

Stranded Away: Implementation and User Experience Evaluation of an Indie Platformer Game Developed Using Unity Engine

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Abstract - Platformer games have been a staple in the video game industry for decades, dating back to the early days of arcade games such as *Donkey Kong* and *Super Mario Bros*. These games continue to be popular today and have evolved to include a wide range of subgenres and gameplay styles. This paper introduces *Stranded Away* - an indie platformer game developed in the Unity engine. The implemented game retains most of the main aspects of platformers, such as collectibles, moving platforms, different types of enemies, and obstacles, along with puzzle video game elements such as solving riddles to progress. However, the emphasis is placed on core game mechanics, namely player movement and puzzles, as well as tools we have developed to design game levels more efficiently. An empirical study was conducted to examine the user experience of the introduced game. The sample of study respondents consisted mainly of students who first played the game and then completed the post-use questionnaire. The reported findings uncovered to which extent *Stranded Away* has met the requirements of relevant user experience dimensions.

Keywords – Videogames; Unity Engine; Indie Game; User Experience; Human-Computer Interaction; 2D Platformer; Puzzle Games; Pixel-Art; Post-Use Questionnaire; Empirical Study

I. INTRODUCTION

Platformer games are a video game genre that involves navigating a character through a series of obstacles and enemies. Originating in the early 1980s, they played a key part in the evolution of video games and even helped game consoles to thrive. Typically, they are defined by their side-scrolling gameplay, where the player controls a character who must navigate through levels filled with obstacles, enemies, and puzzles. The usual objectives include reaching the end of each level, defeating bosses, or collecting certain items or power-ups along the way. These games often rely on precise controls, timing, and strategy to successfully navigate through each level.

In recent years, indie game developers have been able to create and distribute video games on their own, through various channels, including digital distribution platforms such as “Steam” and “App Store”. These indie platformer games often offer unique and creative takes on the classic platformer formula while introducing new mechanics, art styles, and storylines [1].

This paper presents “*Stranded Away*,” an indie 2D platformer developed in Unity. The versatile, user-friendly engine supports cross-platform game creation with built-in components like physics and rendering. *Stranded Away* blends classic platformer and puzzle elements for a unique, challenging gameplay experience. To evaluate the user experience of *Stranded Away*, an empirical study was conducted with a sample of mainly student participants who played the game and completed the post-use questionnaire. The results of this study will provide valuable insights for future indie game developers and contribute to the understating of how platformer games can effectively engage and challenge players.

The remainder of this paper is structured as follows. The second section briefly describes the Unity game engine. In the third section, the methodology and theoretical basis of the proposed UX dimensions are presented, while details on the main aspects of the game and its implementation are provided in the fourth section. The findings of an empirical study are reported in the fifth section. Discussion and implications are covered in the sixth section, and the conclusion and future work directions are provided in the final section.

II. UNITY GAME ENGINE

Unity is a cross-platform development environment for video games, developed by Unity Technologies. The environment provides fundamental functionalities, including a rendering engine, sound importation and utilization, physics simulation, animation capabilities, and networking support. Unity provides tools for designing 2D and 3D games for a variety of devices and operating systems. The extensive availability of learning resources and pre-written libraries for frequently performed tasks is one of the reasons for Unity's popularity among beginner programmers. Unity utilizes the object-oriented programming language C#. All languages supported by Unity are object-oriented scripting languages. The object referred to as “GameObject” in Unity serves as the primary building block within the Unity environment. It allows game developers to encompass various elements such as a *character, object, camera, light source, terrain, image, text*, etc. To endow an object with attributes like objects in the real world, such as light, window, or camera, it is necessary to add components to the object.

The highly flexible and user-friendly user interface of Unity plays a crucial role in the utilization and functioning of the software. For instance, it allows developers to further modify and even create custom new inspectors. That can be very useful for adding frequently needed functionalities directly to the editor interface [2].

III. METHODOLOGY

A. Research Framework

To gain a comprehensive understanding of the user experience in *Stranded Away*, it is crucial to examine various dimensions that contribute to the overall enjoyment and success of the game. By drawing from established models such as the Game Experience Questionnaire (GEQ) by Ijsselstein et al. [3] and the Player Experience of Need Satisfaction (PENS) model by Ryan et al. [4], we can formulate research questions that encompass a wide range of user experience dimensions. These dimensions include gameplay mechanics, learnability, user interface sensibility, visual elements, audio elements, engagement, enjoyment, and behavioral intentions. By investigating these aspects, we aim to answer the following research questions:

1. How do players perceive *Stranded Away*?
2. How does the overall user experience of *Stranded Away* differ between more experienced and less experienced platformer players?

