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Serious Game for Schizophrenia Rehabilitation: Design and Narrative for Patient Engagement in *Life Simulator*

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Relatório de Projeto para obtenção do Grau de Mestre em

Design e Desenvolvimento de Jogos Digitais

(2º ciclo de estudos)

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Declaração de Integridade

Eu, João Victor Mayer e Barros, que abaixo assino, estudante com o número de inscrição M11816 de/o Mestrado em Design e Desenvolvimento de Jogos Digitais da Faculdade Universidade da Beira Interior, declaro ter desenvolvido o presente trabalho e elaborado o presente texto em total consonância com o **Código de Integridades da Universidade da Beira Interior**.

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João Victor Mayer e Barros

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Acknowledgments

In the simplest of terms, I am grateful for my family and my soon-to-be wife, who have endured my absence while providing love and support. I'm thankful for the old friends I miss and the new friends I will miss, and lastly, I’m thankful for the teachers who didn’t let me stray from this path.

Resumo

O trabalho consiste em um projeto de design e desenvolvimento participativo do jogo sério *Life Simulator*, relacionado a tecnologias digitais para técnicas de reabilitação inovadoras, com o objetivo de aplicar a reabilitação psicossocial em pacientes diagnosticados no espectro da esquizofrenia, em um estudo de ensaio clínico randomizado.

Em colaboração com o Departamento de Psiquiatria e Saúde Mental da Unidade Local de Saúde do Nordeste, no âmbito do projeto *GreenHealth,* o jogo sério oferece uma experiência adaptável de realidade virtual, unindo educação com uma jogabilidade envolvente por meio do design e da narrativa. O projeto adota uma abordagem interdisciplinar e multidisciplinar, envolvendo cinco equipes que ajudaram a definir os parâmetros do projeto em um documento de design de jogo.

Atuando em funções como design de jogo, design de níveis e design de narrativa, o autor participou da pré-produção e desenvolvimento dos assets do jogo, resultando em um protótipo final feito para Meta Quest 2 com gráficos semi-realistas. O objetivo do projeto é não ser pior, ou ser equivalente às opções de terapia de reabilitação disponíveis, servindo como ajuda para enfrentar a escassez de profissionais de saúde na região.

Palavras-chave

Esquizofrenia;Jogo Sério;Realidade Virtual;Terapia de Reabilitação;Engajamento

Abstract

The work consists of a participatory design and development of the serious game *Life Simulator*, regarding digital technologies for innovative rehabilitation techniques, to apply psychosocial rehabilitation for patients diagnosed within the schizophrenia spectrum, focused on the negative symptomatology of the mental disorder in a randomized controlled trial study.

Developed with Departamento de Psiquiatria e Saúde Mental da Unidade Local de Saúde do Nordeste, within the scope of project GreenHealth, the serious game offers an adaptable virtual reality experience, merging education with engaging gameplay through design and narrative. The project has an interdisciplinary and multidisciplinary approach, with five teams that helped define project parameters in a game design document.

Acting in roles such as game design, level design, and narrative design, the author took part in the pre-production and development of the game assets, accomplishing a final prototype with semi-realistic graphics made for Meta Quest 2. Its goal is to equal available rehabilitation therapy options and address workforce shortages in the region.

Keywords

Schizophrenia;Serious Game;Virtual Reality;Rehabilitation Therapy;Engagement

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List of Acronyms

AI	Artificial Inteligence
GE	Game Elements
LS	Life Simulator
PGH	Project GreenHealth
SG	Serious Game
UI	User Interface
VR	Virtual Reality

Introduction

This study came to fruition to address the needs of Project *GreenHealth*(PGH), a virtual reality(VR) game for the negative symptoms of stabilized schizophrenia patients. The study focus is on the implementation of game design and narrative elements of an in-progress digital rehabilitation therapy.

This document, built to exhibit the results from a randomized controlled trial study by the Departamento de Psiquiatria e Saúde Mental da Unidade Local de Saúde do Nordeste within the scope of PGH, exposes the contribution of the author to the production of the game *Life Simulator*(LS). The assignment was to work as a game designer and contribute to other roles such as narrative designer and level designer, when deemed necessary.

Background

PGH regards digital technologies for innovative rehabilitation techniques, it aims to apply psychosocial rehabilitation for patients diagnosed within the schizophrenia spectrum, focused on the negative symptomatology of the mental disorder. Its goal is to produce a serious game(SG) in a VR environment with an adaptable difficulty system, capable of challenging the patient according to his symptoms, a simulation to train and teach by merging educational narratives and game mechanics.

Motivation

In 2018 an extra-curricular program preceding PGH, called Project Y (IPB, n.d.), started at Instituto Politécnico de Bragança. Participants of that program had to interact with external stakeholders to conceptualize proposals that answered context-based problems, there, LS was born. The author cooperated on its conceptualization by making the initial level design and the *Game Design*. Later, the first prototype was made for Google Cardboard.

Over the years, the work contribution became extensive, and its results became valuable to the author's education regarding game design and development, therefore, sharing a part of its process in this paperwork will help in the understanding of the pre-production and production stage a game designer has to make in order to select and organize his and his team's ideas, as well as the design intentions to achieve ecological validity and narrative purpose for user engagement, to accomplish PGH's ideals.

Chapter 1

Literature Review

Analyzing the contributions of gaming toward physical condition, neurocognition, and social functioning (Quiles & Verdoux, 2023) the project's purpose is to create a narrative-influenced SG that is not inferior to traditional rehabilitation methods for the negative symptoms of schizophrenia.

Regarding the chosen technology, non-exergames have less beneficial effects on cognitive functioning when compared to exergames. Consequently, patient integration into a VR setting that enables real-life movement, is expected to have the desired positive outcomes, either as a stand-alone or adjunct treatment, while further research has been deemed necessary (Roberts et al., 2021; Kuntz, 2022).

Specifically, the narrative role to enhance immersion, engagement, motivation, and learning was found to be effective (Naul & Liu, 2019), provided that key features concerning design, operation, and rationale are met within the game (Fitzgerald & Ratcliffe, 2020). Thus, this paper discusses the effective utilization of narrative toward the project's goals.

1.1 Theoretical Background

For the creation of a new rehabilitation therapy, the influences of games on the world have played a significant role, and what is said to be their appeal resides in three factors: challenge, fantasy, and curiosity (Malone, 1980).

SGs have been made in diverse settings: educational and training, well-being, advertisement, cultural heritage, interpersonal communication, and biomedical and health care (Laamarti et al., 2014). These games make learning possible when there are constraints in the real world, such as safety, cost, or time. Moreover, they have been claimed as helpful for enhancing various sets of skills for the users (Susi, 2007).

29 million cases of schizophrenia were documented worldwide, making it the most common psychotic illness (Barbato, 1997). With that in mind, PGH aims to ease the treatment costs of this illness in the northeast of Portugal with an SG.

To accomplish that, an effective game design is of utmost importance. It is responsible for unraveling the pleasures of user experiences with compelling stories, characters, goals, rules, and challenges, be it for entertainment or educational purposes (Stefyn, 2022).

1.2 Methods

A search on Scopus, PubMed, and Google Scholar databases started on 15/03/2023 with the research query: "game narrative" AND "mental health" AND ("Negative Symptoms" OR "Cognitive Symptoms") OR "rehab*" AND "game narrative" AND "serious game" NOT "physical".

This research included all studies collected from the databases by the following criteria: must be written in English; Focused on the treatment of cognitive negative symptoms; narrative impact on game rehabilitation or therapy.

Three steps were conducted: through database search and reference screening, all records were collected and all duplicates were removed; titles and abstracts of the studies were examined while applying the Eligibility Criteria above, irrelevant studies were removed; remaining relevant titles received full reading for further exclusions based on the alleged criteria.

1.3 Results

With the research query mentioned, 23 results were presented within the databases. 11 removed papers were addressed as one duplicate, one in French, eight not focused on the treatment of cognitive negative symptoms, and one still in development, leaving 12 included papers for this systematic review (Figure 1.1).

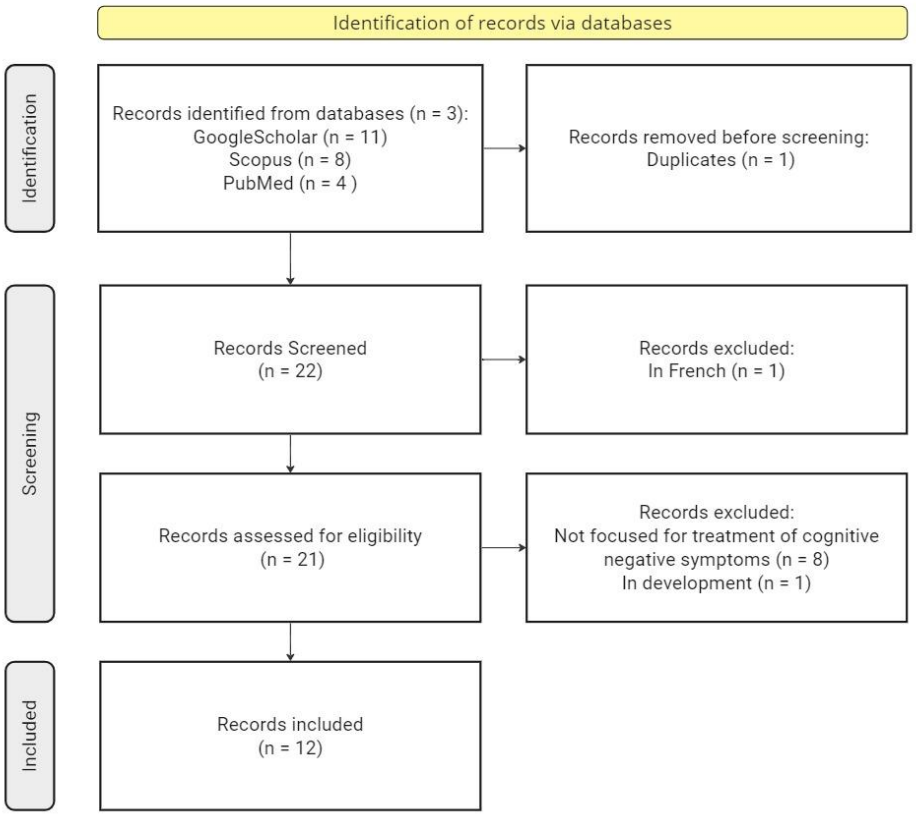


Figure 1.1: PRISMA flow diagram showcasing the records selection process.

Published papers were found within the year range of 2016 and 2022. Out of the twelve selected, nine were articles, two were thesis (one master's and one doctoral), and one was a book chapter.

To increase immediate task efficacy and facilitate sustainable engagement, the Doctoral Thesis by Birk, M. (2018) investigates if game-based motivational design strategies create motivation to engage with health services, during and after treatment. Four studies were conducted: investigate the impact of avatar customization on both the overall experience and behavior within an infinite runner game, how financial rewards influence self-reported motivation and performance within an 11-day gamified training task by varying motivation levels, what are the effects of attrition in an intervention using breathing exercise over three weeks and if there are instant effects of avatar customization in correlation to anxiety-reducing attentional retraining task efficacy. It determines that avatar customization is a viable strategy to increase the user's motivation and engagement

Boldi, A., & Rapp, A. (2021) article focuses on uncovering the usage of commercial video games in mental health with a systematic review of 39 papers. It uncovers that games mitigate depressive symptoms and reduce symptoms of clinical depression while maintaining its benefits on the patient for one month past the intervention, yet, few papers reported potential negative effects. In the end, it highlights major positive results but also recommends further exploration of this field by all involved peers.

To uncover military veterans' usage of video games for mental and behavioral health recovery, Colder Carras, M., Et al. (2018) performed semi-structured interviews with 20 veterans. The research revealed that video games contribute to mood and stress management, adaptive coping strategies, eudaimonic well-being, and social interactions. The paper acknowledges the benefits of games on mood, stress, adaptive coping, eudaimonic well-being, and socializing. It concludes that clinicians should try discussing video game play with patients despite individual variability of results.

The Master Thesis by Danilina, O. (2019), focuses on reporting evidence of the effectiveness of SVGs for mental health and their motivation and engagement potential. Through a systematic review, they explored existing games and their applications to health contexts. It concludes by emphasizing that Serious Video Games can effectively engage, educate, and motivate for overall well-being, and their potential for implementation in mental healthcare.

In search to identify Game Elements(GE) applied in cognitive assessment, training, or rehabilitation with Game-Based Interventions, the Article by Ferreira-Brito, F., Et al. (2019) conducted a systematic review. Ninety-one papers were included based on empirical and original data, usage of video games for cognitive intervention, and with attention, working memory, or inhibitory control as interests. The analysis of certain GE and their correlation with

rehabilitation efficacy led to the conclusion that score system and narrative context were the two most frequently used GE, usage of extrinsic motivation may jeopardize the intervention.

Despite the common clinical usage of games to promote treatment and recovery, the article by Fitzgerald, M., & Ratcliffe, G. (2020) looks to find evidence supporting the usage of SGs and gamification for serious mental illnesses. Conducting a scoping review, they found that game design that supported clear instruction, coherent narrative, a smooth interface between mechanics and play, and service user involvement were important for the successful promotion of engagement and learning. It concludes that there is high feasibility and acceptability among users and providers of SGs for mental illnesses, emphasizing positive engagement efficacy through avatar customization.

The article by Li, M., Et al. (2021). wants to answer how narrative path agility influences mobile fitness App user's real-world purpose and persistence of usage. In a controlled experiment with 118 subjects from local gymnasiums, it was discovered the impact of different forms of gamification narrative design on users' purpose and persistence in App usage. They show that from a range of narrative design choices, static narrative path design improves concentration and understanding.

The book chapter by Godfrey, S. B., & Barresi, G. (2022), wants to explore various kinds of video games for health aimed to improve the lives of senior citizens. Its review presented that video game systems can potentially promote positive aging. Its conclusion identifies two promising areas: the Internet of Things with AI and the Creation of Digital Health solutions.

Article by Ravyse, W. S. Et al. (2016) examined academic literature from 2000 to 2015 aimed to steer games for the health field away from continuously re-assessing correct functionality. Their results show five central SG themes: backstory and production, realism, AI and adaptability, interaction and feedback, and debriefing. It concludes that users must experience enjoyment before effective learning can occur.

Article by Rodrigo-Yanguas et al. (2022), utilizing a quasi-systematic review to evaluate games as tools for patients with ADHD, states that they can be used to better ADHD symptoms and improve adherence to the program. They report increased usage of Serious Video Games as a tool for cognitive rehabilitation in attention-deficit hyperactivity disorder cases.

