionnaire, including their gender, age, gaming frequency and FPS proficiency, and another two questionnaires to acquire their personality and measure their affective states before the gameplay session. For the gameplay session, participants are equally divided into two groups A and B. Group A experiences the game with the character companion that provides gameplay and emotional support however, the emotional support for group A is not personalized and is predefined. Group B experiences the game in the same setting as group A, with one extra condition in which the emotional support is personalized based on the result of the personality trait test. Afterwards, the affective state of both groups is measured followed by a couple of qualitative questions. Since this study might impose a negative affect due to the frustrating nature of the game, proper emotional support resources are provided at the end of the questionnaire to regulate any psychological harm.

To analyze the result, the change in the affect level before and after the gameplay session is measured per participant. Afterwards, the change in affect level for participants in group A is compared to group B. The hypothesis is that group B with personalized emotional support should experience a heightened positive affect and lessened negative affect, compared to group A with no personalized emotional support.

3 RELATED WORK

This research project delves into several subjects and combines them with game research. Each subject is outlined in the following sections along with pertinent recent developments. These sections are subsequently followed by a research motivation, an overview of the methodology, data analysis, a discussion and a conclusion.

3.1 Negative Affect in Games

Emotions are often a key component of media experience with games as no exception [6, 21, 83]. Emotions were evoked by various interactive and non-interactive game aspects, such as in-game loss, character attachment and (lack of) agency, but also personal memories, and were often accompanied by (self-)reflection. Affect is a state and can be positive or negative. Positive affect relates to joy, high energy, and enthusiasm whereas negative affect refers to distress, anger or fear [88]. Both the literature in games and the games themselves, often focus on promoting positive emotions and affect to maximize fun and enjoyment [8, 56]. Yet, research on negative emotions and affect in games is relatively scarce as they are at odds with positive affect. Surprisingly, studies show that negative affect may also contribute to player engagement [8, 15, 59] with one study showing negative affect was valued as more meaningful than fun game experiences [61].

Research on serious games suggests that promoting emotionally challenging game experiences in such context potentially stimulates reflection, raises awareness of real-world issues [40], and facilitates prosocial behavior [80]. A study for instance evaluated serious game experience in a game that promotes reflection on human error and blame culture in the healthcare domain. They discovered that the most impactful game resonated with players for days afterwards [40].

Research on multiplayer games suggests that players experience more negative affect and frustration compared to other types of games [44]. A study investigating DayZ, a zombie survival game, discovered that players associate the permanent death of a character with a frustrating experience that is a necessary part of the game being an enjoyable experience [3]. Another study argues that frustration is essential to "hard fun" once players master a game challenge [50]. For instance, “Super Meat Boy” (Team Meat, 2010) and the Dark Souls series are both known for frustrating gameplay and crushing difficulty curves that are yet popular and receive positive reviews from players. Another study refers to this type of frustration as positive, motivating players to engage more with the game [57].

However, frustration is not the only negative emotion that has been explored in the literature. In the case of DayZ, the ability to attack others even when they are not threatening, and the permadeath, results in feelings of guilt and regret. Other works suggest that sadness is the most frequently reported emotion as a result of losing a character in a game [9]. Other studies looked into various types of abusive game designs aiming to promote feelings of discomfort and even expose players to physical pain [91]. Findings of [9] argue that these negative emotions can support a positive gaming experience for players.

The literature above suggests the positive impact of negative affect such as frustration on player enjoyment. However, there is a gap in exploring the dark side of such intense emotions. Too much frustration has been linked to one of the theories leading to toxic behavior in online multiplayer games. This phenomenon has been named *tilting* as a result of making many mistakes inside the game and repeatedly losing a match [86]. Toxicity is a common term in MOBA games and is considered an umbrella term used to describe various types of negative behaviors including harassment, flaming, trolling (e.g. gaining enjoyment from intentionally annoying other players), and cheating during games [1]. Even though it is considered to be a short-term effect, consistent exposure to toxic behavior in gaming can lead to psychological

and emotional issues for players, such as anxiety and diminished self-esteem [29, 47]. This type of frustration is called negative frustration or disheartening frustration which motivates players to disengage from the game [57]. For the sake of this study, it is important to differentiate between positive and negative frustration. The focus of this study is to provide emotional support for negative frustration which leads to a negative affective state. This type of frustration results from unbalanced design as often seen in multiplayer games when the challenge is way beyond the player's capabilities and the opponent has much greater skill [87].

On a more general overview, other types of games could also incorporate abusive game design and themes leading to intense emotions and negative affective states such as the case in Walking Dead: Season 1 and DayZ. This might lead to a phenomenon called emotional discomfort. According to [37] emotional discomfort results from uncertainty in high-pressure environments (creating anxiety and fear); when things do not go as planned (leading to frustration and feeling foolish); being provided with much responsibility but limited choices (creating anxiety and guilt), the tragedy of losing an in-game character (resulting in sadness and helplessness) and unwanted exposure to disturbing themes (leading to disgust and nausea). Players often distance themselves from the game and take time to process such negative emotions. However, considering the constant global worsening of mental health [92] this is not the optimal solution and it would be beneficial to explore emotional support strategies.

3.2 Emotional Support

When facing difficult situations, individuals seek support from their social circle. Social support is a critical resource for dealing with stressful situations [19, 84]. [22] has categorized social support into the following aspects based on the required support type in a certain situation. *Informational support*, one helps another comprehend a situation or recommends resources or coping strategies. *Instrumental support*, tangible assistance, and *emotional support*, verbal or non-verbal gestures assuring individuals they are cherished, cared for, respected, and appreciated [18].

Although social support interventions can be generally beneficial, determining the most effective methods for a specific situation is not always straightforward [39]. Moreover, individuals may respond differently to the same support strategies depending on external factors such as gender [17] or experience level [64]. This study focuses mostly on providing personalized emotional support and evaluating its impact on individuals' affective states. Emotional support serves as a type of communication assisting individuals in dealing with negative emotions [13]. It is specifically designed to cope with stressful situations encompassing feelings of appreciation, encouragement and care for [14, 85].

Several researchers have developed emotional support systems that reduce negative affect [46, 60, 67]. Moreover, research has demonstrated that emotional support enhances user satisfaction and system appeal, significantly influencing emotions [12, 46, 60, 62, 67]. Receiving suitable emotional support enhances an individual's self-esteem, sense of identity [13], and coping abilities [81], and is associated with various health advantages [34, 38, 68, 90]. Existing literature in game research regarding emotional support also focuses on emotion regulation in esports and coping strategies that players use [7, 48]. Some literature also explores direct intervention systems that provide in-game support [70].

Previous research on designing digital emotional support tools mostly focused on therapeutic intervention and often included empathic communication [28, 51, 66, 82]. These methods often rely on Natural Language Processing and lack functionality in distinguishing between various support types. Previous studies have explored how individuals adapt emotional support to others to shed light on how digital emotional support tools could be adapted. Personality has been proven to be effective in determining the type and quantity of emotional support. Precisely, personality traits impact the delivery and reception of emotional support [23, 24, 78]. Research also discovered that people adapt support type based on culture, context and situation as well [76].

In summary, these studies demonstrate how individual and contextual factors impact the type and quantity of emotional support messages. However, providing emotional support in a video game context has not been fully explored yet. Therefore, this study looks into offering this type of social support to individuals when they experience a negative affect state in a gameplay session and measures the impact of such support on their affective state.

3.3 Personality

In providing a personalized experience, delving into each participant's personality is essential. Every individual is unique in qualities and tendencies that influence their response to the environment and the situation and consequently determine the type of support they require given the circumstances. Some may seek practical advice, while others may find comfort in empathetic and reassuring words. Therefore, personality factors should be considered when providing tailored emotional support. Personality is a complex phenomenon with various theories and methods to measure and categorize it [5, 73] [71]. This study looks into trait models, specifically the Big Five Model for several reasons. This theory suggests that traits evolve over a person's life yet remain stable in dealing with different circumstances [79]. It is a recognized robust model [27, 53] with the potential mapping into other existing theories [27, 42].

Moreover, recent studies in various fields including game research demonstrate a general trend in using the Big Five Model. Existing research has utilized the Big Five Model to explore the identification of sub-groups of players who are susceptible to the potential negative effects of a game [43], links between preferred game genres and personality types [63], the relationships between personality traits and performance [54] personality portrayed as a coping strategy to deal with negative situations within a game [65], and interrelations between personality and gaming disorder [33].

For these reasons, the Big Five remains a suitable theoretical tool to understand player personality. This is particularly suitable for the present study as we examine the impact of tailored emotional support when dealing with negative situations in a game.

For the sake of this study, the following terms and definitions [42] of the Big Five Model are adapted:

(1) **Extraversion**: How talkative, assertive and energetic a person is.
(2) **Agreeableness**: How good-natured, cooperative and trustful a person is.
(3) **Conscientiousness**: How orderly, responsible and dependable a person is.
(4) **Emotional Stability (vs *neuroticism*)**: How calm, non-neurotic and imperturable a person is.
(5) **Openness to Experience**: How intellectual, imaginative and independent-minded a person is.

Personality has also been linked to emotions in several studies as well. According to [30], emotions constitute part of personality traits. A study by [74], exhibits links between The Big Five model with Extraversion and positive affect and neuroticism with negative affect. As a final remark, personality has proved to be a suitable predictor of affective state, especially when combined with performance metrics [72].

4 RESEARCH MOTIVATION

The gap in providing personalized emotional support using in-game support tools in game research is apparent in the literature presented in the previous section. Although some studies attempted to provide such support, their approach lacked personalization, potentially limiting its effectiveness. In this study, we aim to fill this gap by designing a character companion equipped with emotional support tools and a personalisation approach.

4.1 Hypothesis and Research Question

Providing emotional support has proved to be effective in reducing negative affect both in game research and other literature. However, using a personalized approach has not been fully explored yet. Since every individual is unique, it is vital to discover the most effective type of emotional support per individual to provide tailored emotional support.

This study aims to achieve tailored emotional support by conducting a personality trait test and passing the test result to the in-game character companion to decide which emotional support type is effective per individual. To measure the impact of this personalized approach, A/B testing will be performed. Group A would experience the game without tailored support, and Group B would have personalized emotional support. Participants' affect will be measured post-session using a questionnaire.