To evaluate the user experience of *Stranded Away*, several quality dimensions must be considered, as they contribute to the overall enjoyment and success of the game. Gameplay mechanics (GMH) refer to the rules and systems governing player interaction and actions within the game and are crucial for player engagement and enjoyment, as highlighted by Fabricatore et al. [5]. Learnability (LRN) measures the degree to which the game is easy to learn and master, playing a significant role in player satisfaction and motivation, as discussed by Kiili [6]. User interface sensibility (UIS) refers to the design, organization, and intuitiveness of the game's user interface, which enhances the player experience, as suggested by Desurvire et al. [7] in their heuristics for evaluating playability. Visual elements (VIS) encompass the visual design of the game and its impact on the player's overall experience, as emphasized by Miszal and Schild [8] in the context of video game art and visual design. Audio elements (AUD) pertain to the overall feel, mood, and ambiance created by in-game sound, contributing to the player's immersion and emotional connection to the game, as explored by Jørgensen [9]. Engagement (ENG) is the state of focus, concentration, and immersion experienced by players and is a key factor in maintaining player satisfaction, as reported by Ijsselstein et al. [3]. Enjoyment (ENY) reflects the degree to which the player experiences pleasure from playing the game and is crucial in determining the overall success of a video game, according to Vorderer et al. [10]. Finally, behavioral intentions (BEH) represent the likelihood of the player recommending the game, playing again, or purchasing similar games in the future, reflecting the player's overall satisfaction and experience with the game, as supported by

Hamari et al. [11] in their study on the behavioral intentions of players in the context of online games. By examining these dimensions, we can better understand the user experience of *Stranded Away* and identify potential areas for improvement.

B. Apparatus

The user experience in *Stranded Away* was examined through an empirical study involving primarily students from the Juraj Dobrila University of Pula, along with other individuals with gaming experience across Istria County in Croatia. Data collection was carried out online using a questionnaire created and administered with Google Forms. The first part of the questionnaire consisted of demographic questions, as well as inquiries regarding participants' past gaming experience and habits. The second part of the questionnaire aimed to measure user experience, featuring 40 items divided into eight dimensions. Responses to these items were collected using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The user experience evaluation procedure was adopted from previous studies [12,13] and tailored to the context of *Stranded Away*. After participants played the first two levels of the game, which are slow-paced and allowed for thorough exploration and unlocking of the game's features, they were asked to complete the online questionnaire. Finally, the internal consistency of the questionnaire was examined using Cronbach's alpha coefficient, ensuring the reliability of the findings.

IV. GAME INTRODUCTION

Stranded Away is a 2D platformer/side-scrolling game with puzzle elements. The player controls a mysterious space traveler who lands on the planet „Athion” with his spaceship. He is in search of the human species after the galactical apocalypse created by mad scientist dr. Hone - the main antagonist in the game. The player is introduced to the game in the first out of three game levels. Figure 1 represents the opening scene in the first level of the game. All game scenes and visuals are produced in the pixel-art style of graphics.

The story builds up as the player finds data files located on each level. Accordingly, the user unlocks different weapons and power-ups to successfully pass the upcoming levels. Core game mechanics, including player movement, shooting, object interaction, inventory system, and puzzle solving, will be described in the following subsections.



Figure 1. The opening scene in-game

A. Player character movement

Player character movement is an important aspect of every game. Platformers are based on the player traversing through levels and overcoming obstacles thus making character movement one of the core gameplay mechanics.

Player movement in Stranded Away consists of two main parts:

a. Finding the target velocity and then gradually changing towards it over time. The vector is smoothed out by a spring-damper-like function. A spring damper refers to a mathematical model used to simulate physics behavior. It is commonly used in game physics to create realistic motion, such as character jumping, as well as for smoothing out a follow camera [2].

b. Attaching several *colliders* to the player, as shown in Figure 2. In unity, colliders are components that define the shape of an object for physical collisions. For instance, the rounded circle-cast collider will indicate that the player is grounded if it hits anything designated as ground.