To create a promoting and engaging SG for a healthy lifestyle, Schwarz, A., Et al. (2020) conducted a systematic review of 60 studies that helped define various game features that had already a correlation with engagement. It revealed seven game features associated with engagement levels: storyline, age adaptability, character diversity, realistic graphics, skippable and effective instructions, game feedback, and a balance of educational content and fun. It concludes that those features, when well done, had a high influence on positive associations.

Finally, Verschueren, S., Et al., (2019) article aims to identify and evaluate SGs for Health (SGH) requirements, recommendations, and guidelines to further develop a strategy guide for the production of games of this kind. Through a critical review of the literature, they identified 25 development requirements and later created a framework to support future developers of SGH.

1.4 Discussion

To organize, the following order of four subjects was deemed a progression of subsequent sections, the previous complements with information to base the next. First, the exploration of SG usage in health applications, includes Boldi & Rapp (2021), Colder et al. (2018), Danilina (2019), Godfrey & Barresi (2022), and Rodrigo-Yanguas et al. (2022). Then Ferreira-Brito et al. (2019), Fitzgerald & Ratcliffe (2020), and Schwarz et al. (2020) concerns utilized GE and their utilization for SGH. Furthermore, the investigation of specific methods in existing SGs (Birk, 2018; Li et al. 2021), and lastly, regarding enhancement of the overall development of health games by analyzing existing ones, presented in Ravyse (2016), and Verschueren (2019).

On the first subject, paper Boldi & Rapp (2021) suggests that achieving positive results requires a more effective participation of all peers related to SG development, as Barbato (1997), and Stefyn (2022) complement, respectively, the complexity of mental illnesses and making a game, while Laamarti et al. (2014) lists diverse options of approach to SG making. Paper by Godfrey & Barresi (2022) mentions promising areas directed to positive outcomes, while papers by Colder et al. (2018), Danilina (2019), and Rodrigo-Yanguas et al. (2022) affirms the existence of positive contributions of games toward mental illnesses, as mentioned in Quiles & Verdoux (2023), Roberts et al. (2021), Kuntz (2022), and Susi (2007).

Secondly, papers by Ferreira-Brito et al. (2019), Fitzgerald & Ratcliffe (2020), and Schwarz et al. (2020) report repetitively to SG's attention to Game Aesthetics, all three presented high usage of narrative elements and polished game mechanics as contributors to immersion and user involvement with interventions, information found in (Fitzgerald & Ratcliffe, 2020; Malone, 1980). Works by Ferreira-Brito et al. (2019), and Fitzgerald & Ratcliffe (2020) also mention GE to avoid, respectively, GE related to extrinsic motivation and GE that over-complexifies the game design. Godfrey & Barresi (2022) found a lack of negative impact reports on its reviews, stating a probable existent bias in studies.

For the third topic, paper by Birk (2018) strongly affirms the user's avatar and game customization connection to narrative conceivement, complemented by Li et al. (2021) affirmation of narration being a collection of GE listed as avatar, mechanisms, story-telling structure, and customization, contributing to patient's perceived concentration and understanding. These GE can be seen mentioned in papers Fitzgerald & Ratcliffe (2020), and Malone (1980).

On the final subject, paper by Ravyse (2016) ultimately states that users prioritize fun before any learning can take place in an intervention, and Verschueren (2019) analyzes and provides a theory-driven framework to achieve fun and enable patient engagement with the learning provided during the intervention, this so-called fun and learning relationship is every game designer goal when making any kind of game (Stefyn, 2022).

1.5 Conclusion

The review shows acceptance of game designers' work in the delicate fields that SGs are connected to, towards GE that will bring fun and consequently, many benefits. It remarks that the process of creating an SG is not to create a new form of rehabilitation but to make a game that rehabilitates, teaches, trains, or any other genre of SG practice.

From what was found, the majority of papers declare positive outcomes from the correct usage of high-level aesthetics, inciting a constant need for evaluation towards a proper application of game and narrative design choices. To continue, chosen options to create SGs must be a result of a strategic course of action for its specific purpose. Therefore, communication skills between developer teams and health stakeholders may have repercussions in the final media and intervention outcomes.

For the game's development, a sense of player personalization and familiarity seems favorable to consider when applying memorable mechanics, visuals, and narrative GE to induce immersion and capacitate learning. The illusion of control, paired with ease of understanding, looks to appeal to the engagement of patients on interventions.

Still, more research is needed, especially findings centered on the relations between game and narrative design choices, and their effects on schizophrenia patients. However, improvement of social and cognitive skills via SGs, with lasting effects, was d as a possibility and has been more commonly found over the years. Nonetheless, the base work for successful SGs presented itself as fruitful as rehabilitation tools and promising for schizophrenia patients.

The use of serious VR games for focused schizophrenia negative symptoms rehabilitation was found and deemed fruitful on most occasions. Throughout the findings, it was discussed how to make and improve digital therapeutic environments regarding the relations between game design and game design for patient engagement. Successively, this project's development followed previously made design models and it was concluded that User-Centric models and Ease of Approach should be used when conducting the narrative, making game mechanics, and constructing scenarios.

Chapter 2

Pre-Production

The design team's role was to clarify all needed information to enable the start of the development of the game, together with all required tasks to be performed by each contributor, in a game design document. Several meetings were held to establish what should and could be done. The following pieces of information, with added notations, include the Author's contributions to PGH.

To uphold the project's scale, five interdisciplinary and multidisciplinary teams contributed to its making, respectively, design, development, AI, database, and clinical teams.

2.1 Game Summary

LS is a VR SG for psychosocial rehabilitation, for patients diagnosed with schizophrenia, and controlled positive symptoms, who need treatment for the negative symptoms. With a provided 4-meter by 3-meter safe space, the environment will be reconstructed in Meta Quest 2's VR with realistic stylization. All playable scenarios will be used to simulate real-life tasks, from daily house chores to buying groceries or commuting to the Hospital with a little help from an engaging narrative with your house partner on your in-game mobile phone. The design focus was defined with six major points:

Not inferior results when compared to conventional rehabilitation:
An RCT would later identify if this goal had been reached or not.

Patient's safety and comfort:
No intrusive elements such as sounds, or game objects that could be invasive and possibly remind or trigger the patient's positive symptoms. As well as one area of the game, nominated as a safe place, dedicated to reducing stress and anxiety.

Motivate and engage patients:
There must be a reward or points system integrated to encourage patients' return to the intervention.

Artificial Intelligence(AI) adapted difficulty system:
Three levels of difficulty were set, easy, medium, and hard.

A fun experience to enable learning:
Before learning can occur, the patient must first be immersed in fun elements.

Ecological Validity:
The game's activities conducted by the patient must be able to be replicated and validated for real-life applications (Schmuckler, 2010).

2.2 Game Overview

To have a ludic approach to psychosocial rehabilitation is LS's goal. It should not be a digital software to solely rehabilitate patients but an engaging experience that enables a learning state, also known as *Flow*, a psychological state connected to being completely absorbed, focused, involved, and entertained in an activity (Moore, 2022). The experience alone should be the patient's motivation to return to rehabilitative sessions.

An interactable environment will be presented for play through the VR Headset to the patient, where he will find different ways to interact with virtual objects. Actions portrayed in the virtual world could be defined as the created core game mechanics, in conjunction, they create game dynamics and define the gameplay loop (Hunicke, 2022).

Core gameplay mechanics include the actions "Walk", "Grab", and "Touch", while the gameplay loop consists of searching and obtaining an objective, to later complete it and receive a reward for its completion. The major defined restriction was that the patient should not experience anything outside the controlled trial, for example, seeing outside the gameplay area.

"Walk" can be done by physically moving your body, "Grab" can be done by clenching your hand on the controller next to a grabbable virtual object, and the action "Touch" can be done by moving your hand close to a virtual object. These three actions represent the same meaning of their wording.

These elements in conjunction will be used, for example, for making breakfast, organizing shelves, or cleaning the floor, all to attend to the needs to complete daily routine activities.

As a tool for the intervention, different systems such as the difficulty settings, texting messages to a housemate, and an AI-assisted pet, will be done to facilitate the completion of objectives during the sessions, improvement of social skills, relief of stress situations towards difficulties portrayed by the patient, and to help with the association of entertainment to obligations.

The initial game area will be a shared house with a clumsy housemate, that engages with messages to the patient for comic relief, and a pet for a sense of comfort and responsibility. Both will be used to help, to create fun activities and incentivize a healthy parasocial relationship.

To conclude, the game will exchange gathered information as it is part of a group of three intercommunication systems; the other two are the AI system controlling the difficulty settings

and the clinical database system of the patient's live session data. Those were defined as needed systems to make the intervention and were developed by other teams.

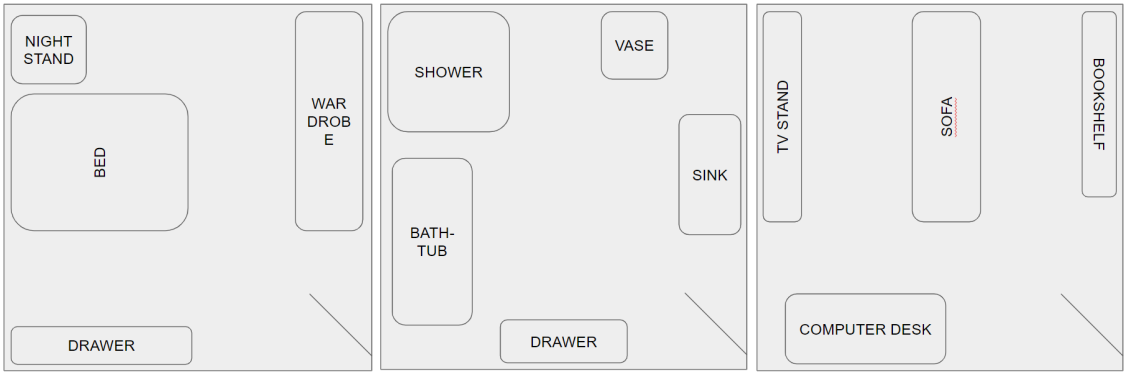
2.3 Player Movement

A provided area of five meters by four meters by the hospital, delimited to a safe four meters by three meters play area, is where the patient can navigate freely through the VR setting according to his real movements, as there should not be a different way of locomotion such as teletransportation, waypoints, or directional input, which not only goes against the ecological validity but may also cause nausea. In this regard, the locomotion was set to be via the Oculus Quest tracking.

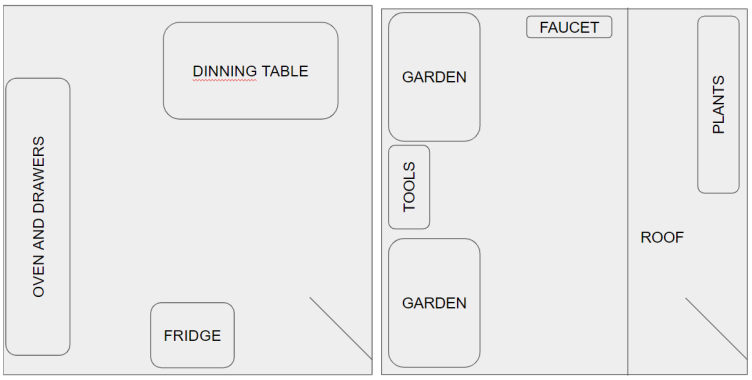
When talking about a virtual house as the first rehabilitation environment to be displayed, the patient will need to navigate to common living areas such as the living room, bedroom, kitchen, garden, and bathroom; therefore, a way to load the mentioned spaces was set to be utilizing the Oculus Quest "Guardian" initialization setup.

Meta Quest 2 also has its own safe area indication as an in-game grid that appears on border proximity. It was determined that objects, when possible, should be positioned to try to limit proximity to the borders, functioning as invisible barriers since no real objects prevent the patient's movement. Mockups following these instructions were made to facilitate the 3D development further in the process (Figure 2.1). Upon 3D visualization, changes had to be made as measurements weren't precise via drawing, leaving some rooms without much space to navigate.

To finalize, regarding patient safety for possible complications on abrupt scene transitions, a Fade to Black and Fade In was required for all scene transitions.



(a) Bedroom (b) Bathroom (c) Living room



(d) Kitchen (e) Garden

Figure 2.1: Level design mockups.

2.4 Objects and Physics

How the player interacts with the virtual world is of great importance for rehabilitation: it needs to be familiar, consistent, and responsive. To accomplish its purpose, it was discussed how much real characteristics should be implemented.

As previously referred, the simulation of daily routines should attend ecological validity, therefore, object physics within the game was kept as close as possible to real-life physics. If game objects appear to be grabbable or pushable, such as cups or drawers, the patient must be able to accomplish those actions in-game.

However, a perfect translation of realistic aspects is not the goal, gamified interpretations were defined as significant positive changes toward gameplay and therapy as it is able to motivate objective competency, one of them being object outlines (Figure 2.2).

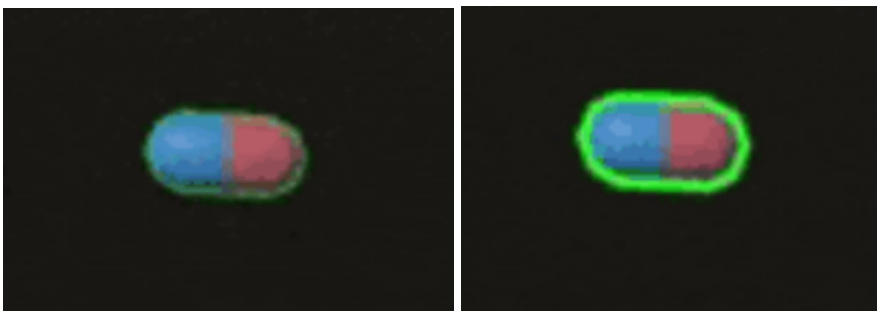


Figure 2.2: In-game initial thin outline (left) and thicker outline (right).

The outline's intention is to provide information to the patient such as “This item is grabbable and in your range”, which will help with reading what is in the ambient and what is able to be done there. Even though it mimics real life, a VR environment is completely new and different to

any user, especially when using it for the first time. Guiding the player to accustom him to the technology is one of the steps to accomplish immersion.

Another added mechanic is that objects were opted to be unbreakable, as well as, if something was dropped too hard or into an unreachable spot, it should teleport back to its initial position. Both were planned to avoid unnecessary frustration, stress, or nervousness, as failing to do a task was considered enough of a consequence.