The hypothesis is that participants from Group B (personalized support) would experience a more positive affect with reduced negative affectpost-gameplay compare to participants from Group A. Based on this our research question is outlined as:

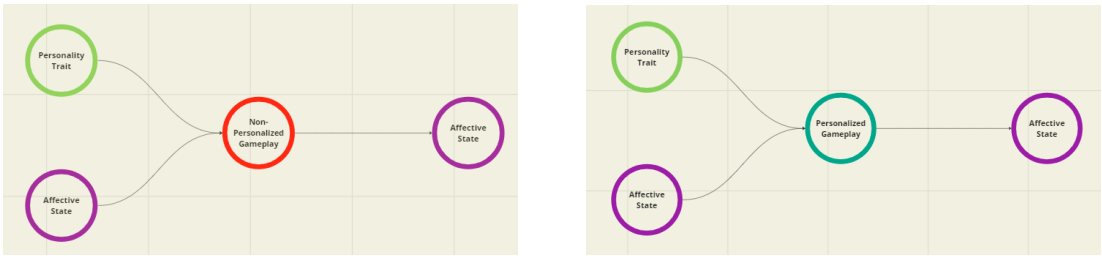
(1) What is the effectiveness of personalized emotional support provided by a character companion in reducing negative affective states, during gameplay compared to non-personalized support?
(2) How do individual differences in personality traits influence the effectiveness of personalized emotional support in reducing negative affect and enhancing positive affect during gameplay?

This study aims to address these questions by conducting an empirical study. The method to acquire answers is explained in detail in the following section.

5 METHODOLOGY

5.1 Study Design

At first, participants fill out a demographic questionnaire including, age, gender, gaming frequency, and FPS proficiency. Later correlation analysis will be conducted for each aforementioned variable to ensure the validity of the result. Each participant will perform the personality trait test of the Big Five Model. To ensure reliable data, participants' affective states are measured before and after the gameplay session. Therefore, after filling out the Big Five Model questionnaire, participants are asked to fill out another questionnaire to measure their affective state. To evaluate the impact of the character companion on participants' affective state, participants are divided into groups A and B. Both groups will play the game, however, group A will experience the game with the non-personalized features and group B will experience the game with the personalized features. Finally, participants will be asked to fill out another affective state questionnaire post-gameplay session following up by a couple of qualitative questions. This study is designed to be executed fully online, therefore, the game presented in this paper has been exported for WebGL and included in the online questionnaire developed by Qualtrics.



(a) Group A: Non-personalized approach

(b) Group B: Personalized approach

Fig. 1. Study design with A/B testing personalized and non-personalized approach in providing emotional support strategies.

5.2 Personality Traits

In this study, we strive to provide tailored emotional support during a negative gaming experience. To employ a personalized approach, each participant's personality trait should be identified and provide emotional support accordingly. The literature on emotional support and game research mainly uses the Big Five Model. In this study, the Big Five Model is adapted to the gaming context as a recognized robust model in similar research directions. As mentioned before, the terms and definitions in section 3.3 are utilized for this study.

Various questionnaires and measurements exist to evaluate the aforementioned traits, however, for the sake of simplicity and time, TIPI (Ten Item Personality Inventory) measurement is selected for this study. TIPI is a very brief measure of the Big Five Model with 10 items and a straightforward scoring system. It is practical due to its brief nature and is less time-consuming compared to the existing measurements [36]. TIPI results are percentages per personality trait and do not have a single answer to categorize individuals into. In the implementation section, we strive to personalize the companion according to these varying percentages. This questionnaire is implemented by Qualtrics.

5.3 Affective States

To achieve the aim of this study, PANAS (Positive And Negative Affect Scale) is adopted to measure the impact of the character companion on each participant's affective state. PANAS is a self-reported questionnaire to measure both negative and positive affect [88]. It is a comprehensive tool that provides insight into understanding the affective state unlike other tools such as SAM [32] that solely focus on valence and arousal. PANAS is also sensitive to data compared to other methods such as The Profile of Mood States (POMS) [55] which asses various mood states. In this case, PANAS has an advantage in capturing short-term changes in affect since POMS measures a broader range of moods and is suitable for long-term studies. Additionally, other questionnaires such as The Affect Intensity Measure (AIM) [49] focus on the intensity of the emotional experience which makes it harder to interpret and draw conclusions based on this type of experiment. Therefore, PANAS is an ideal method to measure the positive and negative affective states and can capture nuances within a particular affective state. This questionnaire is implemented using Qualtrics.

5.4 Game

A First Person Shooter (FPS) game is implemented for this study using Unity engine. This game follows a doctor inside a patient's body intending to eliminate the viruses inside the body. A character companion is developed to accompany players. At the beginning of the game, this companion provides narration and introduces the participants to the goal

and mechanics of the game. The companion also provides emotional and gameplay support. The main mechanic of the game is shooting viruses with the given pistol. Figure 2 outlines the game overall graphics and characteristics:

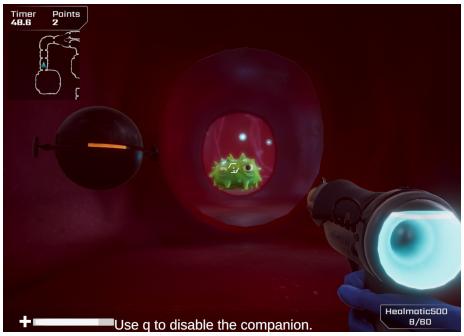


Fig. 2. Overview of the gameplay showcasing viruses, player, and the character companion.

5.4.1 Gameplay. The gameplay strives to enforce the negative affect. It is intentionally designed and balanced to induce frustration and negative affect. To this end, three levels are implemented. To access the next level and progress in the game, a key-door system is employed. Players are required to explore the map and find the key to the next level to proceed with the game. Each level escalates in difficulty using a Fibonacci Sequence [31]. The first level serves as an introduction to the mechanics, objectives, and game narration. The second level is larger allowing participants to get used to the game mechanics. The third level escalates in difficulty where participants face stronger viruses in a larger map. The Fibonacci Sequence is used to determine the number of enemies, encounters, health kits, ammo, and rooms in each level. This sequence is used to balance the third level intentionally difficult for players to ensure frustration and negative affect. Permadeath further supports this by forcing players to start over when they die. Figure 3 displays the level layout:

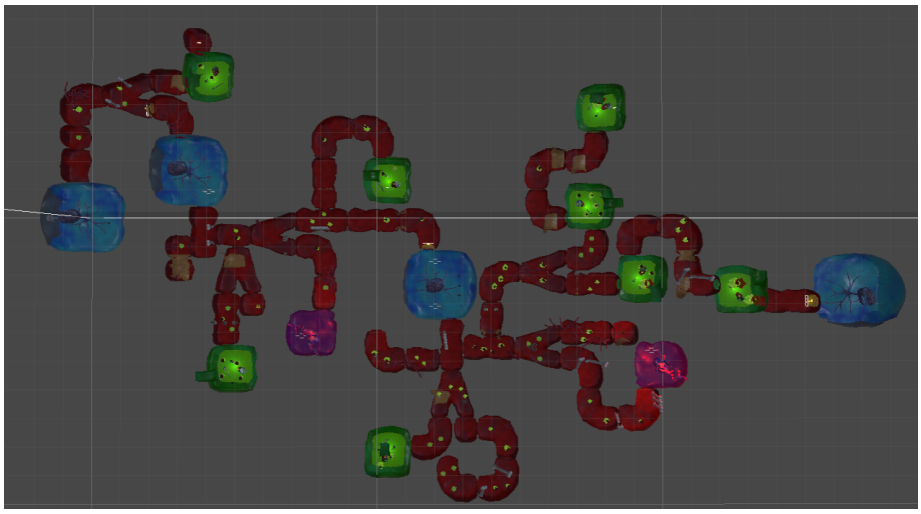


Fig. 3. Level layout consists of four blue rooms with the first one as the introduction. Green rooms represent a main fight and red rooms represent help points containing resources.

5.5 Companion Support Tools

This study aims to reduce players' negative states while facing negative gaming experiences and strives to achieve this goal by employing a character companion. The character companion is equipped with different types of support to accompany players and provide suitable support based on personality traits. Each support type is described as follows:

5.5.1 Emotional Support. Emotional support is crucial in mitigating negative experiences, particularly in interactive environments like gaming. A similar study by Dennis et al. [25] conducted extensive research on adapting emotional support to individual personality traits within educational settings. Their work primarily focused on tailoring feedback and emotional support messages based on the Five Factor Model of personality traits. The research highlighted that different personality traits respond more effectively to specific types of emotional support. This study integrates similar principles to provide tailored emotional support. According to Dennis et al. [25] various types of support exists:

- **Reassurance** (R): Reassuring statements that support well-being such as "Don't worry".
- **Praise** (P): Praising one's skills such as "Good job!"
- **Emotional Reflection** (ER): Empathetic statements that empathise with emotional state such as "I know you may be feeling anxious".
- **Advice** (A): Advice or suggestions on how to avoid a mistake.

In providing emotional support, it is important to take into account the participants' performance. According to Dennis et al. [25] there are three types of performance feedback that the companion could provide:

- **Empathetic:** Providing emotional support.
- **Task-based:** Providing practical and context-based advice on how to complete an objective or how to avoid mistakes.
- **Progress-based:** Providing assessment based on their advancement, and reflecting on their performance compared to the expectations.

In this study, we focus on providing tailored-based empathetic feedback (emotional support messages), and progress-based feedback. Task-based feedback is provided but not personalized. Progress-based feedback only determines the tone of the feedback message which either focuses on the positive or negative aspects of participants' performance or stays neutral.

A total of 24 emotional messages are obtained. Each emotional support category has 6 statements (3 empathetic and 3 task-based statements).

The character companion provides personalized emotional support based on personality traits and the participant's performance. The table below demonstrates the type of emotional support given to a participant based on their score from the study by Dennis et al. [25] which will be used in this work as well:

			Score (%)					
Trait	Level		10	30	45	55	70	90
Extraversion	High and Low	Strategy	R A	R A	R A	*A*	*P A*	P
		Slant	neutral	neutral	neutral	neutral	neutral	neutral
Agreeableness	High and Low	Strategy	R A	R A	R A	*A*	*A*	P
		Slant	neutral	neutral	neutral	neutral	neutral	neutral
Openness to Experience	High and Low	Strategy	R A	R A	R A	*R A*	*P*	P
		Slant	neutral	neutral	neutral	neutral	neutral	neutral
Conscientiousness	High	Strategy	R A	R A	R A	**P A**	**P**	**P**
		Slant	neutral	neutral	neutral	neutral	neutral	neutral
	Low	Strategy	R A	R A	R A	**R A**	**A**	**P P**
		Slant	neutral	negative	neutral	neutral	negative	neutral
Emotional Stability	High	Strategy	**R A**	**R A**	R A	*R A*	**P**	P
		Slant	neutral	neutral	neutral	neutral	neutral	neutral
	Low	Strategy	**ER R A**	**ER R A**	R A	*R A*	**P A**	P
		Slant	neutral	neutral	neutral	neutral	neutral	neutral

Fig. 4. Mapping performance to emotional strategies based on personality traits.