B. Shooting system

The shooting system in platformers allows players to attack enemies or obstacles in the game world. This is implemented by creating an *arm pivot* object, a common mechanism that allows players to shoot projectiles more realistically and intuitively. It works by using an animation of an arm pivoting at the shoulder joint, along with a *ray cast*, to determine the direction of the shot.

C. Object interaction

Object interaction refers to how the player character interacts with various objects within the game world. In Stranded Away, this includes opening doors, pushing, and picking up boxes, and stepping on the pressure plates or jump pads. Object interaction plays a key element in the game since it consists of many riddles that must be solved to progress throughout the game. An example of interacting with an object is presented in Figure 2.

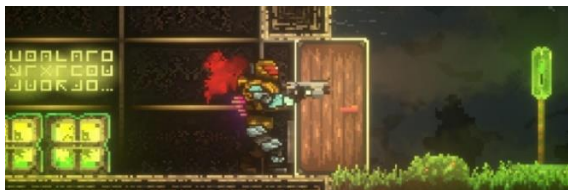


Figure 2. Highlighting doors with white outline

D. Inventory system

Inventory systems in video games enable players to manage and organize collected items. With crafting elements, players gather raw materials and finished products for equipping and selling. Crafting mechanics add depth and strategy to gameplay, as players must manage resources and decide which items to craft for easier progression. For example, players collect raw materials for crafting ammunition. Figure 3 illustrates the game's inventory and crafting grid.



Figure 3. Inventory (right) and crafting grid (left)

E. Gameplay elements

Gameplay in Stranded Away includes typical platforming elements such as jumping, platforming, coin pickup, puzzle-solving, power-ups, and enemies. The main user interface, shown in Figure 4, consists of ten parts: 1 - ammunition, 2 - selected weapon, 3 - health bar, 4 - shield bar, 5 - oxygen bar, 6 - energy bar, 7 - total coins, 8 - settings, 9 - stats, and 10 - inventory. Initially, players have a 4-point health bar and a basic blaster gun which has unlimited ammunition, but it's the weakest of them. As they progress, they unlock weapons and can purchase power-ups with collectible coins. The interface also includes settings, stats, and inventory buttons, which have keyboard shortcuts.



Figure 4. User interface in-game

The core game mechanic involves *energy box* manipulation. Players can move them around to activate pressure plates, which trigger objects like *laser doors* and *moving platforms* by emitting visible signals. Four scenarios exist: (1) One pressure plate → Single object, (2) One pressure plate → Multiple objects, (3) Multiple pressure plates → Single object, (4) Multiple pressure plates → Multiple objects. This allows for the design of more complex and challenging riddles for the player.

F. Enemy AI

Enemy AI is vital for creating engaging virtual opponents in video games. In Unity, ray casting is a common technique for implementing enemy AI, where a line or "ray" is emitted from a starting point to detect the player's character. This enables dynamic adjustments of AI behavior based on the player's actions and position, as illustrated in Figure 5.



Figure 5. Enemy raycasting

The *Enemy AI* script utilizes a state machine to dynamically control the behavior of enemy characters in the game. The state machine has multiple states including *Idle*, *Roaming*, *Chasing*, *Attacking*, *Spitting*, and *Flying*. Each state represents a distinct behavior or action that the enemy can perform.

G. Tilemap painter

Designing levels in a 2D video game can be repetitive and time-consuming, as it often involves manual placement of individual tiles. To address this, a custom system for automatic terrain and tilemap generation was developed, called "Tilemap Advanced Ruleset." This tool streamlines the process within the Unity game engine by allowing level designers to use a prototype tile palette to create a tilemap and apply predefined rulesets. Rulesets are based on the relationship between tiles and their

surroundings, creating a system of logic similar to cellular automata. The tool automatically generates tilemaps using appropriate tiles from pre-defined palettes based on the applied rulesets (Figure 6). Additional tools, like "Tilemap Advanced Generation," were developed to generate decorative elements, such as pillar structures in caves, to enhance the visual appearance of the levels.