2.5 House Partner

A way to introduce an interesting and fun narrative that could also serve as a helping hand in-game was needed, though, it could not be done without regard to schizophrenia symptoms. Common game mechanics such as pop-ups, narrators, or sudden object appearances could not be done; however, it came to an understanding that a way to portray information was needed.

To accomplish that feat it was adapted into an interactable non-playable character that will have its name chosen by the patient and it never shows its face, it will always communicate through in-game messages in a mobile phone given to the patient. The phone is a crucial part of the rehabilitation game due to its usage as a guiding tool. It will contain two apps, the first one is a communication app and the second contains all tasks listed for completion (Figure 2.3). This second app will be described later in this document.

The communication app will serve as a way for the patient to engage in the narrative of the game and involve himself in a parasocial relationship with said House Partner. It will serve to ease out the demands of the therapy through light-hearted jokes, small life problems, or special occasions that both will live in the house via, favors, aid, and kindness. Examples would be organizing bookshelves, turning off the TV that remained on, being asked to prepare a meal, or receiving a notification that your breakfast has been made and the plants have been watered. These are also viewed as a way to make the player think about what more conversations, objectives, or stories his future accomplishments will unravel.

Figure 2.3: Mobile phone and its apps.

2.6 Pet mechanics

A secondary and more direct approach to aid the patient, presented and approved in PGH, is the pet. It is meant to de-stress the patient by being an emotional support companion, but also to indicate where something is located by moving closer to it.

The pet, different from all visible objects, needs to convince the player it is not just an inanimate object, therefore some complementary features were added to it. The player will be able to choose between a Dog or a Cat (Figure 2.4), petting and playing must be possible through hand gestures which it will respond with its own animations, it must move freely around the house through AI, and new objectives such as feeding the pet or cleaning its mess must be present.

Figure 2.4: In-game pet options.

Some characters present in well-known games and gamified applications were studied. Three of them presented interesting characteristics that should be merged and present in LS's pet: *Duolingo Owl*, Navi from *The Legend of Zelda: Ocarina of Time*, and Dogmeat from the *Fallout series*. Respectively, progression incentive, activities aid, and emotional support were their traits for reference.

2.7 Rewards and Meta-Games

One characteristic present in all games is Meta-Games. Mechanical Meta-Games, specifically, mostly revolve around some sort of progression or economy added to the core gameplay to unravel a game beyond the game (Quiles & Verdoux, 2023). Its purpose is centered on player retention and engagement, and since these are major necessities for successful rehabilitation, some needed to be thought of.

Engaging in Meta-Games usually provides some kind of intrinsic reward to the player, these rewards work as a force of motivation to complete objectives while enhancing immersion.

Not all Meta-Games need palpable rewards, their accomplishment by themselves can also be a form of gratification, for example, the reaction of a pet after training it to sit is its own reward. Defined Meta-Games and rewards are:

Table 1: Meta-Game and Rewards

Meta-Games	**Rewards**
● Find hidden objects ● Timed accomplishments on objectives ● Perfect tasks execution ● Play with pet ● De-stress minigames ● Re-organize bedroom ● Customize your pet ● Customize your profile picture ● Get all badges	● Badges ● Narrative snippets ● Trophies ● Bedroom objects ● Profile pictures ● Pet garments

2.8 Progression

Following the core loop, the game progression was established in three subsequent categories to promote daily routines, objectives, tasks, and steps. Objectives are a collective of tasks and a collective of Steps make a Task. Those will be displayed on the mobile phone according to the AI system, while the player's successes and failures determine which category will be shown, affecting directly the difficulty. Steps being shown would be considered an easy difficulty, tasks as medium, and objectives as Hard, as it is the most abstract form of representation.

Objective Example: “Make Breakfast”
Task Example: “Prepare the table for Breakfast”
Steps Example: “Get Plate”

2.9 Controls

Following the necessity of Ecological Validity and ease of use, how the player is supposed to interact with the environment has a great impact when those actions need to be translated into real-life movements. After several discussions, free hand and Meta Quest 2 controllers were the final options. It was determined that the Meta Quest 2 controllers were going to be used. All defined buttons and their resulting action were thought in an attempt to mimic real-life motions (Figure 2.5).

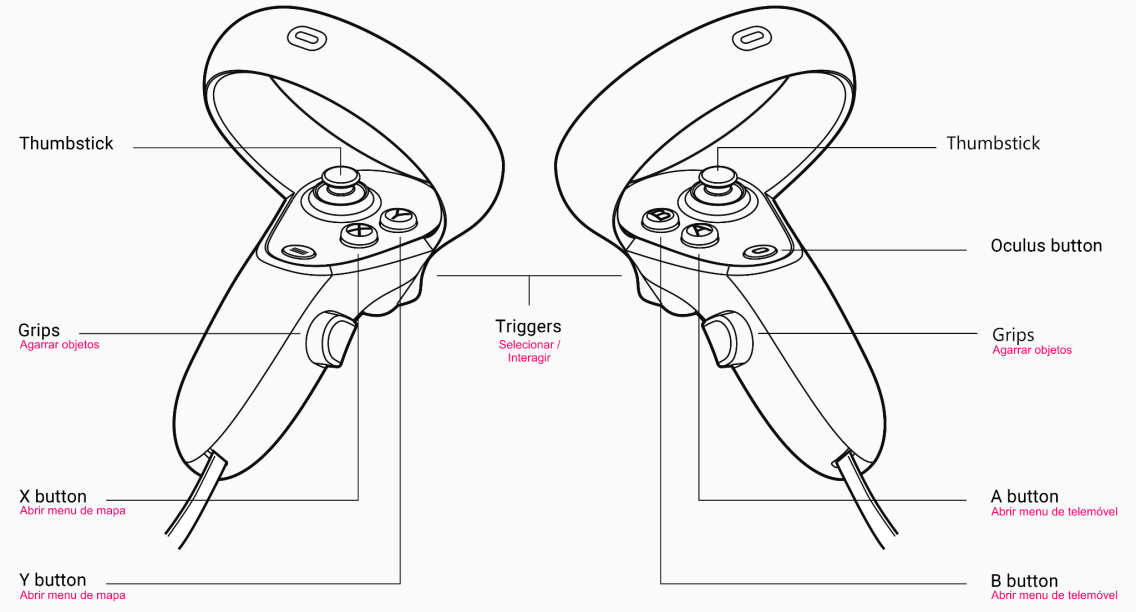


Figure 2.5: Input mapping for Meta Quest 2 handheld controllers.

2.10 Narrative

To make LS an interesting VR rehabilitation experience, some characteristics of how the narrative should be developed were defined. Following the premise that the patient is able to communicate with his House Partner solely via his in-game mobile phone, a parasocial relation must be created through the words they share with one another, therefore, establishing how the created House partner acts is crucial to accomplishing that.

From the already defined features, it was determined that the only possible ways to present the player with the narrative were through the scenery and the mobile phone. They needed to be impactful, yet non-distracting from the real purpose of the intervention. Messages on the mobile phone were limited to the screen size of the virtual mobile phone and they should, most of the time, be correlated with available session objectives.

An initial mandatory tutorial to facilitate the adaptation of the use of VR by patients, and to familiarize the patient with the game and the partner relationship, was made:

EXT. PATH TOWARDS THE HOUSE

The player will arrive at the door of his new home and find a taped to the door with the following message:

> "Hello! I heard you were moving here today but I couldn't be there... If you look down you'll see a rug, I hid the key under it! Just lift the mat and get the key to open the door!"

The player then, after opening the door, must take his luggage and enter the house, where he will be transitioned directly to the room.

INT. ROOM

The player gets a new message:

> "To welcome you, I prepared a delicious dish. I believe that if you can walk to the door you'll eventually find the kitchen, I left it right on the table."

[UI] The player must use the UI to select going into the kitchen.

INT. KITCHEN

When in the kitchen, he receives another message:

> "Get the dish inside the microwave and set it for 1 minute, then eat it, I hope you like it!"

When the food has been eaten, another message is received:

> "Did you like your food?

The patient must answer Yes or No via touch:

> "Oh! I forgot to wash the dishes! Could you please wash them?"

T*he player proceeds to the cleaning, and then the tutorial ends.*

2.11 Visual Identity

All 3D assets should follow a semi-realistic stylization for ease of interpretation on the patient's behalf, and with consideration to all its angles of visualization; for example, a blanket must have textures underneath it because it will be moved.

As for 2D assets, they are to be used only for the User Interface (UI). The UI design should be clean and simple for good readability, when interactable, they should resemble the characteristics of a button, and have a good contrast between the 3D assets and the Interface.

Since the spectrum of schizophrenia affects a very wide range of patients, the house in the game's initial area was requested to have two different styles, one traditional and the other contemporary.

The colors, on the other hand, were predetermined. For the contemporary look, the color palette was kept simple and welcoming, consisting of blues, white, grays, and light brown, as seen in Figure 2.6. For the traditional look, the major consideration was the heavy usage of wood. Both, when under asset development, were to be done following common elements of the architecture of single-family houses in Portugal.

Figure 2.6: Color references provided for the contemporary house.

2.12 Gameplay

The game was established to be divided into days, where each has a routine of objectives to be accomplished before the patient can advance to the next day. It was also kept in mind that all routines portrayed for completion will be presented differently according to the AI.

For the first game session, it was intended that the patient start learning how to play the game, how to use the controller, or how to grab things. For that, there is a pre-planned routine, serving as a game day dedicated to tutorials, adaptation to technology and controls, and initial assessment of their performance in different tasks and objectives.

There, the patient will be able to choose the visual style of the house, the type of pet, and the housemate's name, which will all be saved for later sessions. These choices only affect the visuals and they intend to increase the patient's immersion in the experience. Soon after, a more detailed tutorial came in place to establish the narrative.

At the end of each daily routine, the AI makes a plan of daily goals based on the task performance of the patient, considering whether he is ready for new challenges. Accordingly, all tasks were grouped in objectives for interchangeability.

Since the objective is to emulate the patient's day-to-day tasks, in a simulated, safe, and controlled environment without repercussions in real life, the types of needed interactions were thought of. While it is not possible to perfectly recreate these interactions in VR, it is possible to create a sense of immersion if the player's actual action matches the simulated environment.

For this purpose, six essential mechanics were listed as crucial features for the therapy, Hold, Fixed Hold, Rotate, Fixed Rotation, Press, and Tracking:

Hold
The player can grab, place, or drop an object freely (however it may need to be in a specific position for the task to be successful).

Fixed hold
The player can grab or release the game entity, but it has restrictions on its position in the game world, for example, a drawer.

Rotation
The player can grab and rotate the object freely with no restrictions.

Fixed Rotation
The player can grab and limitedly rotate the object, such as a faucet or doorknob.

Press
The player virtually touches or presses another entity in the game world, or presses two or more entities together.

Tracking
Position effects of any game objects, such as food disappearing when getting near the headset, simulating it being eaten.

2.13 AI

LS has, as one of its selling points, adaptive difficulty controlled by AI. It was determined that the AI will have control upon the creation of the session, it shall select all Tasks for the patient to play during the daily routine. Therefore, the assignments provided by the AI development team to the Design team were to establish which were going to be all the metrics that the game would send to the AI software and how the difficulty would be portrayed.

On the mobile phone, the objectives app will only show the current objective if the game is set in the hard settings. However, on medium, it will list the needed tasks for the objective completion. As for the easy settings, Each Step for the first task, and subsequent tasks, will be listed for completion.

2.14 Comparative Metrics

A way to save the patient information and analyze their behavior was required by the clinic and AI team, therefore, the following Metrics were deemed relevant for the rehabilitation and exemplified in Table 1.

General time of execution

Timing from the beginning of the first achievement of objectives to the fulfillment of the last objective, thus completing the daily routine, or until the day is considered finished.

Execution time per task

Save the time intervals in which the player performs a task in order to be aware of tasks that may be difficult to perform or interpret, either by command or level design.

Execution time per step

Save the time intervals in which the player executes a step in order to be aware of which steps may be difficult to execute or interpret, either by command or level design.
Save the amount of input close to or abnormal to what was requested (eg. turning a faucet the wrong way) in each task in order to document the player's ease or difficulty in performing it. The saved values serve as feedback for reassessing the disposition of tasks or assets.

General accuracy

Save the amount of accuracy errors of a whole session, for a general evaluation.

Correct execution per task

Record the successes and failures of each task so that it can be analyzed whether the patient is acting as expected/requested in the task.

Overall correct execution

Record the successes and failures of the entire session.

Spatial orientation

Save the route taken by the patient in order to document their routes and interactions to check for consistencies and distractions on objectives completion.

Adaptability to VR

Quantitatively access, out of gameplay, whether the player is having difficulty operating the technology. Recording difficulties implies a reduction in the player's immersion, reducing the quality of the game.

Information external to the game (of the player)

Additionally to in-game metrics, external information of the players such as their body temperature at the beginning and end of the session, and four questionnaires regarding their adaptability to the intervention.

Table 2: Example of a table with metrics about tasks.

Session X	**Session Date and Time**			
Average Precision	**Total wrong attempts**	**Game Time**		
0.87	5	21:02		
Tasks	**Task State**	**Execution time**	**Wrong Attempts**	**Precision**
Stop and prepare Alarm-Clock	Completed	3:12	0	1.00
Open Curtains	Completed	2:00	0	1.00
Do the Bed	Completed	2:24	3	0.57
Brush Teeth	Completed	13:26	2	0.91
Change Clothes	Inactive	0:00	0	1.00
Eat Breakfast	Inactive	0:00	0	1.00
Wash Dishes	Inactive	0:00	0	1.00

2.15 Conclusions

All of the above was evaluated and accepted by supervisors for the start of the production stage, serving as the foundation of the game production and development. From this point forward, no changes were made and all teams agreed to follow these guidelines.

Most of the teams understood what their goals were. When a team was unsure of what steps to follow or if they needed more information, reunions were made for explanations, afterwards, they would have to develop their own steps to accomplish it as each had different areas of expertise. For example, explaining that the AI needs to control the difficulty is too abstract, it resulted in questions of what pieces of information from the game the AI could use and mentions of their technological limitations.

Chapter 3

Design and Development

In this chapter, will be discussed the process of acquiring assets for the project. It will outline the steps, challenges, and decisions made in obtaining and refining 2D and 3D assets for the two required visuals, how the narrative writing was made, and the creative and technical processes that bring LS's virtual world to life.

3.1 3D Assets

When developing a game, some things must be kept in mind for asset development: the need for programmers to have assets to code into, the time constriction of the delivery date, and an estimated time of asset coding after delivery. Therefore, for the project's operational time, it was decided that the usage of free pre-made 3D props would be a necessity. To find assets online, sites such as *Sketchfab* and *TurboSquid* were used. All 3D assets consisted of house objects, therefore, all research was made regarding objects usually found at a home.