The character companion decides on the suitable support based on the participant's performance according to the figure 4. Therefore, the character companion constantly keeps track of the performance. We have mapped the players' performance to a player progression model. This player progression map has 6 states based on player performance outlined in figure 5, Transition between states can occur whenever players' performance increases or decreases and falls into a different category than the current states. This transition is based on a *encounter* heuristic. *Encounter* heuristic is a mathematical formula that considers player and enemy resources and calculates player death and win probability. After every encounter that players have with enemies, this heuristic is calculated to decide if the player should progress into the progression model based on their performance and whether any transition is applicable or not. Encounters are any situation players face with enemies and defeat them to progress through the game. The *encounter* heuristic contains several metrics from players and enemies listed below:

- **Player Resources**:
  - **Accuracy (Acc)**: The accuracy of shots. The number of shots that hit the enemies is divided by the total number of shots.
  - **Player Damage Taken (PDT)**: Total amount of damage the participant is taken divided by the total number of damage inflicted upon.
  - **Player Health (PH)**: Players'current health points.
  - **Player Damage Rate (PDR)**: Player bullet damage divided by the player fire rate.
  - **Bullet (B)**: Number of bullets available to players.
- **Enemy Resources**:
  - **Enemy Damage Rate (EDR)**: Enemy bullet damage divided by the enemy fire rate. For instance, if an enemy bullet can inflict 3 damage points and the enemy fire rate is 0.7 per second. This means that the enemy damage rate is approximately 4.2 per second.

– **Enemy Health (EH)**: Enemy total amount of health points.

Encounter heuristic at its essence is computing the following formula:

$$P(t) = W(t) - \frac{W(t)}{TTW} \cdot t$$

$P(t)$ stands for player performance at time t. W is the win probability at time t and TTW is the total amount of time that players have to defeat the enemies before getting killed by the enemies.

W is calculated as follows:

$$W(t) = \frac{PDR \cdot B \cdot Acc}{EH}$$

This formula checks if the player's resources and skills can match the enemy's resources.

TTW is calculated as follows:

$$TTW(t) = \frac{PH}{EDR \cdot PDT}$$

This formula computes how long it takes for the enemy to defeat the player. This means that the more time passes after an encounter begins, the more damage players are taken.

For instance, if a player encounters an enemy with 3 health points. Assuming the player has 1 damage per bullet, 3 available bullets and 90% shot accuracy. The W is calculated as $\frac{1 \cdot 3 \cdot 0.9}{3}$ which is 0.9. This is the win probability of the player given the resources they have. Now considering the player has 3 health points the enemy has 1 bullet damage with a fire rate of 1 and the player has taken 50% of all the damage inflicted upon them, TTW is calculated as $\frac{3}{1 \cdot 1 \cdot 0.5}$ which gives us 6. This means that in an ideal probabilistic world, if players fail to defeat the enemy by 6 seconds they are defeated. Therefore, with every second pass, the player wins probability and performance drops. If players at the beginning have 90% chance to win according to W, after 1 second passes, they have $\frac{90}{6}$ less chance to win or 75%. As time passes players have less and less chance to win.

After finishing each encounter the remaining $P(t)$ is calculated to check if a transition is needed for player in the player progression model. In the previous example, if players previously had a performance of 85 (state 6), if they manage to defeat the enemy in 3 seconds, according to the $P(t)$ formula their performance is $90 - \frac{90}{6} \cdot 3$ or 45 which is state 3. After this encounter players receive performance feedback and emotional support strategy based on their performance and personality traits. In this case, a performance of 45 with the personality trait of extraversion receives a neutral *Reassurace* and *Advice* support strategy. That being said, emotional support is only provided after an encounter where players interact with the game and their performance changes accordingly.

To keep track of the encounters, a detection box, (sphere collider) is attached to the player. Whenever an enemy enters this sphere around the player, it is considered an encounter. If the enemy stops colliding with this sphere, either by getting killed or being out of range, the player performance is calculated and based on the performance and the personality traits an emotional strategy is selected and performed.

To personalize the emotional support according to the player's personality traits, the process begins with normalizing the personality trait scores. Each trait score is transformed into a number between 0 and 100, where the total sum of all traits equals 100. These normalized scores are then used to construct a *trait bar*, ranging from 0 to 100, where each segment of the bar corresponds to a specific personality trait. The size of each segment reflects the proportion of that trait in the player's overall personality profile.

For each encounter, the system randomly generates a number between 0 and 100. This number is then used to determine which personality trait will guide the emotional support strategy for that particular *encounter*, based on where the number falls on the *trait bar*. For example, consider a participant with the following Big Five Model results:

Extraversion: 2 Agreeableness: 3.5 Conscientiousness: 4.5 Emotional Stability: 4.5 Openness: 3

After normalization, these traits are mapped onto the bar as follows:

Extraversion: 0-11.4 Agreeableness: 11.4-31.4 Conscientiousness: 31.4-57.1 Emotional Stability: 57.1-82.8 Openness: 82.8-100

If the system generates number 10 for a specific *encounter*, the Extraversion trait is selected, as 10 falls within the Extraversion segment (0-11.4). This mapping ensures that traits with higher scores occupy a larger portion of the bar and are more likely to be selected.

Once a trait is selected, the emotional support strategy is determined based on the performance score from the encounter. For example, if the performance score is 45, and the selected trait is Extraversion, the emotional support strategy involves providing reassurance and advice.

Fig. 5. Player progression model consists of 6 states. Transition is only possible through the *encounter* heuristic after each encounter.

5.5.2 Gameplay Support. As the companion strives to bond with participants to maximize the impact of the emotional support, it is essential to equip the companion with strategies to support participants inside the game. Therefore, the following strategies are implemented:

- **Provide Health Kits:** The character companion provides Health Kits to participants when they need help.
- **Provide Ammo:** The character companion provides Ammo to participants when they are low on ammo.

The gameplay support consists of predefined events and is the same for both personalized conditions and non-personalized conditions to ensure the results are valid for evaluating the effectiveness of emotional support messages.

(a) Health Packs

(b) Ammo

Fig. 6. Game resources including a) health packs and b) ammo

Figure 7 is an overview of the character companion functionality:

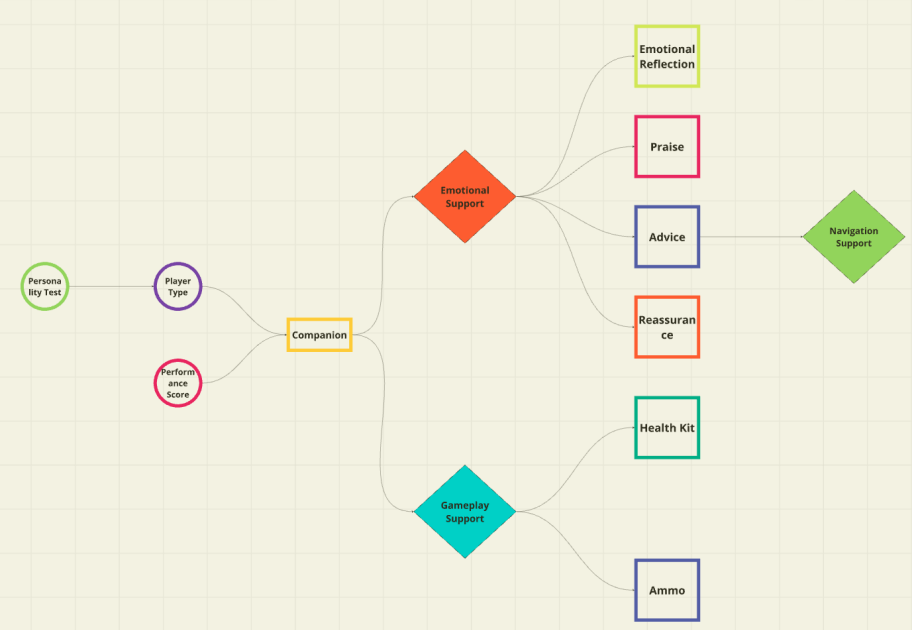


Fig. 7. The character companion functionalities and system.

6 ANALYSIS OF THE RESULT

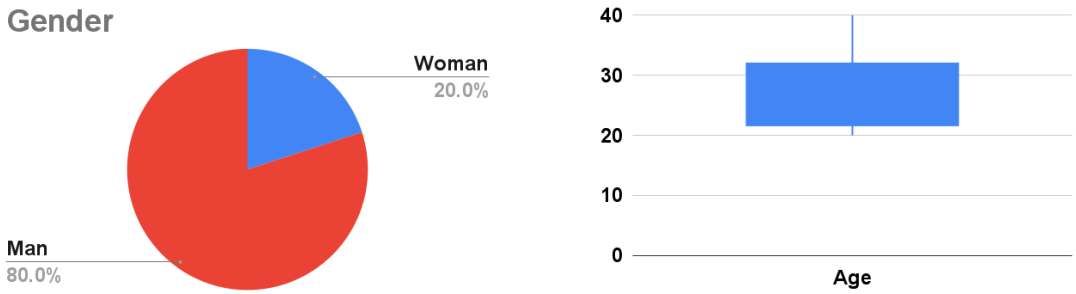
To answer the first research questions stated in the section 4. First, the difference between the affective state from pre and post-gameplay sessions is calculated in both groups. The obtained results from groups A and B will be compared to evaluate the impact of the personalized approach. According to the hypothesis, we expect that group A (non-personalized) on average report a less positive affect compared to group B (personalized).

To answer the second research question, we seek to uncover whether certain personality traits are more prone to the impact of emotional support strategies. Therefore, the calculated affective state from the difference in pre and post-gameplay sessions is grouped per personality trait from group B who experienced the personalized approach. Each personality trait's affective state is then compared to others. Even though the sample size might not be suitable for gaining statistically significant data, we argue that such a comparison provides valuable insight and contributes to the field.