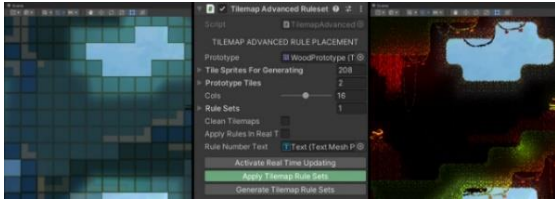


Figure 6. Before and after applying the tilemap generation tool

H. Level generation

The game includes a "challenge" level, "The floor is lava," where players must climb infinitely, dodging rising lava and obstacles while collecting power-ups. A "Level generation" tool with a procedural generation algorithm was implemented for fair terrain generation, using predefined "platforms" to create random yet well-designed sections (Figure 7). The tool also tracks the player's maximum height, enabling additional elements like "money barriers" and height-based effects.

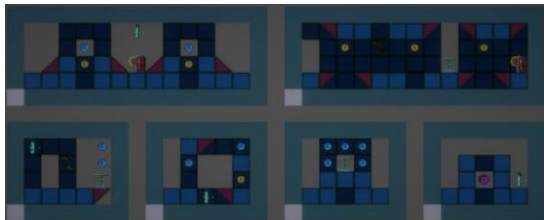


Figure 7. Predefined sets of tiles

This approach in combination with "Tilemap Advanced Generation" not only keeps the level interesting and fresh for the player but also ensures that the player's path is not blocked.

V. USER EXPERIENCE EVALUATION

A. Participants

To gather an understanding of to which extent Stranded Away has met the requirements of relevant user experience dimensions, an empirical study was carried out. A total of 75 participants, mostly students from the Juraj Dobrila University of Pula, Faculty of Informatics took part in the study. The sample was composed of 72% male and 25.3% female respondents while the remaining 2.7% declined to provide an answer in that respect. The majority (44%) of participants were enrolled in the first year of undergraduate study, 24% were enrolled in the third year of undergraduate study, 20% were enrolled in the second year of undergraduate study while the remaining 8% percents were enrolled in the second year of undergraduate and first year of graduate study. Three participants (4%) were not students. The average age of respondents was 22.15 years (SD = 3.86).

Regarding previous gaming experience and gaming habits, the participants were rather diverse, ranging from casual gamers to avid gamers, with different preferred

genres. Participants' responses related to the most important game feature are summarized in Figure 8. The majority of participants (40%) agreed that enjoyment is the most important aspect of a video game.

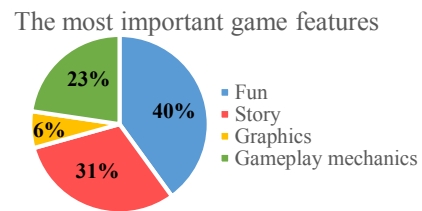


Figure 8. The most important game features

Platformers might pose a challenge for players with little to no experience for several reasons, such as precision jumping, timing-based obstacles, challenging enemies, and increasing difficulty. As shown in Figure 9, a majority (59%) of players had no to limited previous experience with platformers, while others were moderate to very experienced in such games.

Previous experience with platformer games

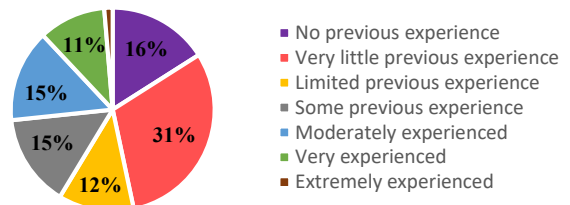


Figure 9. Previous experience with platformer games

Finally, a bar chart presented in Figure 10's bar chart illustrates the most popular video game genres based on a multiple-choice survey. Action and shooter games are the top choices, preferred by 50% of respondents. About a third enjoy survival, strategy, and RPG games, while 25% prefer horror, racing, sports, fighting, and other genres. Platformer games attract only 12% of participants.

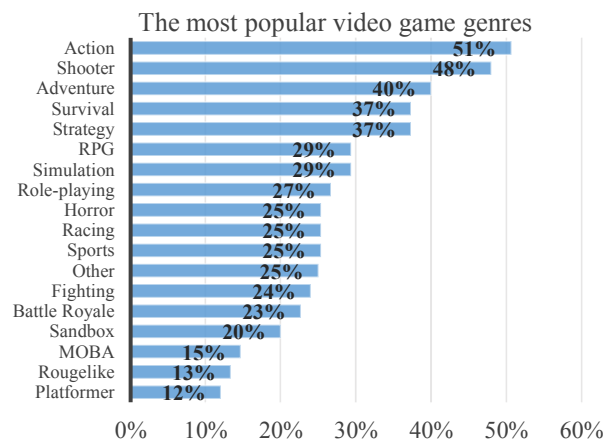


Figure 10. The most popular video game genres

B. Findings

As demonstrated in Table 1, Cronbach's alpha values ranged from 0.639 to 0.880, which is acceptable for exploratory studies and indicates that the reliability of the scales is considered adequate [14].