As mentioned earlier, the contemporary and traditional visuals were requirements; in addition, they needed to correspond to architecture common in Portugal. Some references for the proposed visuals can be seen in Figures 3.1 and 3.2.

Figure 3.1: Contemporary house references.

The workflow towards 3D assets consisted of checking the asset list provided, finding a missing asset, searching the asset online and downloading it, asset vertices cleanup on *Blender 3D* for better game optimization to prevent game stuttering, texture corrections on *Blender 3D* to follow the project's visual identity, and lastly, implementation of the asset on *Unity*. If the asset wasn't able to be found online or needed some modifications to be usable, it should be manually modeled and textured in *Blender 3D*.

Figure 3.2: Traditional house references.

To exemplify, Figure 3.2 shows an interesting and considered good-quality kitchen asset that was found on *Sketchfab*, while Figure 3.3 shows the same kitchen after modifications and cleanup to match the project's needs. Lastly, Figure 3.4 presents the alternate contemporary version of the kitchen.

Figure 3.2: Unmodified kitchen with approximately 19600 vertices.

Figure 3.3: Modified and cleaned up traditional kitchen with 14415 vertices.

Figure 3.4: Contemporary kitchen with 12424 vertices.

One example of assets that weren't found were the garden tools. They were modeled and texturized in *Blender 3D*, as you can see in Figure 3.5.

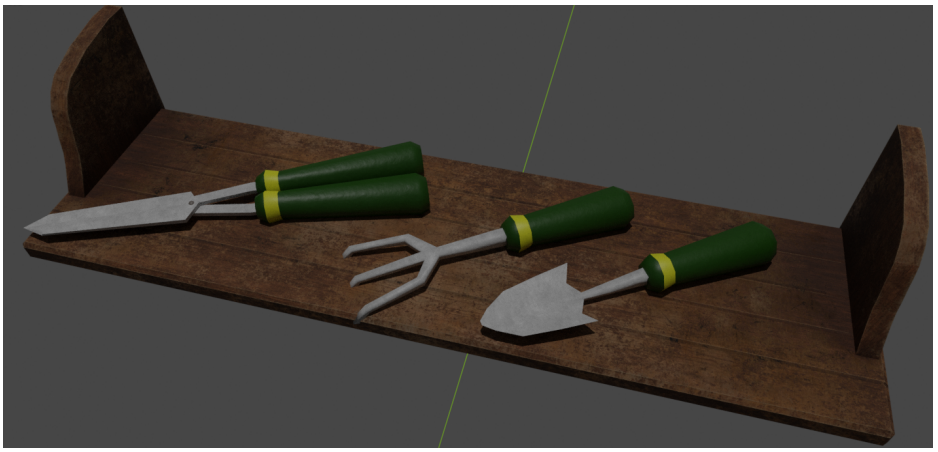
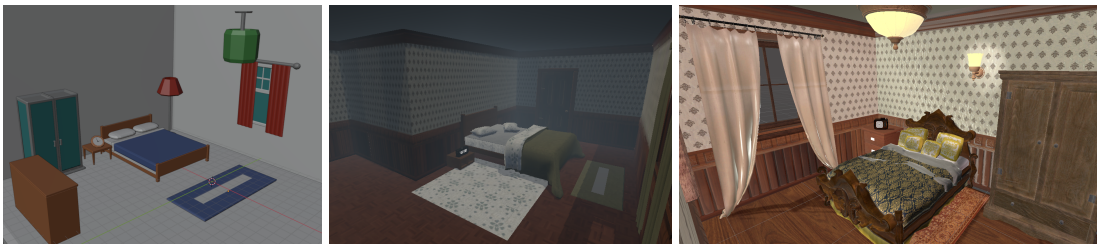


Figure 3.5: Garden Tools.

The production of 3D assets went past three main stages: low poly blockage, visual update, and in-engine update seen respectively in Figure 3.6 from left to right. The low poly stage provided the essential assets to start developing the game inside *Unity*, making it possible to code needed mechanics. Transitioning to the visual stage was a time-consuming task, the number of available assets online made it difficult to find ones that matched the targeted aesthetic, as well as requiring an extra effort to make them VR-ready, with optimized models and textures. In-engine updates showed problems importing textures, requiring manual relocation of textures and materials when needed, nonetheless, the biggest concern was to not create a conflict when tweaking objects and scenes parameters when constructing the house.



(a)Low Poly (b) Visual Update (c) In-engine update

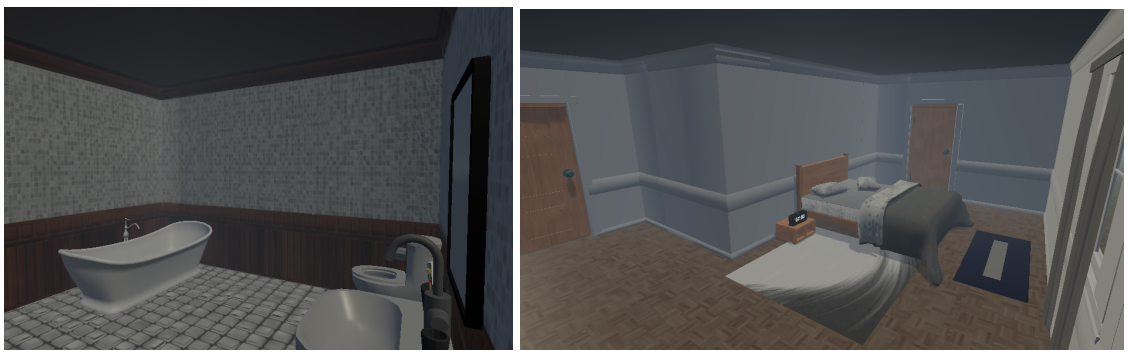
Figure 3.7: Three prototype stages.

Level Design

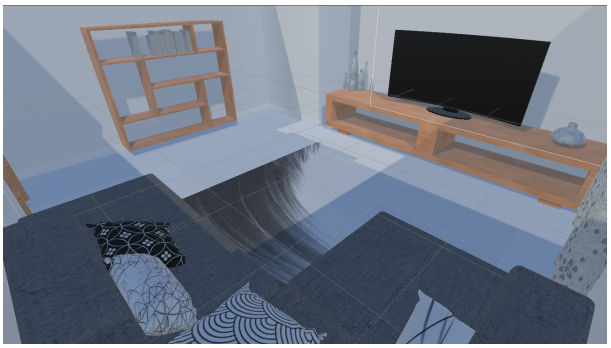
3D assets collected and corrected added up to over 500 objects. From those, approximately 200 were used to develop all the needed ambiences that consisted of a kitchen, bedroom, bathroom, garden, and living room. Assessing the assets for that purpose was an arduous task and, to organize, each room was fully constructed before the start of the next.

The process of putting assets together to create a room and make therapy possible, while remaining immersive and eye-catching, was mostly ensuring that users would have minimal approach to the walls. Most objects were placed near the wall to function as a virtual barrier and an unoccupied middle area needed to be present in the rooms to promote the action of walking around the scenario.

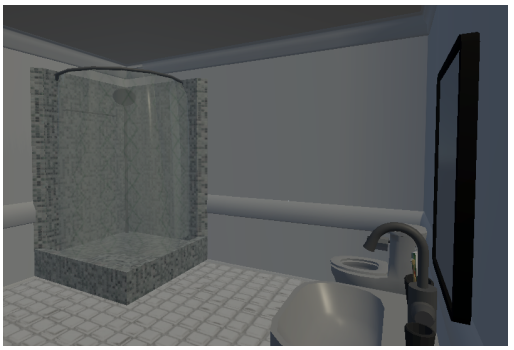
Objectives that needed objects, like making breakfast, required object positioning related to their usual common placement. In this case, their common placement is in a kitchen. For example, milk is usually in the fridge, while bread is usually on the shelves. In that regard, the placement of bigger objects like the fridge, and shelves, was thought to encourage walking and searching by not being placed so close when possible. Made efforts can be seen in Figure 3.8, later updated to realistic scales and visuals with higher fidelity to the aimed aesthetics, seen in Figure 3.9.



(a) Traditional bathroom. (b) Contemporary bedroom.



(c) Contemporary living room.



(d) Contemporary bathroom.

Figure 3.8: Levels of the second prototype.

(a) Traditional bathroom.

(b) Traditional kitchen.

(c) Traditional living room.

(d) Contemporary bedroom.

(e) Contemporary garden. (f) Contemporary bathroom.

Figure 3.9: Levels of the third prototype.

3.2 2D Assets

Contrary to the 3D assets, all 2D assets had to be developed specifically for the project. They were made utilizing the software *Krita* and all consisted of visuals for the UI, mostly, buttons. The objective of the 2D art was to accomplish simple and readable visuals, in vectorial format, to help identify what areas the user would be selecting, as well as organize the layout of interactable instances.

When searching for references to create the buttons and icons, it was found that outlines, and high contrast of colors between icon, button background, and outline were important characteristics, as seen in Figure 3.10. The workflow consisted of identifying what was the needed icon, finding references for it, and drawing a similar example on *Krita*.

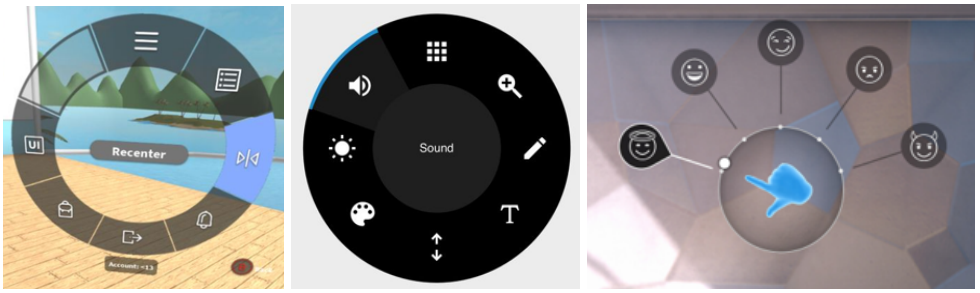


Figure 3.10: References of UI.

A layout was tested throughout one prototype but still not used on the final product due to changes in interface display mechanics, which invalidated its planned scrollable layout. Icons, on the other hand, were saved to be used in the future. All developed 2D assets can be seen in Fig 3.11.

Figure 3.11: Developed UI icons and buttons.

3.3 Narrative

To complete the game design, a way to bind all mechanics and their rehabilitation purposes with a fun experience was with narrative elements. Since the patients needed to utilize LS as a rehabilitation tool for daily activities, it was natural to make the setting a home. As a way to correlate and affirm the transition from real-life sessions to VR sessions, the idea of moving to a new home of your choice was settled.

Firstly, the tutorial was made to establish the mood of the narrative and the virtual partner personality; subsequently, a way to tell short stories effectively, as required in the game design, was with episodic events. Each room objective should have its own small story behind it, as well as some non objective restricted stories as meta-games, and variations of the same story due to the repetitive aspect of rehabilitation therapies.

The development started by utilizing *Twine* for its interactive value, where all stories would be written for each objective (Figure 3.12). Later, it was transferred to *Trelby* with said variations; there, it could be read easily by others (see Appendix A). Lastly, it had to be rewritten in *EditPad Regex* format to allow it to be implemented in *Unity*(see Appendix B).

An observation made by the clinical team was that it was important to soften imperative words and remove grandiosity remarks, for example, "*Make me a coffee"* or "*I'm the best coffee maker of all! Do you want some?"*. This type of wording could trigger positive symptoms of schizophrenia. An example of their correction would be "*I'm late! Could you make me a coffee*?" and "*I made too much coffee! Do you want some?"*.

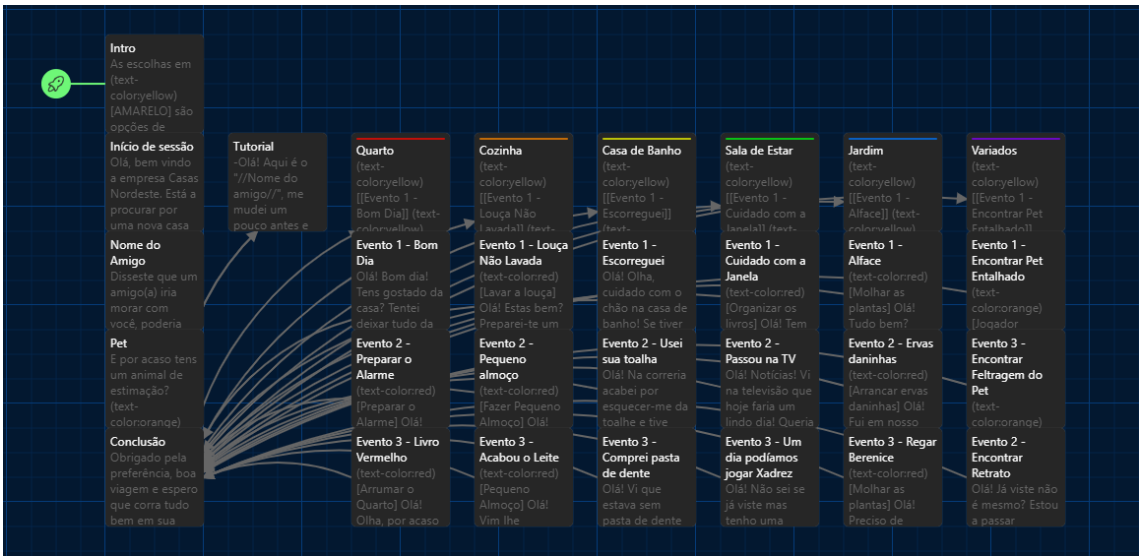


Figure 3.12: Narrative layout on *Twine*.

3.4 Prototypes

The first prototype (Figure 3.13) to be tested by health stakeholders was made with low poly assets. This approach permitted a fast delivery of assets to programmers, easing the implementation of mechanics, as there was no need for much correction of assets since they would be corrected.

The second prototype (Figure 3.14) was made with visually updated assets, that when regarding level design, were in similar positions to the low poly stage, resulting in a lack of consistency to the aimed aesthetic.

As everything was replaced with better 3D assets, a third prototype (Figure 3.15) to be tested by health stakeholders was made, it consisted mostly of final assets and all five rooms were present in the experience.

Figure 3.13: Low poly prototype.