In the following sections, the analysis of the data including demographics, quantitative and qualitative is explained:

6.1 Demographics

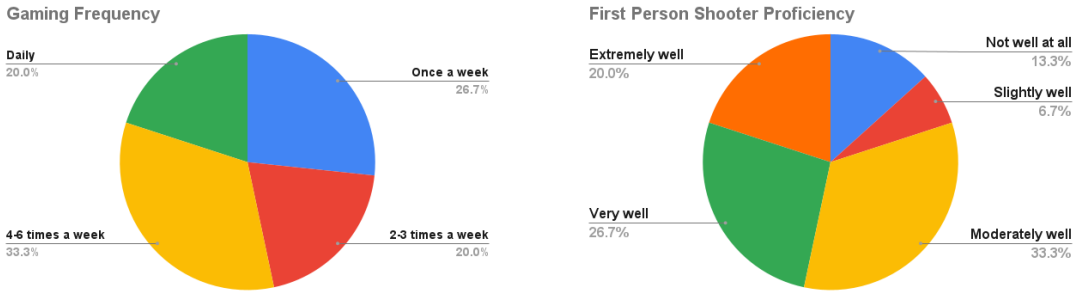
25 total responses were collected via Qualtrics.15 of 25 managed to fully finish and answer every question inside the questionnaire. The responses include 3 women (20%) and 12 men (80%) with an average age of 26.8 (Min = 20, Max = 40, STD = 5.1436). Figure 8 illustrates the gender distribution as a pie chart and age distribution as a box plot.



(a) Gender Distribution (b) Age Distribution

Fig. 8. Demographics information including a) gender distribution and b) age distribution

Other collected demographic data include how often participants play games in their daily lives (gaming frequency) and how much they are familiar with first-person shooter games (FPS proficiency). As illustrated in figure 9a, 53.3% of the participants play games in a week at least 4-6 times and 20% 2-3 times. This suggests that the sample data in this study consists of mostly people who play games regularly. As for FPS proficiency, only 13.3% were not familiar with this genre and 6.7% only knew the FPS genre slightly well. This leaves us with the majority of participants with 33.3% who were moderately familiar with first-person shooters. This data confirms that the sample data in this study were mostly familiar with FPS games.



(a) Gaming Frequency (b) FPS Proficiency

Fig. 9. Demographics information including a) gaming frequency and b) FPS Proficiency

6.2 Quantitative Data

This study focuses on A/B testing. According to figure 10, 40% (6 out of 15) of the participants fall into the A category (non-personalized) and 60% (9 out of 15) were in the B category (personalized).

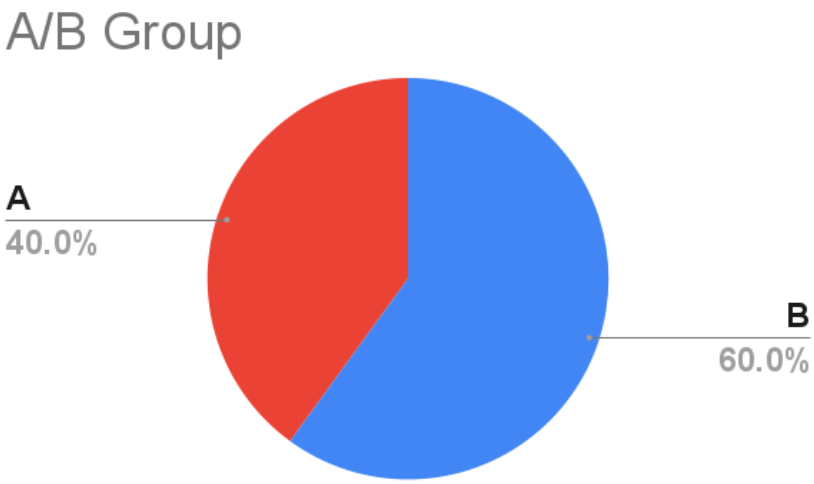


Fig. 10. Participant distribution in groups A and B

6.3 Big 5 Personality Trait

Figure 11 represents the Big 5 personality traits among all participants. Each trait is ranged from 1 to 7.

(1) **Extraversion**: Extraversion trait has a minimum of 3 and a maximum of 5.5 with an average of 4.33 and a standard deviation of 0.6454.
(2) **Agreeableness**: Agreeableness trait has a minimum of 3 and a maximum of 6 with an average of 4.66 and a standard deviation of 0.9574.
(3) **Conscientiousness**: Conscientiousness trait has a minimum of 3.5 and a maximum of 4.5 with an average of 4.13 and a standard deviation of 0.3518.
(4) **Emotional Stability**: The emotional Stability trait has a minimum of 3.5 and a maximum of 7 with an average of 4.5 and a standard deviation of 1.0177.
(5) **Openness**: Openness trait has a minimum of 2.5 and a maximum of 5.5 with an average of 3.93 and a standard deviation of 0.7527.

According to the figure, it is evident that the conscientiousness trait has the most stable rate among participants with the lowest standard deviation whereas the emotional stability trait has the most distributed rate among participants with the highest standard deviation. Wider variability in emotional stability suggests that this trait might be more affected by the individual differences. Additionally, every trait average is close to 4 which demonstrates a balanced distribution of traits among the sample size. Moreover, since there is no sign of individual points outside the box, we can conclude that there are no outliers in this data.

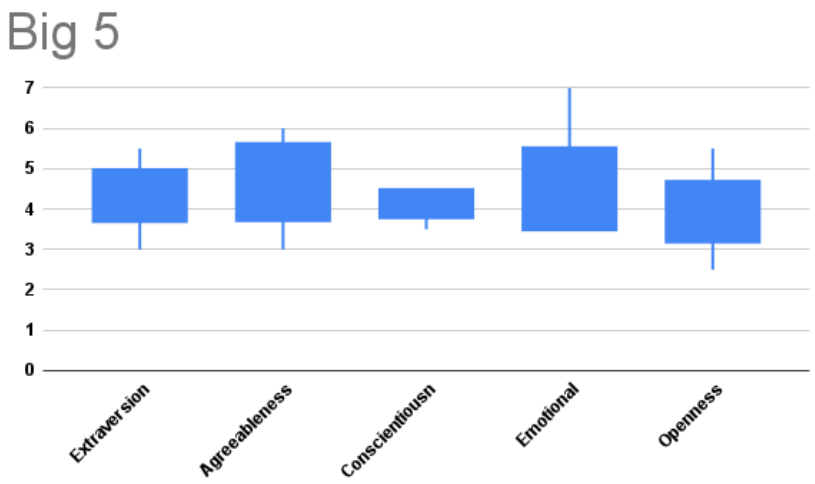


Fig. 11. The distribution of big 5 personality traits among participants.

6.3.1 Extraversion. Figure 12, displays the distribution of extraversion traits among groups A and B.

(1) **Group A**: Minimum is 3 with a maximum of 5 and an average of 4 with a standard deviation of 0.7071.
(2) **Group B**: Minimum is 4 with a maximum of 5.5 and an average of 4.55 with a standard deviation of 0.572.

This concludes that on average, participants from group B had higher extraversion traits with a lower standard deviation compared to group A. However, group A exhibits a higher level of diversity with a higher standard deviation.

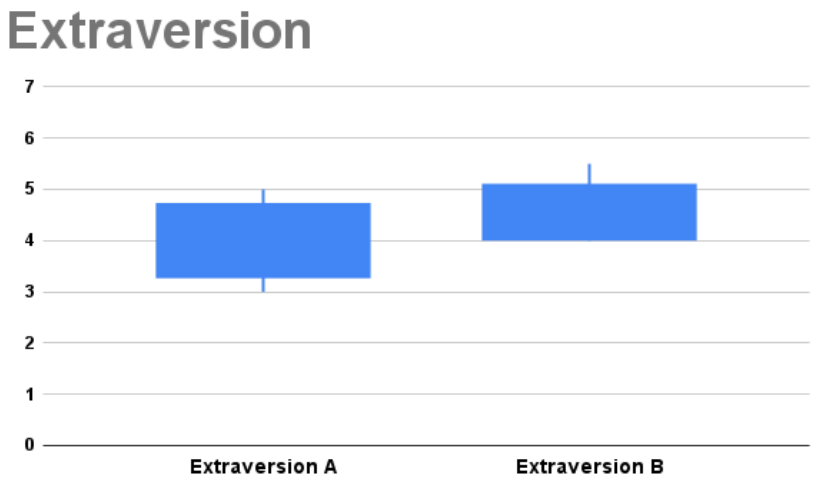


Fig. 12. The distribution of extraversion trait among groups A and B

6.3.2 Agreeableness. Figure 13, displays the distribution of agreeableness traits among groups A and B.

(1) **Group A**: Minimum is 3 with a maximum of 5 and an average of 4 with a standard deviation of 0.7071.
(2) **Group B**: Minimum is 3.5 with a maximum of 6 and an average of 4.83 with a standard deviation of 1.

This concludes that on average, participants from group B had higher agreeableness traits compared to group A. Additionally, a higher standard deviation in group B suggests a higher level of diversity in this group.

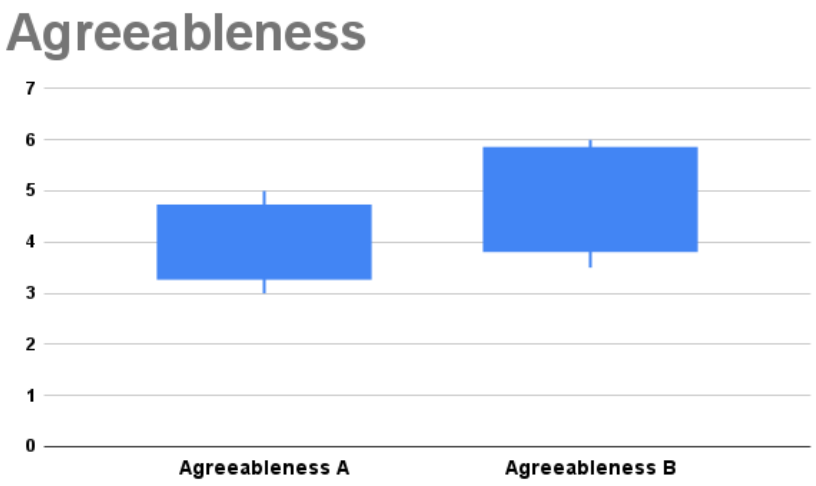


Fig. 13. The distribution of agreeableness traits among groups A and B.

6.3.3 Conscientiousness. Figure 14, displays the distribution of conscientiousness traits among groups A and B.

(1) **Group A**: Minimum is 3.5 with a maximum of 4.5 and an average of 4.16 with a standard deviation of 0.4082.
(2) **Group B**: Minimum is 3.5 with a maximum of 4.5 and an average of 4.11 with a standard deviation of 0.33.

This concludes that on average, participants from groups A and B have relatively similar conscientiousness traits. Since the standard deviations for both groups are low and similar, we can conclude that there is a similar level of diversity in both groups as well.