The independent t-test was conducted to compare the perceived user experience among players with varying degrees of platformer game experience. Players were divided into two groups: the first group consisted of those with "No previous experience," "Very little previous experience," and "Limited previous experience," while the second group included players with "Some previous experience," "Moderately experienced," "Very experienced," and "Extremely experienced." First, the scores were calculated by adding up the values of each item in the construct, and the overall user experience score was determined by summing the scores across all dimensions, as indicated in bold in Table 1. The results of the t-test revealed no significant difference ($p = 0.137$) in the perceived user experience between the two groups, with p-values above the threshold level of 0.05 [15]. This suggests that Stranded Away provides a consistent user experience across players with different levels of platformer game experience, highlighting its accessibility and appeal to a diverse audience.

TABLE I. CRONBACH'S ALPHA AND T-TEST P VALUES ACROSS UX DIMENSIONS

Constructs	Cronbach's alpha	Independent Samples Test p-value
Gameplay mechanics (GMH)	0.785	0.423
Learnability (LRN)	0.639	0.704
User interface sensibility (UIS)	0.768	0.410
Visual elements (VIS)	0.878	0.109
Audio elements (AUD)	0.843	0.924
Engagement (ENG)	0.848	0.700
Enjoyment (ENY)	0.880	0.156
Behavioral intention (BEH)	0.800	0.067
User Experience (UX)		0.137

Utilizing descriptive statistics, the analysis of the collected data revealed that 77% of participants agreed on the well-designed game mechanics, with 21% remaining neutral. A significant majority, 90.7%, found Stranded Away easy to learn. Furthermore, 96% of participants perceived the user interface as well organized. In terms of visual elements, 80% found them appealing, 13.3% stayed neutral, and 7% expressed a negative opinion. For the audio experience, 76% of players felt that sound and music enhanced their gaming experience. 68% found the game to be engaging, and 78.7% considered the game enjoyable. As for future play intentions, 38.7% of participants remained neutral, but over half agreed they would recommend the game to their gaming community and try other games from the same development team. These findings are summarized in Figure 11 (refer to the Appendix).

VI. DISCUSSION AND IMPLICATIONS

Understanding the impact of user experience dimensions on player satisfaction enables developers to cater to diverse preferences and expectations. Study constructs were validated using background work and Cronbach's alpha test, enhancing the research findings. In the context of this study, one strength of using students as

a sample is their familiarity with digital technologies and gaming, making them an appropriate and relevant population for evaluating user experiences in video games. Moreover, students tend to have diverse gaming habits and preferences, which can provide valuable insights into the factors that contribute to a positive gaming experience across a wide range of player profiles. However, one limitation of using students as a sample is the potential lack of generalizability to other populations, such as older adults or individuals with different cultural backgrounds [16]. The study's findings may not apply to all player demographics, and further research is needed to confirm these insights across a wider participant range. In summary, the insights offered by this study provide valuable guidance for both practitioners and researchers in the field of video game design and development. Incorporating these learnings and addressing study limitations can help the industry create engaging experiences for players across various genres and platforms, informing new game design principles that consider genre and context nuances. Additionally, further research could explore the relationships between user experience dimensions and player demographics or gaming habits to better understand how different player profiles might influence the user experience. Ultimately, the study's findings provide a valuable starting point for both practitioners and researchers to enhance the design, development, and evaluation of video games, ensuring that they continue to provide engaging and satisfying experiences for players.

VII. CONCLUSION

Platformer games, like Stranded Away developed in Unity, have regained popularity due to indie developers. Unity's versatility and user-friendliness make it a popular choice. Stranded Away combines classic platformer and puzzle elements, offering a unique and challenging experience. Various tools were built for tasks like terrain generation and puzzle creation. An empirical study evaluated user experience, demonstrating Unity's potential and the game's engaging gameplay. This study serves as a starting point for developing a UX research framework for video games and reveals positive user perceptions of Stranded Away, primarily due to its well-designed game mechanics, and visual, and audio elements. However, the study's limitations include a small, homogenous sample of students mostly from one university.