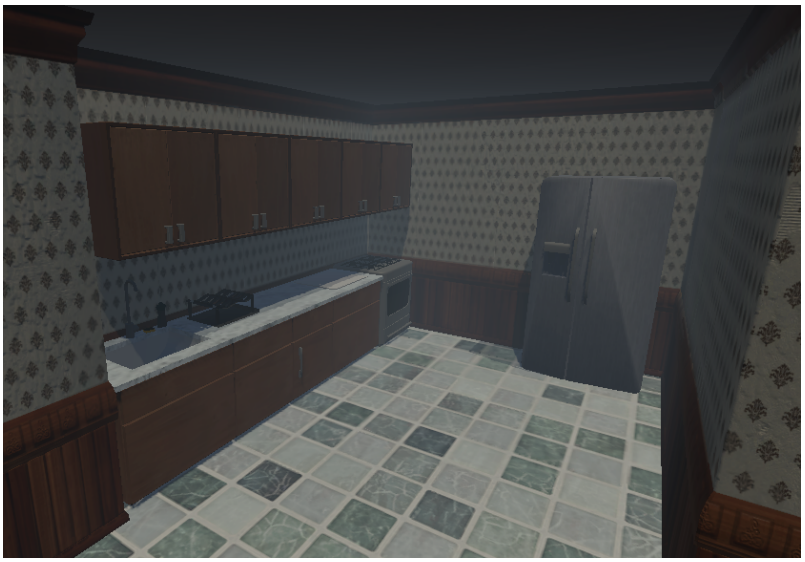


Figure 3.14: Visual update prototype.

Figure 3.15: Final asset in *Blender 3D*.

The testing procedure consisted of doing two questionnaires prior to the experience, an immersive tendencies questionnaire (Witmer & Singer, 1998) and a presence questionnaire (Witmer & Singer, 1994). Afterward, the user should be helped in order to utilize the Meta Quest 2 and play the game demonstration. In the end, a final questionnaire was conducted, EGameFlow (Fu et al., 2009). All questionnaires follow questions of self-evaluation from the values of zero to seven, where they were lightly adapted to attend to the needs of the project in development and the targeted users, as some questions could be insensitive for patients with schizophrenia.

3.5 Results

12 was the number of testers for the low poly prototype, 20 tested the visually updated version, and 14 the final updated prototype. Four of those participants tested all prototypes. The questionnaires were done exclusively for the second and third prototypes, with the immersive tendencies and presence questionnaires having the purpose of validating the user experience and, consequently, the game's design impact on players and the EGameFlow. Almost all testers had above-average results for psychological immersion and high mind during the tests.

The EGameFlow questionnaire had similar results on tests from both prototype sessions. Above-average results were identified for the goal as an educational tool, general immersion, immersion consequent of visual quality, low game distractions, and control of the game. Average remarks were made regarding the difficulty of proposed challenges and objective clarity. Results were higher on the third prototype test. Below-average remarks were made regarding the level of the game's feedback on the player's actions. Results were higher on the third prototype test.

Considering that the mechanics were kept the same throughout all prototypes, the rise in questionnaire values supports not only that, visual cues have major contributions to the immersion and game expectations, but also to the understanding that higher quality visuals contribute to all inherent aspects of a game. It may be a helping factor in the understanding of the game, a requirement to achieve the status of a rehabilitation therapy. At the same time, results regarding visuals were already high from the first prototype, and even higher on the second. It can possibly mean that the game's visuals need to achieve a, not so high, quality to be enjoyable.

The game was best optimized on the first prototype due to its simplicity, while on the second and third prototypes, the textures were causing stuttering and were later replaced. Two testers ended up not feeling well due to stuttering, a common problem in VR, denominated motion sickness, which happens based on the user's sensibility even without game malfunctions. This reflects on the need for testing to accomplish great results when creating a SG, especially when targeting sensitive users.

Final Assets

With all assets in hand, they were implemented into *Unity* with a 1:1 size ratio via *GitDesktop*. In-engine rendered images can be seen through Figures 3.17 to 3.26, while the narrative implementation passed through a final iteration where it was converted to *EditPad Regex* (see Appendix B). Its layout was defined as a group of objectives containing task descriptions that trigger a specific activity step, activating message prompts, allowing it to be seen by the user. This is best described in Figure 3.16.

```
<objectives> -> START
<description> 1.OBJECTIVE NAME </description>
      <stepMessage> -> START IF:
         <step> REQUIRED ACTIVATION TRIGGER </step>

            <message> -> START OF MESSAGE READ
            MESSAGE DISPLAYED
            </message> -> END OF MESSAGE READ

      </stepMessage> - END IF
</objectives> - END
```

Figure 3.16: *EditPad Regex* explanation.

Figure 3.17: Contemporary Garden.

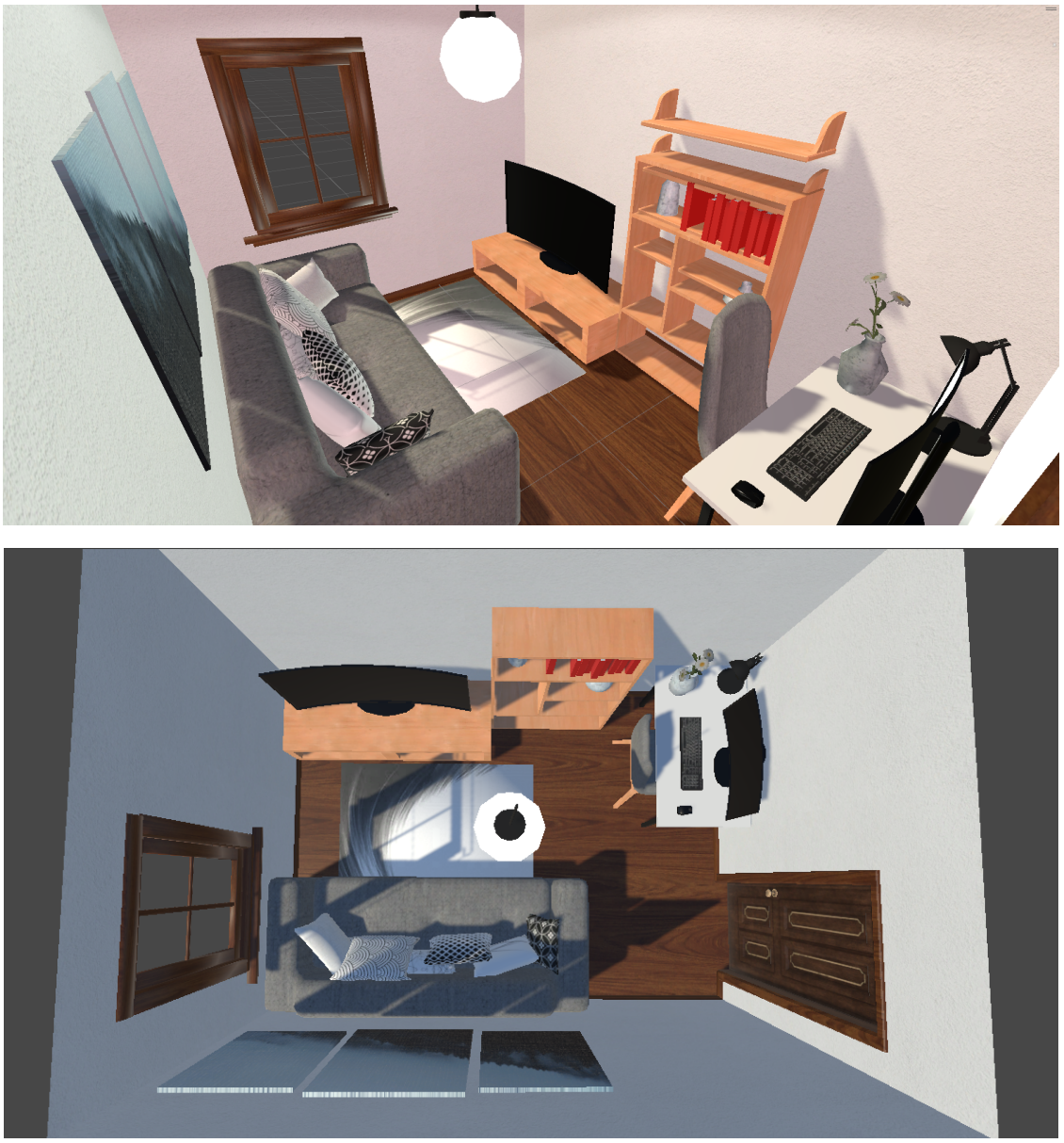


Figure 3.18: Contemporary living room.