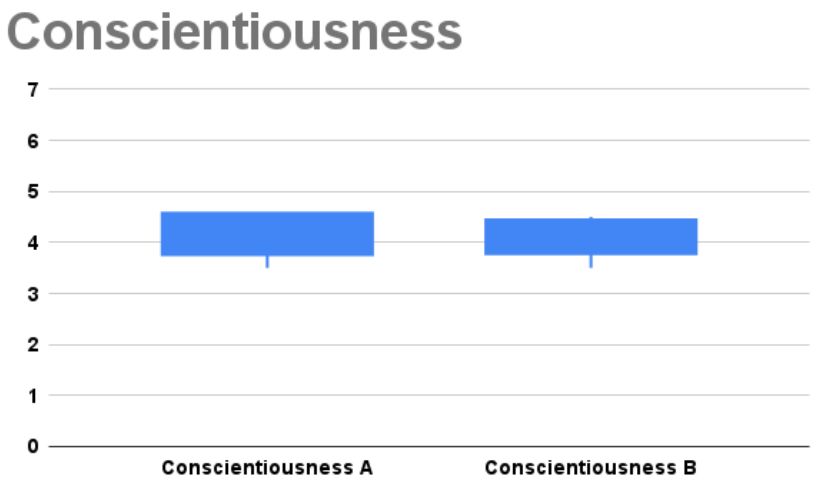


Fig. 14. The distribution of conscientiousness traits among groups A and B.

6.3.4 Emotional Stability. Figure 15, displays the distribution of emotional stability traits among groups A and B.

(1) **Group A**: Minimum is 4 with a maximum of 7 and an average of 4.66 with a standard deviation of 0.7527.
(2) **Group B**: Minimum is 3.5 with a maximum of 6 and an average of 4.38 with a standard deviation of 0.9279.

This concludes that on average, participants from group A have higher emotional stability traits compared to group B. However, group B exhibits a higher level of diversity with a higher standard devaition.

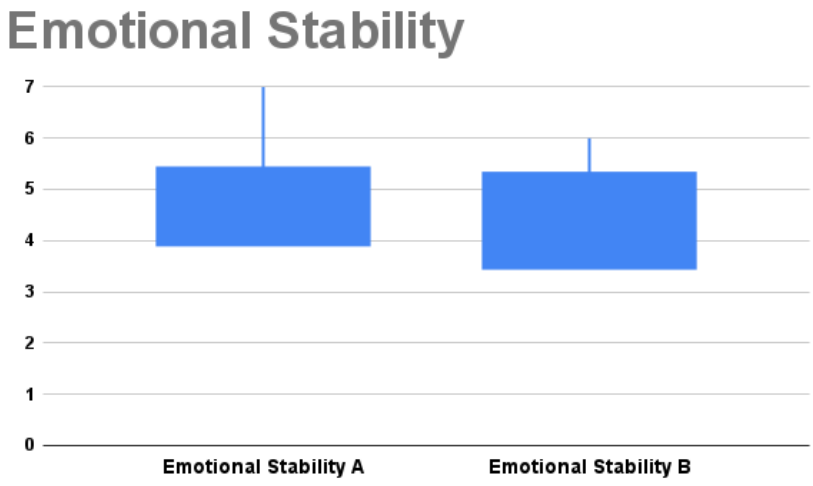


Fig. 15. The distribution of emotional stability traits among groups A and B.

6.3.5 Openness. Figure 16, displays the distribution of openness traits among groups A and B.

(1) **Group A**: Minimum is 2.5 with a maximum of 4.5 and an average of 3.83 with a standard deviation of 0.7527.
(2) **Group B**: Minimum is 2.5 with a maximum of 5.5 and an average of 4 with a standard deviation of 0.7905.

This concludes that on average, participants from group B have slightly higher openness traits compared to group B. Both groups have relatively similar level of diversity with similar standard deviation.

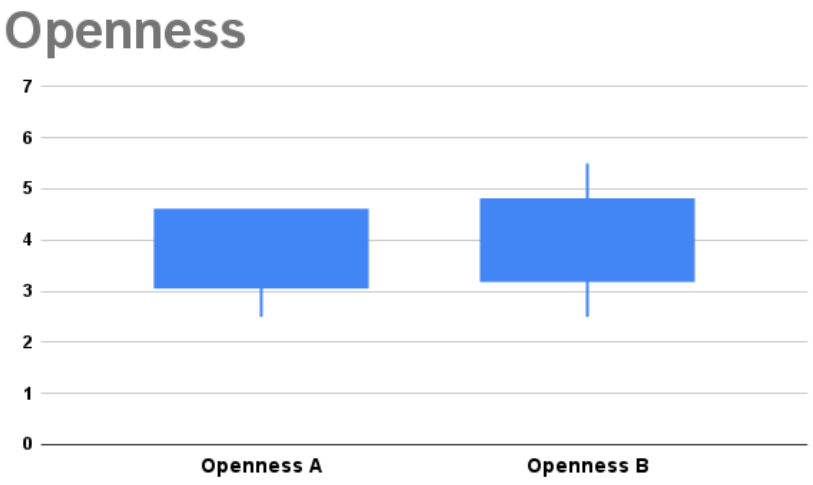


Fig. 16. The distribution of openness traits among groups A and B.

6.4 Affective State

Both groups were instructed to fill out the PANAS questionnaire prior to experiencing the game and also after the gameplay session. Figure 17 displays general information regarding differences in affective state pre and post-gameplay sessions for all participants regardless of their group. The first two columns in this figure indicate the changes in the positive affect and the last two columns indicate the changes in the negative affect.

(1) **Positive Affect**
   (a) **Pre-gameplay positive affect**: Prior to the experience, the minimum positive affect state was 11 with a maximum of 41, average positive affect for both groups was 25.4 with a standard deviation of 8.6586.
   (b) **Post-gameplay positive affect**: After the gameplay session, the minimum positive affect state was 11 with a maximum of 45, average positive affect for both groups was 27 with a standard deviation of 9.6584.
(2) **Negative Affect**
   (a) **Pre-gameplay negative affect**: Prior to the experience, the minimum negative affect state was 10 with a maximum of 37, average negative affect for both groups was 16.13 with a standard deviation of 8.7494.
   (b) **Post-gameplay negative affect**: After the gameplay session, the minimum negative affect state was 11 with a maximum of 36, average negative affect for both groups was 18.2 with a standard deviation of 6.3941.

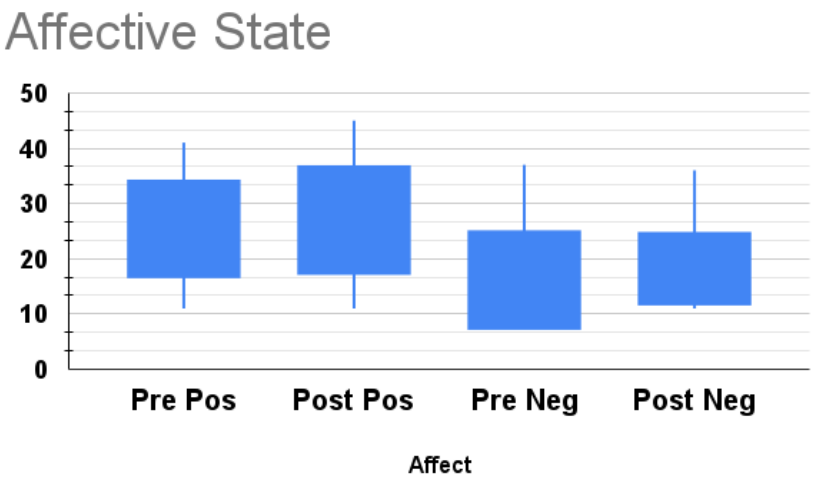


Fig. 17. The affective state pre and post-gameplay.

Figure 18 displays the differences in positive affect in groups A and B, pre and post-gameplay. The first two columns illustrate the differences in positive affect in group A pre and post-gameplay. The two columns in the middle illustrate the differences in positive affect in group B pre and post-gameplay. The last two columns summarize the differences in groups A and B pre and post-gameplay.

(1) **Group A**:
   (a) **Pre-gameplay**: Prior to the experience, the minimum positive affect state for group A was 16 with a maximum of 39, average positive affect for group A was 27.83 with a standard deviation of 8.8411.
   (b) **Post-gameplay**: After the gameplay session, the minimum positive affect state for group A was 21 with a maximum of 46, average positive affect for group A was 29.5 with a standard deviation of 8.5965.
(2) **Group B**:
   (a) **Pre-gameplay**: Prior to the experience, the minimum positive affect state for group B was 11 with a maximum of 41, average positive affect for group B was 23.77 with a standard deviation of 8.6570.
   (b) **Post-gameplay**: After the gameplay session, the minimum positive affect state for group B was 11 with a maximum of 45, average positive affect for group B was 25.33 with a standard deviation of 10.4522.
(3) **Differences between pre and post-gameplay**:
   (a) **Group A**: Group A's minimum differences between pre and post-gameplay positive affect was -15 with a maximum of 18, an average of 1.66 and a standard deviation of 11.12.
   (b) **Group B**: Group B's minimum differences between pre and post-gameplay positive affect was -11 with a maximum of 14, an average of 1.55 and a standard deviation of 7.6.

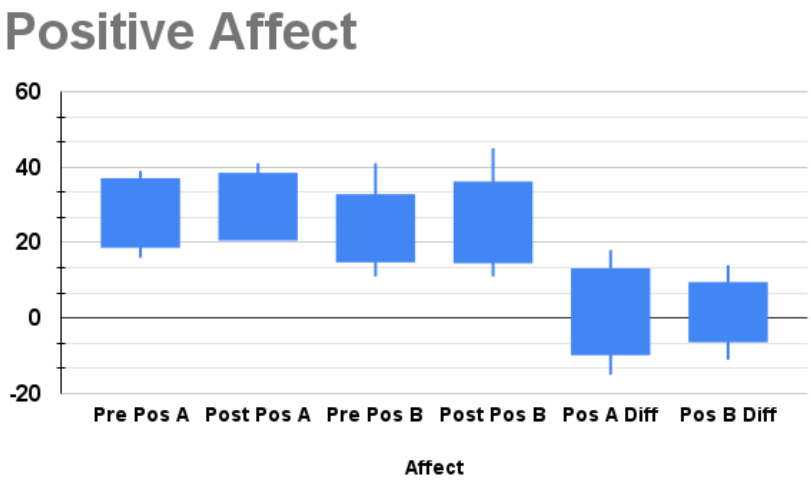


Fig. 18. The positive affective states in groups A and B pre and post-gameplay.

Figure 20 shows the differences in negative affect in groups A and B, pre and post-gameplay. The first two columns illustrate the differences in negative affect in group A pre and post-gameplay. The two columns in the middle illustrate the differences in negative affect in group B pre and post-gameplay. The last two columns summarize the differences in groups A and B pre and post-gameplay.