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APPENDIX

RESPONSES TO QUESTIONNAIRE ITEMS

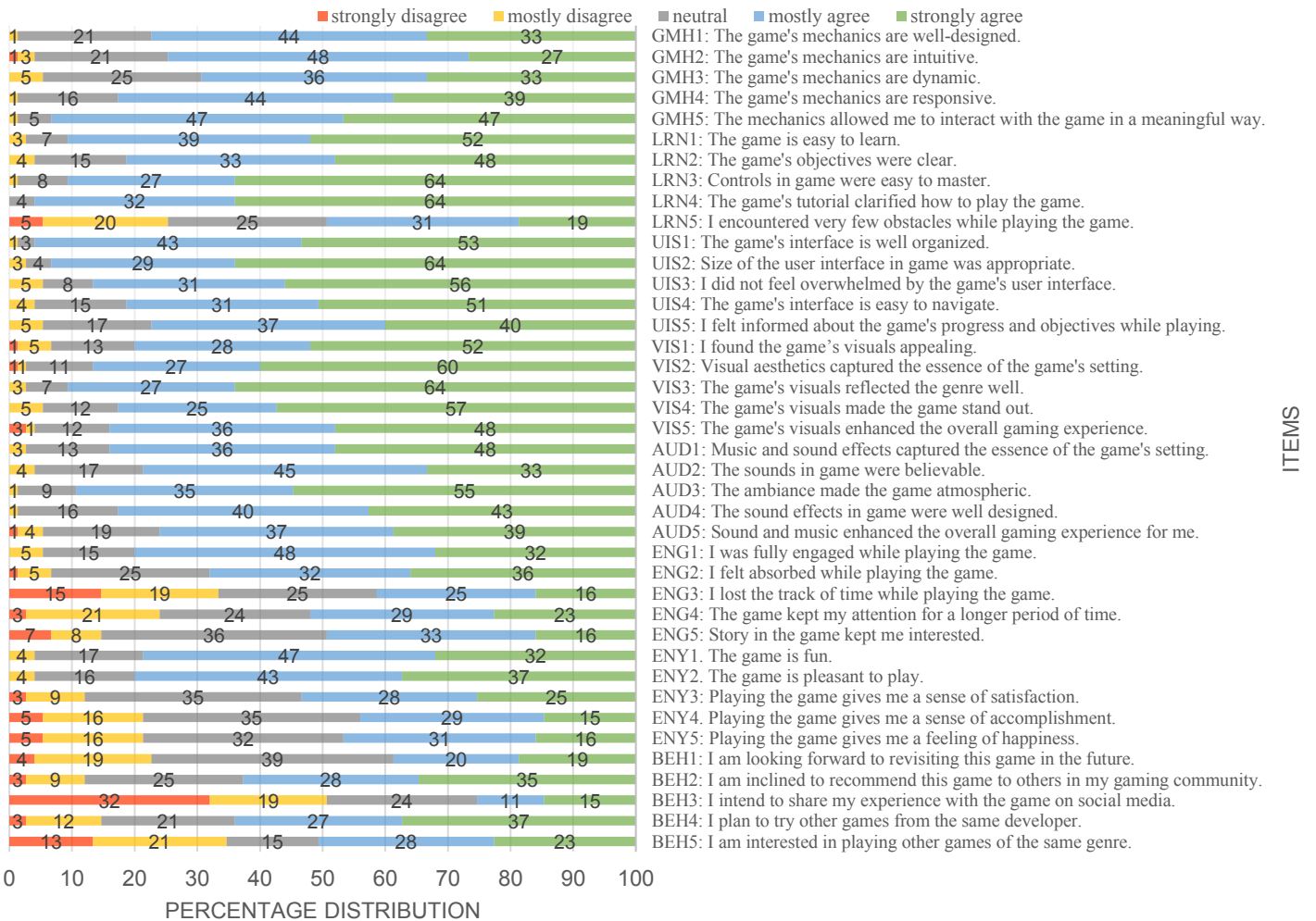


Figure 11. User experience evaluation findings