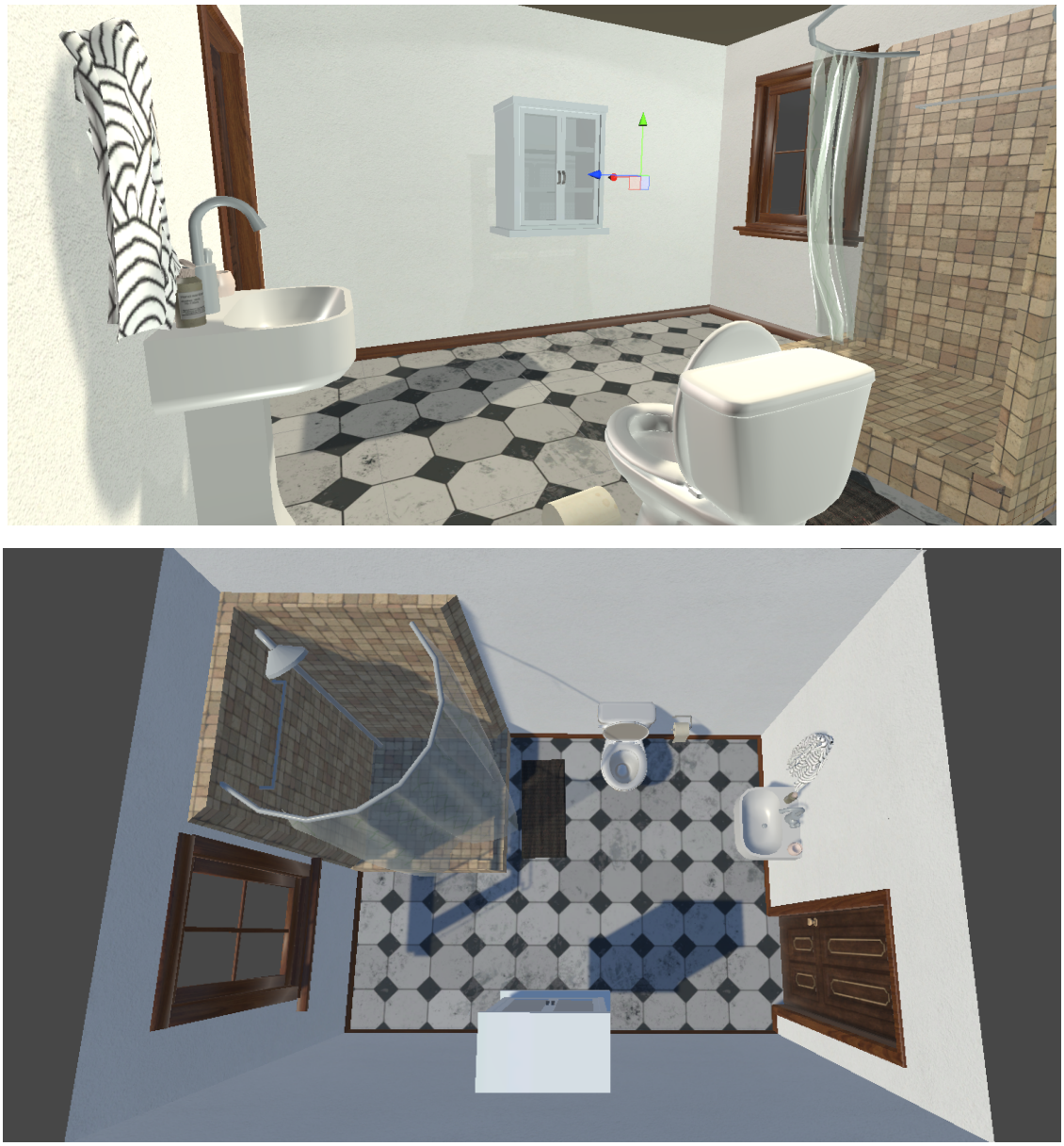


Figure 3.19: Contemporary bathroom

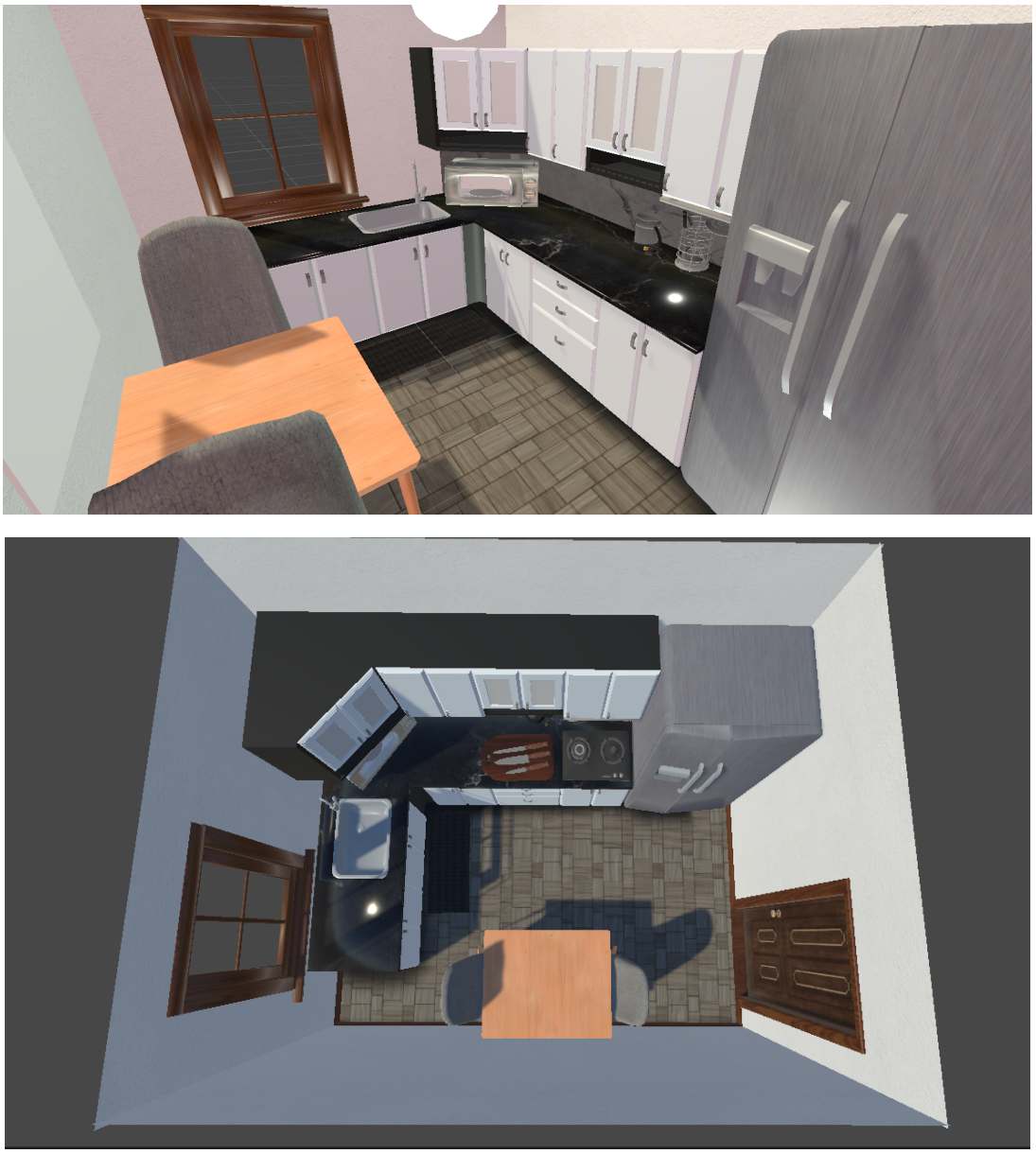


Figure 3.20: Contemporary kitchen

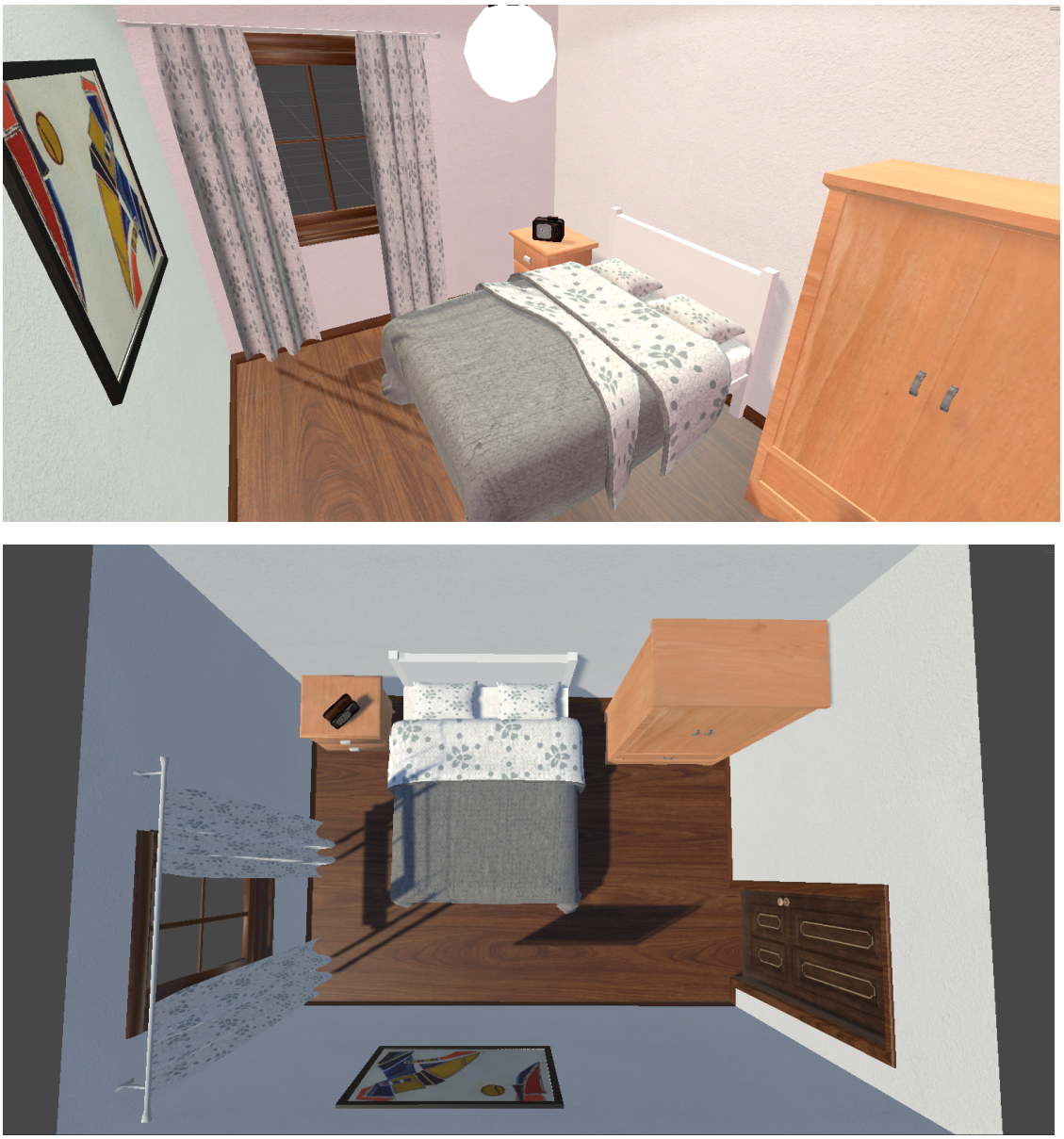


Figure 3.21: Contemporary bedroom.

Figure 3.22: Traditional garden.

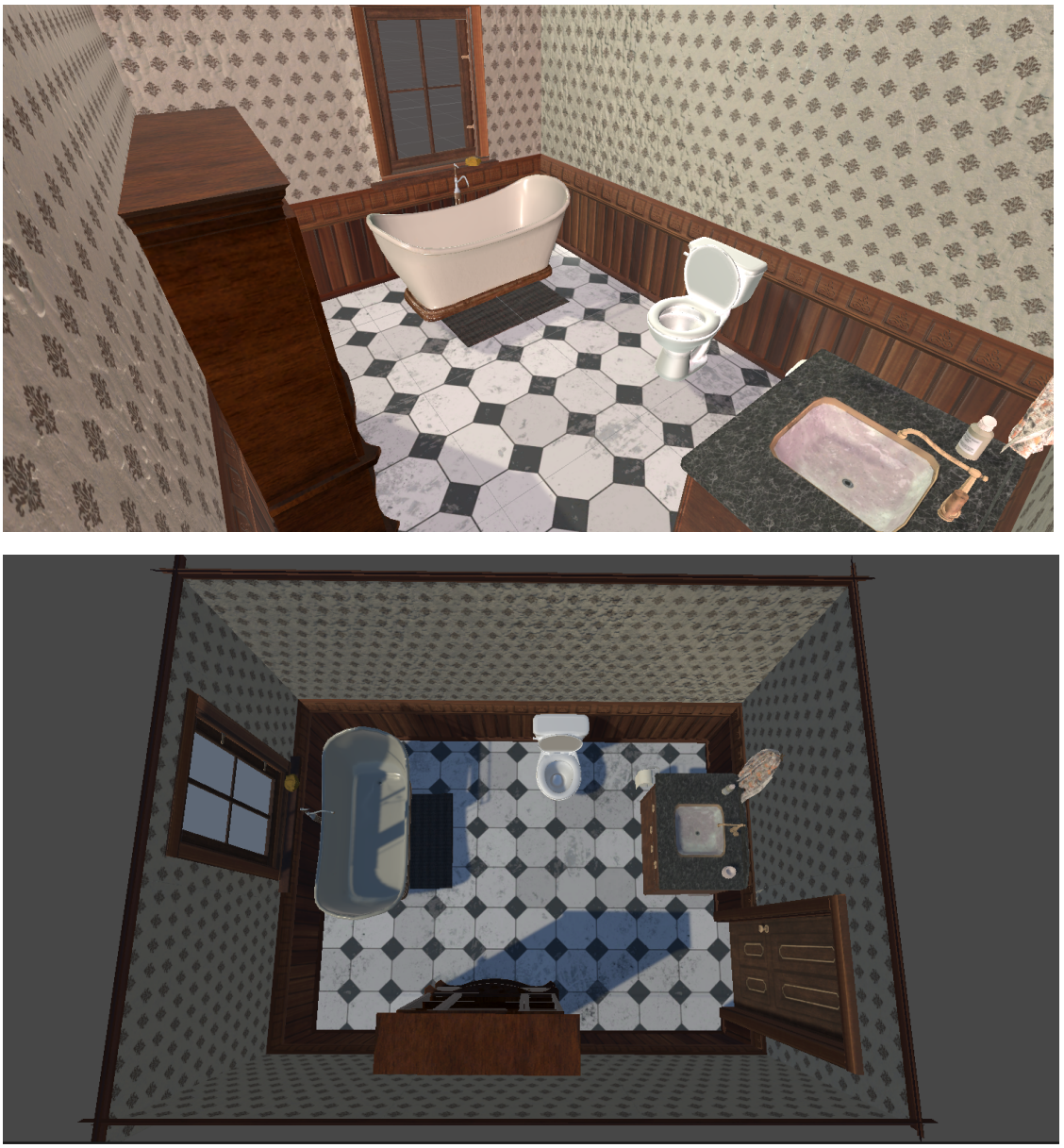


Figure 3.23: Traditional bathroom.

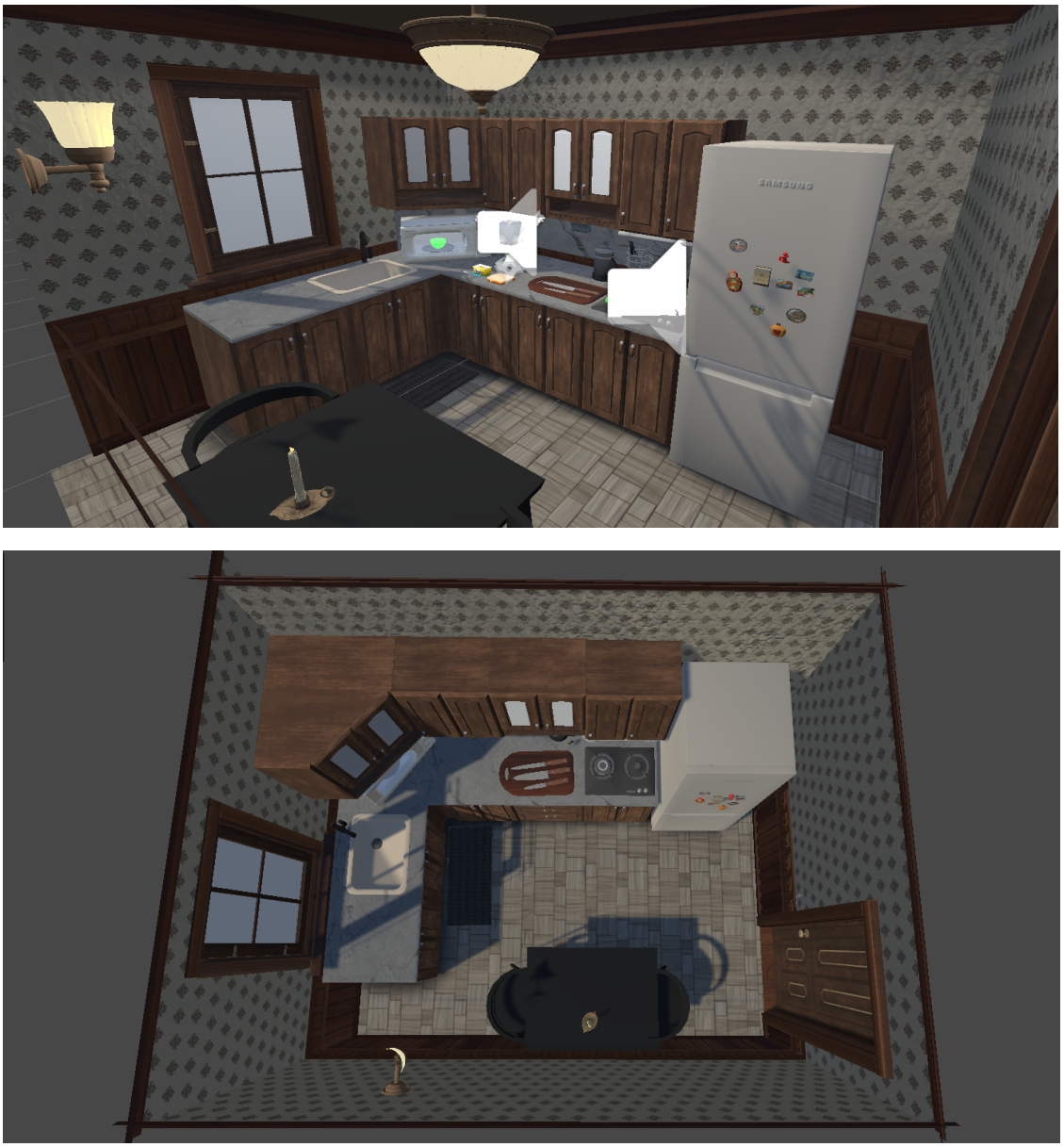


Figure 3.24: Traditional kitchen.