(1) **Group A**:
   (a) **Pre-gameplay**: Prior to the experience, the minimum negative affect state for group A was 12 with a maximum of 33, average negative affect for group A was 17.16 with a standard deviation of 8.035.
   (b) **Post-gameplay**: After the gameplay session, the minimum negative affect state for group A was 13 with a maximum of 36, and the average positive affect for group A was 19.16 with a standard deviation of 8.58.
(2) **Group B**:
   (a) **Pre-gameplay**: Prior to the experience, the minimum negative affect state for group B was 10 with a maximum of 37, and the average negative affect for group B was 15.44 with a standard deviation of 9.6.
   (b) **Post-gameplay**: After the gameplay session, the minimum positive affect state for group B was 11 with a maximum of 24, and the average negative affect for group B was 17.55 with a standard deviation of 4.92.
(3) **Differences between pre and post-gameplay**:
   (a) **Group A**: Group A's minimum differences between pre and post-gameplay negative affect was -14 with a maximum of 22, an average of 2 and a standard deviation of 11.6.
   (b) **Group B**: Group B's minimum differences between pre and post-gameplay positive affect was -14 with a maximum of 13, an average of 2.11 and a standard deviation of 7.54.

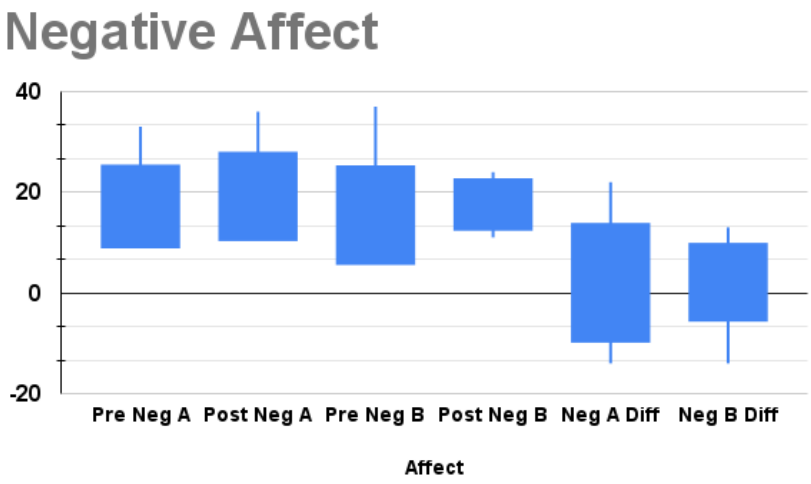


Fig. 19. The negative affective states in groups A and B pre and post-gameplay.

6.5 Qualitative Data

In this section, a thematic analysis is conducted similar to the concept defined by Braun and Clark [11] and further guided by Byrne [16]. The purpose of this thematic analysis was to find common themes in what players enjoyed the most about the companion and what they did not.

First, the data was stored carefully to analyze the data obtained through the qualitative questions. Most answers were regarding either the implementation of the game or the companion itself. Therefore, first, each entry point was categorized into two main categories "Implementation" and "Companion". Then each answer was coded as either negative or positive. Some long answers were divided into more sections if they were referring to various topics. After the initial coding for each data point, common themes were detected for each sections and reported as below:

(1) **Positive Implementation Comments**:
   (a) **Graphics**: A couple of answers regarding the qualitative questions praised the visual design and graphics of the game.
   (b) **Experience**: The rest of the answers in the category of positive implementation (6 out of 8 in both A and B categories) praised the overall experience of the game with participants stating "*The game was fun at times.*" and also praised the concept, idea, and the vibe of the game with another participant stating "*I love that it has the vibe of early fps games.*"

(2) **Negative Implementation Comments**:
   (a) **Lag**: Some participants reported that despite the optimization techniques used to ensure the smooth run on Chrome, they experienced low frame rates which made the game unenjoyable with one specifically mentioning "*but i think the experience was deteriorated from playing it on chrome? I have a gaming laptop and im pretty sure i was playing with 30fps or something which made it very unenjoyable.*"

(b) **Design**: Some other general answers were regarding various design decisions made throughout the game such as the font and the text replacement and UI and sound design with participants stating " *It also seemed like some enemies needed multiple shots to die and it would be nice to know their current health.*"

(3) **Positive Companion Comments**:

(a) **jokes**: A couple of participants reported how they appreciated the jokes and funny comments the companion made during their playthrough with one commenting "*I liked the jokes that he made but on the first run.*"

(b) **Support System**: Other comments in this category were praising the companion support system in various ways with 13 out of 16 comments:

(i) **Ammo and Health**: Some participants enjoyed the companion in situations were they had low ammo and health points and the companion provided the resources.

(ii) **Emotional Messages**: Most answers praised the emotional messages that was displayed with 6 comments in total such as "*when he said good job or well done.*" and "*nice to have a companion! i get scared easily when playing games alone (i'm a bit anxious in general) so a companion does make me feel more at ease :)* " 5 out of 6 comments (83.3%)in this category belonged to the group B which indicates the effectiveness of the personalized approach in providing support to participants.

(iii) **Tips**: Other participants appreciated the tips and clues that the companion was providing regarding the character and the environment such as "*the reminder to reload because i sometimes forget lol.*" and "From time to time it gave some valuable clues." There were 6 comments grouped in this category in total with 4 of them belonging to group B (66.6%). This again indicates that participants were able to recognize the effectiveness of the personalized companion in comparison with participants who had the non-personalized companion.

(4) **Negative Companion Comments**:

(a) **Personalization:** Although the companion support system was praised due to its various functionalities, the frequency of tip was high for some participants and they found some of the comments from the companion to be unnecessary and annoying with some stating "*The constant "tips" for the game.*" and "*Very annoying, even during the 1st playthrough, only few clues were helpful and the rest were unnecessary and annoying.*". This suggests that the support system was unable to fully personalize and adopt itself to these participants. Since 6 out of 8 comments (75%) in this category belongs to group B, it is evident that again this group were more aware of the personalized approach and had more comments regarding it.

(b) **Voice**: Some participants disliked the companion voice with comments such as "*monotone, emotionless, slightly annoying*"

(c) **Design**: Other comments were regarding the design decisions around the concept of the companion such as "*the fact that i had to press q to make it disappear*" and "*Too big, it could be just a voice in the background.*"

7 DISCUSSION

In this section, findings derived from the result is discussed following up with answers to the research questions.

7.1 Correlation Analysis

In this section, correlations between various charts are explained. To obtain this correlation, statistical tests, namely, *Pearson*, *Spearman* and *Kendall Tau*, are run through the dataset using Python.

Age and Affect:

Across the overall dataset and within both groups, the correlations between age and affect (both positive and negative) are consistently weak and not statistically significant. This indicates that age does not have a substantial impact on positive or negative affect changes related to gameplay. Any observed trends are either very weak or not statistically significant ($p > 0.05$), suggesting that age is not a strong predictor of the changes in affect in the context of this study.

Gender and Affect:

The analysis indicates that gender does not have a significant impact on either negative or positive affect within the dataset and both groups. Both the lack of strong correlation and the absence of statistical significance ($p > 0.05$) in the results support the conclusion that gender is not a key factor influencing affective states in this particular dataset.

Gaming Frequency and Affect:

While a general trend suggests that higher gaming frequency might be associated with lower but stabler positive affect, especially in Group B ($Pearson : \beta = -0.555, p > 0.1$), the evidence is not statistically strong enough to draw definitive conclusions.

The data suggest that gaming frequency does not have a statistically significant effect on negative affect, although there is a weak negative correlation in group B ($Pearson : \beta = -0.203, p = 0.6, Spearman : \beta = -0.456, p > 0.2, Kendall : \beta = -0.298, p > 0.3$) that associates higher gaming frequency with less negative affect and more stable result.

FPS Proficiency and Affect:

Group A displays a strong, significant negative relationship between FPS proficiency and differences in positive affect pre and post-gameplay. This negative association is consistent across all correlation measures. Pearson: ($\beta = -0.7714, p > 0.05$) Spearman ($\beta = -0.8197, p < 0.05$) and Kendall Tau ($\beta = -0.7454, p < 0.05$) suggesting that in this group, greater proficiency may be associated with stable positive emotions. In contrast, Group B shows no significant relationship ($p > 0.05$), indicating that other factors such as the personalized behaviour of the companion may moderate the relationship between proficiency and affect in this group.

The analysis shows a moderate positive relationship between FPS proficiency and changes in negative affect pre and post-gameplay across the entire dataset, but this relationship is not statistically significant. In Group A, there is a strong positive relationship, with Spearman ($\beta = -0.537, p < 0.05$) and Kendall Tau ($\beta = -0.430, p < 0.05$) correlations statistically significant, indicating that higher FPS proficiency is associated with greater changes in negative affect, and Pearson's correlation also suggests a near-significant strong linear relationship ($\beta = -0.466, p = 0.08$. In contrast, Group B displays weak and non-significant correlations, indicating that FPS proficiency has little to no impact on differences in negative affect for this group with Spearman ($\beta = -0.233, p > 0.5$) and Kendall Tau ($\beta = -0.185, p > 0.5$) and Pearson ($\beta = -0.325, p > 0.3$).

Extraversion and Affect:

Across all groups and correlation methods, the correlations between extraversion and differences in positive affect pre and post-gameplay are negative but not statistically significant. For the entire dataset, the moderate negative correlations suggest a trend where higher extraversion might be associated with stabler positive affect (Spearman ($\beta = -0.4173, p > 0.1$) and Kendall Tau ($\beta = -0.3466, p > 0.1$) and Pearson ($\beta = -0.4135, p > 0.1$)). Still, the lack of significance means this finding could be due to random chance. In groups A and B, correlations are weaker and highly

insignificant ($p > 0.5$), indicating little to no relationship between extraversion and differences in positive affect pre and post-gameplay.

Across all datasets and within both groups, there is no statistically significant ($p > 0.1$)correlation between extraversion and differences in negative affect pre and post-gameplay. While some positive correlations were observed, they were weak and insignificant, suggesting that extraversion does not have a reliable impact on differences in negative affect pre and post-gameplay based on the current data.

Agreeableness and Affect:

The results show a moderate to strong negative correlation between Agreeableness and differences in positive affect pre and post-gameplay across all data points, with statistically significant p-values (Spearman ($\beta = -0.702, p = 0.003$) and Kendall Tau ($\beta = -0.610, p = 0.003$) and Pearson ($\beta = -0.602, p = 0.017$)). This suggests that generally, higher Agreeableness is associated with stabler positive affect in this dataset. For both groups, the correlations are weak and not statistically significant ($p > 0.5$), indicating no meaningful relationship between Agreeableness and differences in positive affect pre and post-gameplay within groups A and B.

The correlations between Agreeableness and differences in negative affect pre and post-gameplay across the entire dataset are weak and not statistically significant ($p > 0.5$). For group A the correlations are slightly stronger than those in the overall dataset but still not statistically significant ($p > 0.5$). For group B the correlations are very weak and not statistically significant ($p > 0.5$). Overall, the analysis shows weak and statistically insignificant correlations across all groups. There is no strong evidence to suggest a meaningful relationship between these variables in this dataset.

Conscientiousness and Affect:

The correlations across all data suggest no significant relationship between Conscientiousness and differences in Positive Affect ($p > 0.5$). For group A there is a strong and statistically significant positive relationship between Conscientiousness and Positive Affect Spearman ($\beta = 0.926, p = 0.008$) and Kendall Tau ($\beta = 0.856, p = 0.024$) and Pearson ($\beta = 0.895, p = 0.016$). This indicates that higher conscientiousness is associated with higher differences in positive affect in this group. For group B there is no significant ($p > 0.5$) relationship between Conscientiousness and differences in Positive Affect, suggesting that these variables do not meaningfully correlate in this group.

The correlations suggest a moderate negative relationship between Conscientiousness and differences in Negative Affect, with a trend toward significance Spearman ($\beta = -0.469, p = 0.078$) and Kendall Tau ($\beta = -0.434, p = 0.061$) and Pearson ($\beta = -0.447, p = 0.095$). This implies that higher Conscientiousness may be associated with stabler Negative Affect, although the evidence is not strong enough to be considered statistically significant. For group A there is a strong and statistically significant negative relationship between Conscientiousness and differences in Negative Affect Spearman ($\beta = -0.926, p = 0.008$) and Kendall Tau ($\beta = -0.856, p = 0.024$) and Pearson ($\beta = -0.865, p = 0.026$). This indicates that in Group A, higher Conscientiousness is associated with stabler Negative Affect. For group B there is no significant ($p > 0.1$) relationship between Conscientiousness and differences in Negative Affect, suggesting that these variables do not meaningfully correlate in this group.

Emotional Stability and Affect:

There is a significant positive relationship between emotional stability and differences in positive affect, indicating that as emotional stability increases, differences in positive affect tend to increase with Spearman ($\beta = 0.5221, p = 0.045$) and Kendall Tau ($\beta = 0.432, p = 0.052$) and Pearson ($\beta = 0.66, p = 0.007$). Both groups show non-significant ($p > 0.1$)

correlations, with both showing a weak. This suggests that the strong positive correlation in the overall data might not be present when the data is split into these groups, possibly due to smaller sample sizes or different underlying factors.

There is no significant correlation ($p > 0.9$) between emotional stability and differences in negative affect, as indicated by all three correlation methods. The results suggest no meaningful relationship in the overall dataset. For group A there is a strong positive correlation according to the Pearson coefficient ($\beta = 0.8108, p = 0.0503$), suggesting a possible relationship where increased emotional stability might correlate with increased differences in negative affect. However, this finding is at the border of statistical significance and should be interpreted cautiously. For group B there is no significant correlation ($p > 0.9$) between emotional stability and differences in negative affect, consistent across all measures. This indicates no clear relationship between the two variables in this group.

Openness and Affect:

Overall, none of the correlations are statistically significant across the overall data, Group A, or B, as all p-values are above the typical threshold of 0.05. This means that, based on the data provided, there is no strong evidence to suggest a significant relationship between openness and differences in positive affect in either group or overall.

There is a strong and statistically significant positive relationship between openness and differences in negative affect across all correlation methods in the overall dataset with Spearman ($\beta = 0.885, p = 1.16e-05$) and Kendall Tau ($\beta = 0.830, p = 0.000183$) and Pearson ($\beta = 0.908, p = 2.82e-06$). For group A the results are not statistically significant ($p > 0.3$), showing weak to moderate positive correlations. Group B shows strong and statistically significant positive correlations across all measures, indicating a robust association between openness and differences in negative affect in this group with Spearman ($\beta = 0.898, p = 0.001$) and Kendall Tau ($\beta = 0.796, p = 0.005$) and Pearson ($\beta = 0.702, p = 0.035$). This means that as openness increases, the negative affect of post-gameplay also increases for group B.

7.2 Affective State

It is evident by the reported numbers and figure 17 that the positive affective state in both groups was higher after the gameplay session and the negative affective state was higher but stabler. To answer the research question, differences in affective state in groups A and B should be compared.

According to the previous section and figure 18 that on average group A experienced higher positive affect after the gameplay session. It is also evidence that group B also experienced higher positive affect after the gameplay. Comparing both group's differences between pre and post-gameplay, demonstrate a more stable result for group B with a lower standard deviation of 7.6 compared to 11.12 in group A. This suggests that even though both groups experienced higher positive affect post-gameplay, yet group B had more stable results and a steady positive affect.

According to the reported numbers and figure 20 that on average group A experienced higher negative affect after the gameplay session. It is also evidence that group B on average also experienced higher negative affect after the gameplay. Comparing both group's differences between pre and post-gameplay, demonstrate a more stable result for group B with a lower standard deviation of 7.54 compared to 11.6 in group A. This suggests that even though both groups experienced higher positive affect post-gameplay, group B had more stable results and a steady negative affect.

To summarize, both groups had higher post negative and positive affect. However, group B exhibited stable negative affect. This indicates that the personalized companion was successful in regulating the enforced negative affect by the intentionally frustrating design of the game.

7.3 Research Questions

The study explores the effectiveness of a personalized approach in providing emotional support in the context of video games. For this purpose, a mixed-method study was conducted to compare two conditions, personalized and non-personalized companions. The data gathered from the participants is reported in the previous section. In this section, we strive to answer the previously stated two research questions by utilizing the obtained data:

(1) What is the effectiveness of personalized emotional support provided by a character companion in reducing negative affective states, during gameplay compared to non-personalized support?
(2) How do individual differences in personality traits influence the effectiveness of personalized emotional support in reducing negative affect and enhancing positive affect during gameplay?

To answer RQ1 we need to compare the differences in negative affect pre and post-gameplay from group A (non-personalized companion) and group B (personalized companion). Figure 20, demonstrates that on average both groups experience higher negative affect after playing the game compared to pre-gameplay. However, group B had a much more stable result. Additionally, figure 18, showcases that both groups experienced higher positive affect with group B exhibiting stabler results. The hypothesis for this research question was that the participants from group B would experience higher positive affect and less negative affect compared to group A. However, the result showcases that on average both groups had higher positive and negative affect with group B demonstrating stabler results and lower changes in their affective state compared to their pre-gameplay affective state. Considering the frustrating stressful nature of the FPS genre and considering that the game used in this study was designed and balanced to exhibit a negative affect, stabler result in group B and higher negative affect in group A proves that the companion was successful in offsetting the imposed negative affect of the gameplay.

Extensive correlation analysis was made in the section **??** to ensure the results are not influenced by other underlying factors such as age and gender. Test results ensure that the correlations between age and gender with both positive and negative affective states are consistently weak and insignificant suggesting that none of these variables have a substantial impact on the result.

The correlations between gaming frequency and both positive and negative affective states are generally statistically weak. However, there is a weak correlation in group B that higher gaming frequency was associated with stable positive and negative affect after the gameplay. Suggesting that participants from group B who played games regularly utilized the personalized companion and experienced much more stable mood compared to participants with less gaming frequency. However, this correlation is insignificant and requires a larger sample size to clarify the result.

Correlations between FPS proficiency and both positive affective state are insignificant for group B. However, results demonstrate a weak to moderate relationship for group A. A higher FPS proficiency in this group is associated with higher positive and negative affect post-gameplay experience. This suggests that participants who had higher familiarity with the FPS genre enjoyed the game more and exhibited higher positive affect. At the same time, these participants had higher negative affect. Since the FPS game in this study was intentionally designed to be frustrating, participants familiar with this genre did not expect such intense gameplay and had a higher negative affect as they also had non-personalized support.

Cross-referencing the quantitative and qualitative analysis of the data, we can observe that participants from group B also praised the emotional support messages of the game much more than participants from group A in the qualitative section 6.5 with 83.3% of the comments belonging to this group. This implies that participants from group B were more aware of the personalized approach and appreciated this strategy more than the non-personalized group. However,

participants from group B also complained about the frequency of these support messages more than group A with 75% of the comments, which is an indicator of their awareness towards the personalized approach. These comments showcase the differences in personalized and non-personalized approaches where the personalized strategy was more noticeable among participants from group B as they also referred to that more in the qualitative section.

To conclude the answer to RQ1, a personalized companion in group B proved successful in stabilizing emotional responses. Correlation analysis confirmed that other variables such as age, gender and gaming frequency had insignificant correlations. Although group A exhibited a weak to moderate relationship between FPS proficiency and affective states, this was not evident in group B and thus requires further investigation to confirm the relation. Qualitative feedback further supported these findings, with participants in group B acknowledging and appreciating the personalized emotional support, despite some complaints about the frequency of messages which should be considered in future work.

To answer RQ2 we refer to the section **??** and investigate the correlations between each personality trait and differences in affective state pre and post-gameplay.

(1) **Extraversion**: Even though the figure 12 suggests that on average group B had a higher extraversion attribute, the correlation analysis confirms that there is no meaningful relation between extraversion and differences in affective state.
(2) **Agreeableness**: According to figure 13, on average group B had higher agreeableness traits, yet the correlation analysis shows weak and insignificant correlations for groups A and B.
(3) **Conscientiousness**: Figure 14 displays a relatively similar conscientiousness attribute for both groups. According to the correlation tests, group A had a strong relationship with the affective state, with higher conscientiousness associated with higher positive affect and stabler negative affect. However, no significant relationship was found for group B.
(4) **Emotional Stability**: According to the figure 15, group A exhibited higher emotional stability traits yet correlation analysis does not confirm any meaningful relationship for this attribute. However, for group A there was a strong positive correlation for negative affect. Suggesting that higher emotional stability in group A resulted in higher negative affect. Since this group had a non-personalized companion, they did not have access to proper emotional support messages to moderate their negative affect which resulted in more negative emotional responses to the game.
(5) **Openness**: There was no strong correlation between openness and the affective state even though based on figure 16 group B had slightly higher openness attribute.

To conclude on RQ2, Extraversion, Agreeableness, and Openness had no meaningful correlations with participant's affective states. However, participants from group A who had higher Conscientiousness attributes tend to have higher positive affect and stabler negative affect post-gameplay experience. Additionally, participants from group A who had higher emotional stability seem to have a higher negative affect post-gameplay due to the absence of personalized emotional support.