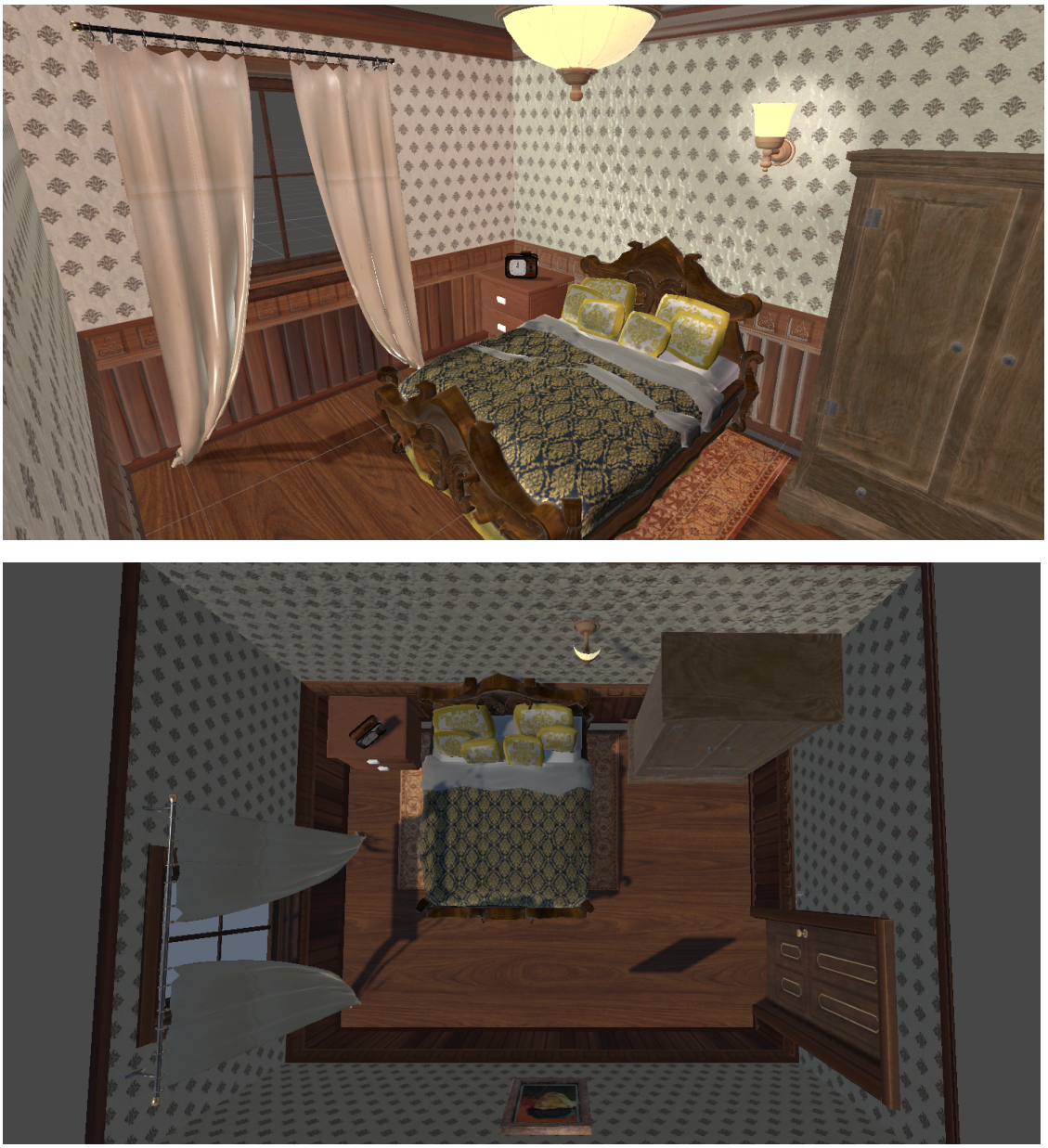


Figure 3.25: Traditional bedroom.

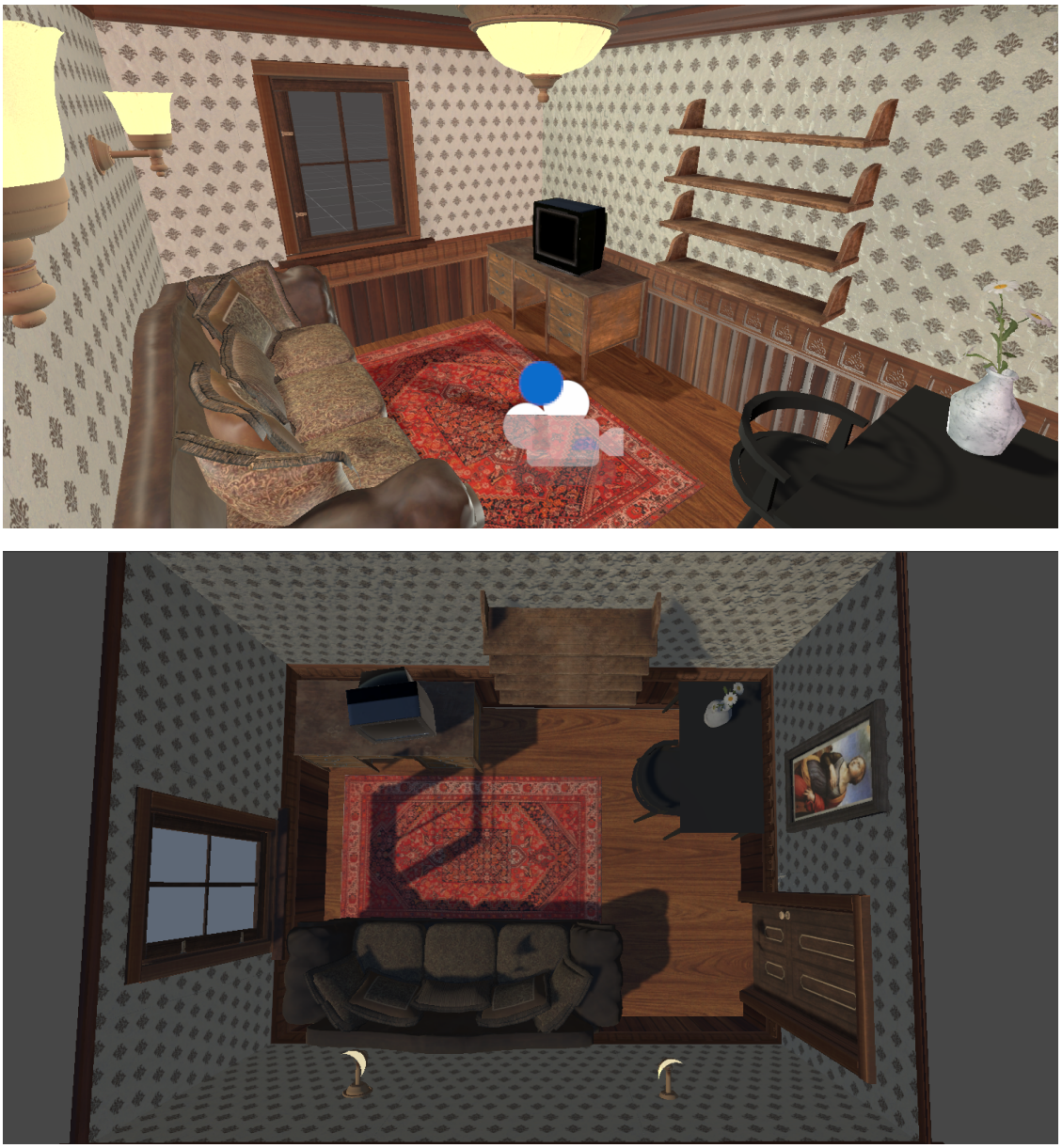


Figure 3.26: Traditional living room.

3.6 Conclusion

Game design elements intended for the project results presented high acceptability by testers on both prototypes, reassuring that the liberties taken to transform a rehabilitation therapy into a game capable of rehabilitating were given positive outcomes, possibly on the right path to be effective towards patients with schizophrenia.

Lack of expertise in modeling and texturing 3D assets, as well as drawing 2D assets for UI, especially for VR, proved to be a difficult task. The need for more realistic visuals conflicted with the needed optimization for VR games, modeling had to receive more attention to cut down the amount of vertices of objects and textures couldn't be as well defined. Not attending to those

problems resulted in game stutters on initial tests that required some hotfixes. As for 2D assets, the difficulty came from not being able to visualize made UIs and interact with them in VR for most of the project's time, due to it having to be a last addition. It didn't accomplish high-quality results when compared to their real counterparts or mainstream games that are well-known to the public, such as *The Sims*. Nevertheless, questionnaires showed that the overall reception of the testers was that the graphics displayed in the prototype contributed to immersion and felt real.

The narrative implementation was deemed sufficient for its purpose, a fundamental part of transforming a rehabilitation into a SG. The fun and aloof aspect of the helping character was considered to be a good addition to the game and was understood partially through reading by the project's peers. Unfortunately, it had a minor presence on the prototypes, possibly contributing to the lack of accomplishment feedback, resulting in players feeling lost on what to do next.

Conclusion and Future Work

SGs for health have been an increasing topic for the betterment of people's daily lives. This project sought to comprehend and produce an exemplary within the genre of SGs, a genre that can address a wide range of issues in education and health, where VR can further extend the capabilities of these games. Those qualities were vised to attend to the needs of Unidade Local de Saúde do Nordeste, for even a literature review was made to further understand what were the contributions of VR SGs towards mental health, and what are the requirements for a successful and engaging rehabilitating game experience.

The investigative development of a VR SG for the negative symptomatology of schizophrenia represents a significant step forward in addressing the challenges posed by this complex mental health disorder. The lack of personnel to attend decentralized areas of Portugal instigated this project, nevertheless, this problem is certainly present in more countries. This emphasizes the need to deepen knowledge for this cause. LS is also an attempt to promote creative options of accessible therapy.

The pre-production phase presented a unique set of challenges due to its meticulousness. Designing a game that not only educates but also engages users, demands creativity to overcome its concerning restrictions when talking about mental healthcare. Conveying the created and existing complexities to interdisciplinary, and multidisciplinary teams, requires a shared understanding of the subject in matter and all of the game's necessities. If these aspects of game development are poorly administrated, it can lead to the project's failure.

Some clinical professionals, at Unidade Local de Saúde do Nordeste, have done training sessions with the design team to learn how to operate the VR equipment, but the knowledge gaps among professionals from various fields working in PGH can hinder the game's development.

However, back-and-forth communication was crucial to unravel problems that could sabotage the making of the game design document, which has been shown to have led to successful outcomes in this report. This proactivity resulted in an extensive document with well-defined features, tailored to the needs of each participating team, and the target audience. Each design decision made and done in prototypes demonstrated notable accomplishments toward immersion and engagement, as displayed in questionnaires.

Regarding the visuals, the process of searching, fixing, and crafting 3D assets presented challenges initially. Nevertheless, as LS progressed, and expertise was gained, realizing tasks became more manageable. Produced assets highlight the growth in modeling and texturing

techniques that were acquired throughout the project. Clear differences can be seen from the shown initial and final assets.

The results obtained from the fabricated assets that followed the pre-production guidelines have shown a positive glimpse of what LS can accomplish. The 3D models highly impacted the immersion within the game and its visual updates. Achieving higher scores on the questionnaires means a possible strengthening of that psychological state.

Concerning the narrative, creating well-written episodic narratives proved to be difficult as it had to be made in Portugal's native language and mannerisms. For example, Portuguese from Brazil wouldn't have the same impact and relatability upon reading for the targeted audience. After receiving advice, the narrative was able to deliver a higher interest in playing LS to the participants. For the developers, it raised the enthusiasm to keep making the game. The possibility of different outcomes, and a noticeable player progression in the game, might have enhanced immersion and contributed to higher results on questionnaires.

Feedback from participants underscores what was believed that this game could harness with the power of immersive technology: educate while engaged in a fun, and realistic experience for users from various backgrounds. While the testing procedures with participants faced some challenges, LS represents one of PGH's pioneering efforts in this area. It managed to satisfy testers to some extent, yet there is ample room for further growth and improvement.

In conclusion, LS not only searches to rehabilitate but also to engage users in a dynamic and interactive manner. Hopefully, with further development, this innovative approach will mitigate the negative impacts of schizophrenia on stable patients and facilitate their social reintegration.

Future Work

LS reached all the proposed objectives by the PGH and will be passed on to other researchers to continue its development. To accomplish LS's future objectives, it still needs a lot of work before being fully integrated into hospitals, therefore, some elements mentioned in this document that need improvement are: better visuals to enhance immersion, more narrative episodes to permit long-term replayability, and more creative tasks to entertain the patient. The Unidade Local de Saúde do Nordeste looks forward to making a fully functional, autonomous VR rehabilitative SG.

Visuals can always be updated to a better and optimized version. What is lacking at the moment in regard to 3D assets are dedicated multi-texture maps to optimize development, asset style standardization to combat distractions and shader differences, a detailed art bible, and more decor.

As for the narrative, what was developed is just but a start of the amount of variations needed to accomplish replayable sessions. For now, there are three variations for each objective within the game. The first approach should be increasing the number of variations per objective to five or higher. Later, there are areas planned to be developed outside of the home, these should be the new focus of the narrative design as it is inherent that different rehabilitation techniques can be applied in new explorable areas. These exterior areas will prove to be difficult as it requires a deeper understanding of schizophrenia, while also being out of the player's comfort zone.

It would be interesting that the next plans for LS would consider its portability to Meta Quest 3, as it will have higher specs and higher visual fidelity, lessening restrictions on the designer's creativity and the artist's liberty. In consequence, it may prevent motion sickness complications as it can handle higher graphics, making it less likely to stutter.

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Appendix

A. Trelby Narrative

1. Cena Sequêncial - INÍCIO DE SESSÃO

UI. INTRODUÇÃO - SELEÇÃO EM TELEMÓVEL

Ao iniciar sua primeira sessão, será apresentado ao paciente a UI do telemóvel onde poderá ler uma mensagem.

TELEMÓVEL:

Olá, vem vindo a imobiliária Casas Nordeste. Estavas a procurar por uma nova casa para morar certo? Poderia me relembrar da sua preferência?

Prompts são apresentados ao paciente e ele deve escolher entre MODERNA ou TRADICIONAL.

TELEMÓVEL:

Disseste que um amigo(a) iria se mudar antes de você. Poderia me dizer o nome dele?

Prompts são apresentados ao paciente e ele deve escolher entre NUNO ou ANA.

TELEMÓVEL:

E por acaso tens um animal de estimação?

Prompts são apresentados ao paciente e ele deve escolher entre CÃO ou GATO

TELEMÓVEL:

Obrigado pela contacto, espero que corra tudo bem em sua mudança!

FADE OUT AND IN:

2. Cena Sequêncial - TUTORIAL

EXT. CHEGADA À CASA - DIA

BILHETE(1):

Olá! Aqui é o (Nuno/Ana), me mudei um pouco antes e logo em sua chegada não pude estar presente. Vim lhe avisar que coloquei a chave debaixo do tapete! É só levantá-lo e pegar a chave para abrir a porta. E não deixe suas malas do lado de fora!"

O jogador então, após abrir a porta, deve pegar sua mala e entrar na casa, onde será transportado diretamente ao quarto, lá encontra mais um bilhete.

Int. Quarto - DIA

BLIHETE(2):

Como boas vindas, preparei um prato delicioso para você. Com sua mão esquerda consegues abrir o menu, nele selecione a cozinha, deixei bem em cima da mesa.

O paciente deve então ir até a cozinha, onde se depara com mais um recado ao lado de um prato.

BILHETE(3):

Coloque no microondas por 1 minuto, espero que goste.

O Paciente após realizar a ação de comer, recebe uma mensagem.

MENSAGEM:

Espero que tenha gostado da comida!

O Paciente deve escolher no telemóvel entre MUITO BOA! e NÃO GOSTEI. Ao responder, recebe outra mensagem.

MENSAGEM:

Ah! Esqueci-me de lavar a loiça! Faria esse favor quando for lavar a sua?"