8 FUTURE WORK

As the results indicate the potential use of tailored emotional support, in this section potential future research directions are explored to further refine this study.

The study was carried out fully online and despite gaining higher external validity, there was not much control over how participants confronted the game and the questionnaire. As the game was ported for web browsers, it was not fully optimized for some participants. They mentioned experiencing lagging during gameplay which was not intended and might have affected the result by increasing the negative affect. Despite including step-by-step guidance, some participants seemed to have forgotten to submit their final response. This is evidenced on the Qualtrics dashboard as there are 25 responses but only 15 finished every question. It seems that some participants forgot to return to the questionnaire page or might have dropped the study during gameplay. Some considerations were applied to ensure the validity of the data, such as hiding the next button on the game web page to ensure participants were playing the game for at least 15 minutes.

To gain higher credibility when A/B testing it is important to have a sufficient sample size. Despite conducting a mixed method and including qualitative questions rather than having a fully quantitative study, future studies could benefit from a higher number of participants.

This study only compares two conditions of having either a personalized support strategy based on Big Five Model personality or having a non-personalized approach. To gain more insightful results and valid data, in a future study a third condition could be added which is having no companion and no type of support. This will deeply examine each functionality of the companion. At this point, it is not clear whether the results are only due to the personalized approach or whether other characteristics of the companion are influencing the result.

The Big Five Model is a personality trait model which does not categorize participants into certain categories. Instead, each participant will have different grades from each category. In future studies, other types of personality models could be used to capture other characteristics of the participants. This study uses every trait to personalize the companion, in future, the personalization could only be based on one dominant trait.

Additionally, according to the comments from the qualitative section 6.5, some participants had complaints regarding the frequency of support messages suggesting that the emotional messages were not fully tailored according to their needs. In future work, other personalization theories could be utilized to refine the methodology in this study and obtain a more accurate system in providing support.

This study was conducted on an FPS game and, therefore the results are limited to this type of game. Other types of games could be utilized for this type of study in future directions.

The concluding remarks of this study are heavily based on self-reported measurements and therefore are subjective. Future studies could use other techniques such as behavioural data or psychophysiological techniques to validate the data.

Even though the age distribution in this study is quite diverse, it is not the case for gender distribution. Only 20% of the participants were female and all were categorized into group B. In future studies, a more unified gender distribution across the sample size and subgroups including marginalized groups could be used to validate the data.

9 CONCLUSION

This study explored the effectiveness of a personalized supportive system in an FPS game. At first, an FPS game was made using Unity with an intentionally frustrating gameplay which induced negative affect. A character companion, a flying robot, was integrated into the gameplay, providing emotional support. To test the effectiveness of the companion, two versions were implemented, one with a non-personalized approach and predefined events, and the other with a personalized approach based on Big Five Model personality traits. An online mixed method, AB test experiment was conducted to compare the two versions and evaluate the effectiveness of the personalized companion versus

non-personalized. 15 responses were gathered in total. Both groups were instructed to fill out demographic data, as well as a self-reported measure to evaluate their affective state pre and post-gameplay and their personality traits according to the Big Five Model followed by qualitative questions.

The results indicate that participants from group B (personalized companion) had a stable affective state post-gameplay whereas participants from group A (non-personalized companion) had a higher negative affect. An extensive correlation analysis was conducted between other variables such as age, gender, gaming frequency, and FPS proficiency. No correlation was significant except for FPS proficiency and group A which with a higher FPS proficiency, a higher affective state was seen in group A.

This study also explored whether certain personality traits are prone to emotional support strategies. A correlation analysis was conducted between each personality trait and affective state. Results indicate that no correlation was found for Extraversion, Agreeableness, and Openness. However, group A demonstrated some correlations for Conscientiousness and Emotional Stability.

The findings of this study show the effectiveness of a personalized approach in stabilizing and improving the mood of players. In future studies, the personalization could be further improved and other personality models could be integrated to ensure the results are applicable among all personality models and game genres.

APPENDIX

.1 Qualitative Questions and Answers

User ID	Enjoyed Companion	Didn't Enjoy Companion	Other Comments
5	The idea of the game.	The map.	I couldn't understand how the map should be used, it would be better to make it more clear
6	Helpful when you run low on health or ammo.	The constant "tips" for the game.	I liked the jokes that he made but on the first run and was happy it didn't occur again on the second run.
10	when he said good job or well donw	he was always there and took up screen space. also the message of press q to make him disappear also took up valuable screenspace. Even when i pressed it he was still appearing out of thin air	the game was fun at times but i think the experience was deteriorated from playing it on chrome? I have a gaming laptop and im pretty sure i was playing with 30fps or something which made it very unenjoyable. It also seemed like some enemies needed multiple shots to die and it would be nice to know their current health. I really liked the graphics though
11	gives somewhat useful tips	monotone, emotionless, slightly annoying	no
12	Visual design	Everything (probably the jittery voice)	I think the mouse sensitivity is way too high
13	Good tutorial.	Too big, it could be just a voice in the background.	The navigational map needs a serious improvement.
14	The positive reinforcement and the reminder to reload because i sometimes forget lol	the robotic voice and the reminder for the map (although it is probably more because i didn't really use the map because it was hard to use for me)	very fun game and nice to have a companion! i get scared easily when playing games alone (i'm a bit anxious in general) so a companion does make me feel more at ease :)
17	The concept.	the lagging of the game	N/A

Table 1. Qualitative Question Answers

User ID	Enjoyed Companion	Didn't Enjoy Companion	Other Comments
18	its comments about the environment around the character	the fact that i had to press q to make it disappear	yes, i think you can have the companion disappear automatically after a timer is expired. for example, you may show the text "press q to make the companion disappear" for like 45 seconds and, if the player still hasnt pressed the q and the companion is doing nothing, you can simply disable it.
19	It reacted based on my chhoices and some of the dialouges when you face certain objects in the scene such as golden tooth shows it has some degree of agreeableness and companionship with the player	I senced it is a programmed robot. I think the companion did not gave me the feeling it needs to get gratificaation from me! instead I got the feeling that I needed to follow his orders and get gratification from him!	I expected it to be more reactive. for example in direct shootings it could cheer the player or when i get hit it can have some supportive comments. but in general it was guiding and helpful.
20	Making funny comments	Constantly coming to my face!	I love that it has the vibe of early fps games
21	i dont think i need the companion	Heads up.	i dont think the companion is that much helpful.
22	From time to time it gave some valuable clues.	Very annoying, even during the 1st playthrough, only few clues were helpful and the rest were unnecessary and anoying.	N/A
23	I enjoyed the little anecdotes, made me feel less alone in a hostile game world	The font used and the text placement didn't really feel professional, felt like it still needs polishing	Overall I really enjoyed the game! When I was too far away, the enemies would stop shooting, making the game trivial
24	the little jokes he made along the way	he talked a lot in moments i did not really like	The launched version of the game would run more smoothly and i would be able to listen to the game more . Also some shooting sound for the enemies and glow in the bullets to dodge

Table 2. Qualitative Question Answers

.2 FPS Game

To gain access to the game's code base refer to the following link:
https://gitlab.com/parinazmirbagheri/smallProject

.3 WebGl Build

To gain access to the personalized version of the game and play the game online, refer to the following link:
https://play.unity.com/en/games/aa5745e4-b1d7-4cbc-af72-a770924f2eaa/personalized-companion

To gain access to the non-personalized version of the game play the game online, refer to the following link:
https://play.unity.com/en/games/7c9a6340-fe74-46a7-8bfb-3266783b9c85/none-personalized-companion

.4 Questionnaire

To gain access to the online questionnaire refer to the following link:
https://survey.uu.nl/jfe/form/SV_1NsF9ugUJp57jEO

.5 Thematic Analysis

For a detailed overview of the thematic analysis refer to the following link:
https://miro.com/app/board/uXjVKvZXyWY=/?share_link_id=33935621966

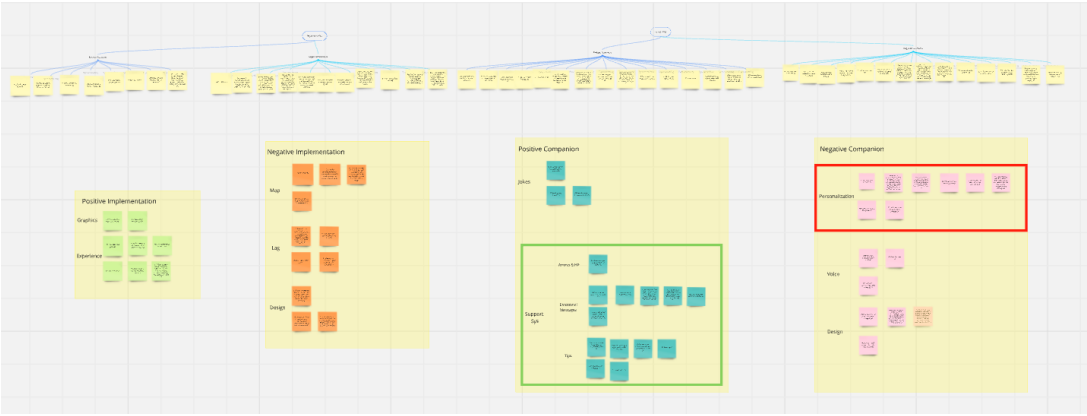


Fig. 20. Thematic analysis of the qualitative questions.

.6 Planning

Outlined below is a basic weekly plan on how this study was carried out during the given time.

Date	Task
Week 1 (Apr 29 - May 5)	Project Initiation
Week 2 (May 6 - May 12)	Implementation
Week 3 (May 13 - May 19)	Implementation
Week 4 (May 20 - May 26	Implementation
Week 5 (May 27 - June 2)	Implementation
Week 6 (June 3 - June 9)	Playtest
Week 7 (June 10 - June 16)	Playtest
Week 8 (June 17 - June 23)	Playtest
Week 9 (June 24 - June 30)	Data Collection
Week 10 (Jul 1 - Jul 7)	Data Collection
Week 11 (Jul 8 - Jul 14)	Data Collection
Week 12 (Jul 15 - Jul 21)	Data Analysis
Week 13 (Jul 22 - Jul 28)	Data Analysis
Week 14 (Jul 29 - Aug 4)	Data Analysis
Week 15 (Aug 5 - Aug 11)	Thesis Report
Week 16 (Aug 12 - Aug 18)	Thesis Report
Week 17 (Aug 19 - Aug 25)	Wrap up and Thesis Defense

Table 3. Basic weekly planning

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