O paciente deve então realizar a limpeza e é terminado o tutorial.

FIM.

(INT/EXT. EPISÓDIO NARRATIVO - OBJETIVO RELACIONADO - lOCAL)

Cenas não sequênciais - QUARTO

INT. BOM DIA - ARRUMAR O QUARTO - QUARTO

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Bom dia! Tens gostado da casa? Tentei deixar tudo da melhor maneira possível com o tempo que tive. Na correria posso ter deixado alguma coisa fora do lugar.Ainda não me conheces mas só não esqueço a cabeça porque está presa! Espero que goste de passar o tempo cá! Um abraço! (Nuno/Ana)

FIM.

INT. COMIDA NO FORNO - PREPARAR O ALARME - QUARTO

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Tudo bem? Preparei-lhe um prato que acho que vais gostar. Ele está no fogão e fica pronto às (horário+2h). Se preferir preparar o alarme fique à vontade pois tive de sair. Estou indo para uma

entrevista a ver se publicam meu livro, "O mistério das meias sem pares". Um dia espero compartilhar-lo com você!

O paciente, após preparar o alarme, deve se dirigir a cozinha, assim que chega recebe outra mensagem.

INT. COMIDA NO FORNO - PREPARAR O ALARME - COZINHA

MENSAGEM:

Imagino que a comida esteja pronta! Tirou do fogão? Gostou? Pode comer tudo que a minha parte já guardei!

O paciente deve remover a comida do forno e come-la, de seguida, quando retornar ao quarto, o despertador deve estar a tocar e o paciente deve desliga-lo.

FIM.

INT. LIVRO VERMELHO - ARRUMAR O QUARTO - QUARTO

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Olha, por acaso esqueci perdi um livro vermelho em seu quarto? Antes que você chegasse, estive a limpar seu quarto e imagino que acabei esquecendo ele aí. Pode ficar com ele! É só para saber se tenho de procurar mais ou se estava aí o tempo todo.

Logo após receber a mensagem, o paciente deve procurar o livro e poderá escolher entre duas alternativas de resposta ESTÁ AQUI e NÃO ESTÁ AQUI. Caso o paciente responda "Está aqui" ele receberá a seguinte resposta:

MENSAGEM:

Que bom! Muito obrigado(a)!
Tenho de me organizar melhor.

Caso responda "Não está aqui":

MENSAGEM:
Tem certeza? Tenho uma grande impressão de que ele estava aí...

O Paaciente fica em loop até escolher a 1ªopção.

FIM.

Cenas não sequênciais - COZINHA

INT. LOIÇA NÃO LAVADA - LAVAR A LOIÇA - COZINHA

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:
Olá! Estas bem? Preparei-te um belo pequeno-almoço! A louça hoje fica por sua parte. Abraço!

Paciente deve comer o prato já preparado e em seguida lavar a loiça.

FIM.

INT. PEQUENO ALMOÇO - FAZER PEQUENO ALMOÇO - COZINHA

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:
Olá! Estas bem? Eu não estou... Mais uma vez fiquei doente. Consegues fazer um pequeno almoço extra para mim?

Logo após receber a mensagem, o paciente deve escolher entre duas alternativas de resposta SEM PROBLEMAS e NÃO CONSIGO

AGORA. Caso o paciente responda SEM PROBLEMAS ele receberá a seguinte resposta:

MENSAGEM:

Agradeço muito! Aposto que vai ficar uma delícia!

De seguida, o paciente deve realizar o pequeno almoço EM DOBRO e acaba o episódio. Caso responda NÃO CONSIGO AGORA, receberá a resposta

MENSAGEM:

Tudo bem, assim que eu conseguir levantar,arranjo-me.

Neste caso, o paciente realizará apenas um pequeno almoço.

FIM.

INT. ACABOU O LEITE - FAZER PEQUENO ALMOÇO - COZINHA

MENSAGEM:

Olá! Vim lhe informar que eu acabei com o leite sem ver se havia mais. Espero que não precise dele para tomar seu pequeno-almoço Creio que temos ingredientes para outros pratos.Pode deixar que mais tarde os compro! Fica por minha conta.

O paciente portanto deve realizar uma opção de pequeno almoço que não contenha leite.

FIM.

Cenas não sequênciais - CASA DE BANHO

INT. ESCORREGUEI - NENHUM - CASA DE BANHO

Ao visitar este cômodo o paciente poderá receber esta mensagem:

MENSAGEM:

Olá! Olha, cuidado com o chão na casa de banho! Se tiver algo no chão é porque estive a passar pano mais cedo e caí feio.

O paciente poderá encontrar uma esponja de limpeza no ambiente e, no telemóvel, aparecerá a opção FIQUE BEM como resposta.

FIM.

INT. USEI SUA TOALHA - NENHUM - CASA DE BANHO

Ao visitar este cômodo o paciente poderá receber esta mensagem:

MENSAGEM:

Olá! Na correria acabei por esquecer-me da toalhe e tive que usar sua. Não se preocupe! Já coloquei para lavar!

O paciente poderá responder ISSO NÃO É HIGIÊNICO ou QUERO UMA TOALHA NOVA! No qual o companheiro de casa responde:

MENSAGEM:

Peço desculpas, pode deixar que vou lhe recompensar.

FIM.

INT. COMPREI PASTA DE DENTE - ESCOVAR OS DENTES- CASA DE BANHO

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Vi que estava sem pasta de dente e comprei uma para você!

O paciente poderá responder OBRIGADO! E deve continuar a cumprir o objetivo de escovar os dentes.

FIM.

Cenas não sequênciais - SALA DE ESTAR

INT. CUIDADO COM A JANELA - ORGANIZAR OS LIVROS - SALA DE ESTAR

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Tem andado a ventar muito esses dias! Venta tanto que até os livros caem todos, então cuidado ao fechar as janelas!

O paciente irá encontrar livros jogados no chão e deve prosseguir a organiza-los.

FIM.

INT. PASSOU NA TV - NENHUM - SALA DE ESTAR

Ao visitar este cômodo o paciente poderá receber esta mensagem:

MENSAGEM:

Olá! Notícias! Vi na televisão que hoje faria um lindo dia! Queria eu passar um tempo no jardim para relaxar, aposto que seria magnífico!

FIM.

INT. JOGO DO GALO - NENHUM - SALA DE ESTAR

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Não sei se já viste mas tenho uma grande coleção de jogos na sala de estar. Fique à vontade para joga-los! Se quiser me convidar para uma partida através do computador (TV ou outro que for), eu adoro o jogo do galo!

Caso o paciente decida jogar contra a IA ele poderá ganhar ou perder. Caso perca, receberá a mensagem:

MENSAGEM:

Essa foi difícil. Não sei se ganharei a próxima!

Caso ganhe, irá lhe aparecer a mensagem:

MENSAGEM:

Parabéns pela vitória! Darei meu melhor na próxima.

FIM.

Cenas não sequênciais - JARDIM

INT. ALFACE - MOLHAR AS PLANTAS - JARDIM

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Tudo bem? Comprei uma plantinha para o nosso jardim, a nomeei de Alface(Um cacto). Acho que ela ficará linda com as plantas da casa!

Em seguida, o jogador deve molhar as plantas.

FIM.

INT. ERVAS DANINHAS - ARRANCAR ERVAS DANINHAS - JARDIM

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Fui em nosso jardim e vi que começou a crescer algumas plantas lá que não conheço. Acho que são

ervas daninhas Poderia dar uma olhada?

Em seguida, o jogador deve arrancar as ervas daninhas e ao terminar recebe outra mensagem:

MENSAGEM:

Eram ervas daninhas, certo? Muito obrigado(a) por cuidar do jardim!

FIM.

INT. REGAR ALFACE - MOLHAR AS PLANTAS - JARDIM

Neste objetivo, o paciente pode receber esta mensagem.

MENSAGEM:

Olá! Preciso de ajuda! Hoje era dia de molhar Alface, minha plantinha! Poderia fazer esse favor?

O paciente deverá responder POSSO SIM! E irá receber uma nova mensagem.

MENSAGEM:

Muito obrigado(a)!

Em seguida, o jogador deve molhar as plantas.

FIM.

Cenas não sequênciais - VARIADOS

INT. PET ENTALHADO - NENHUM

No momento em que o paciente encontra o objeto PET ENTALHADO, ele irá receber esta mensagem:

MENSAGEM:

Olá! Lhe contei que uma vez estive a praticar o entalhe? Cheguei a começar a fazer nosso animal de estimação mas não terminei pois

me destraí fazendo carinho nele. Nunca mais achei o entalhe! Pena que agora já não uso mais as ferramentas.

O Paciente poderá colocar o objeto na estante em seu quarto.

FIM.

INT. RETRATO - NENHUM

No momento em que o paciente encontra o objeto RETRATO, ele irá receber esta mensagem:

MENSAGEM:

Olá! Já viste não é mesmo? Estou a passar vergonha, esqueci minha foto na sala de estar... Ela foi de quando tentei aprender a surfar, caí com tudo na água e na imagem só sobrou foi a prancha!

O Paciente poderá colocar o objeto na estante em seu quarto.

FIM.

INT. PET ENTALHADO - NENHUM

No momento em que o paciente encontra o objeto PET FELTRADO, ele irá receber esta mensagem:

MENSAGEM:

Olá! Uma vez fiquei indignado com tanto pelo que encontrei no meu quarto que acabei por fazer uma feltragem de nosso animal de estimação e dei pra ele! Onde foi parar não sei, mas ele dormiu com o feltro por bastante tempo.

FIM.

B. EditPad Regex Narrative

<objective>
<description>PRIMEIRA SESSÃO</description>

<stepMessage>
<step>1.INÍCIO DE SESSÃO</step>
<message>
Olá, vem vindo a imobiliária Casas Nordeste. Estavas a procurar por uma nova casa para morar certo?
Poderia me relembrar da sua preferência?
</message>
</stepMessage>

<stepMessage>
<step>2.ESCOLHER A CASA</step>
<message>
Disseste que um amigo(a) iria se mudar antes de você.
Poderia me dizer o nome dele?
</message>
</stepMessage>

<stepMessage>
<step>3.ESCOLHER UM NOME</step>
<message>
E por acaso tens um animal de estimação?
</message>
</stepMessage>

<stepMessage>
<step>4.ESCOLHER O PET</step>
<message>
Obrigado pela contacto, espero que corra tudo bem em sua mudança!
</message>
</stepMessage>

</objective>

<objective>
<description>TUTORIAL</description>

<stepMessage>
<step>1.PEGAR BILHETE NA PORTA</step>
<message>
Olá! Aqui é o "Nome do amigo", me mudei um pouco antes e logo em sua chegada não pude estar presente... Vim lhe avisar que coloquei a chave debaixo do tapete!
É só levantá-lo e pegar a chave para abrir a porta. E não deixe suas malas do lado de fora!
</message>
</stepMessage>

<stepMessage>
<step>2.PEGAR BILHETE NO QUARTO</step>
<message>
Como boas vindas, preparei um prato delicioso para você. Ao chegar na porta deves conseguir se guiar, deixei bem em cima da mesa da cozinha.
</message>
</stepMessage>

<stepMessage>
<step>3.PEGAR BILHETE NO MICROONDAS</step>
<message>
Coloque no microondas por 1 minuto, espero que goste!
</message>
</stepMessage>

<stepMessage>
<step>3.COMER A COMIDA</step>
<message>
Espero que tenha gostado da comida!
</message>
</stepMessage>

<stepMessage>
<step>4.RESPONDER SE GOSTOU OU NÃO</step>
<message>
Ah! Esqueci-me de lavar a loiça! Faria esse favor quando for lavar a sua?
</message>
</stepMessage>

</objective>

<objective>
<description> QUARTO - ARRUMAR O QUARTO </description>
<stepMessage>
<step>1.PRIMEIRA VEZ DO OBJETIVO</step>
<message>
Olá! Bom dia!
Tens gostado da casa? Tentei deixar tudo da melhor maneira possível com o tempo que tive. Na correria posso ter deixado alguma coisa fora do lugar.Ainda não me conheces mas só não esqueço a cabeça porque está presa!
Espero que goste de passar o tempo cá!
Um abraço!(NOME)
</message>
</stepMessage>
</objective>

<objective>
<description> EPISÓDIOS NO QUARTO </description>

<variant>
<description> QUARTO - PREPARAR O ALARME </description>

<stepMessage>
<step>1.ÍNICIO DE OBJETIVO</step>
<message>
Olá! Tudo bem?
Preparei-lhe um prato que acho que vais gostar. Ele está no fogão e fica pronto às (HORÁRIO+2H). Se preferir preparar o alarme fique à vontade pois tive de sair. Estou indo para uma entrevista a ver se publicam meu livro, "O mistério das meias sem pares".
Um dia espero compartilhar-lo com você!
</message>
</stepMessage>

<stepMessage>
<step>2. IR PARA A COZINHA</step>
<message>
A comida já está pronta! Pode comer tudo que a minha parte já guardei!
Só tira-la do fogão!
</message>
</stepMessage>

</variant>

<variant>
<description> QUARTO - LIVRO VERMELHO </description>

<stepMessage>
<step>1.ÍNICIO DE OBJETIVO</step>
<message>
Olá! Olha, por acaso esqueci perdi um livro vermelho em seu quarto?
Antes que você chegasse, estive a limpar seu quarto e imagino que acabei esquecendo ele aí. Pode ficar com ele! É só para saber se tenho de procurar mais ou se estava aí o tempo todo.
</message
</stepMessage>

<stepMessage>
<step>2.RESPONDER SE O LIVRO ESTÁ OU NÃO NO QUARTO </step>
<variant>
<message>
Que bom! Muito obrigado(a)! Tenho de me organizar melhor.
</message>
</variant>

<variant>
<message>
Tens certeza? Tenho uma grande impressão de que ele estava aí...
</message>
</variant>

</variant>
</objective>

<objective>
<description> EPISÓDIOS NA COZINHA </description>

<variant>
<description> COZINHA - LAVAR A LOIÇA </description>

<stepMessage>
<step>1.INÍCIO DE OBJETIVO</step>
<message>

Olá! Estas bem?

Preparei-te um belo pequeno-almoço!

A louça hoje fica por sua parte.

Abraço!

</message<

</stepMessage>

</variant>

<variant>

<description> COZINHA - FAZER PEQUENO ALMOÇO 1 </description>

<stepMessage>

<step>1. INÍCIO DE OBJETIVO </step>

<message>

Olá! Estas bem?

Eu não estou... Mais uma vez fiquei doente. Consegues fazer um pequeno almoço extra para mim?

</message>

<stepMessage>

<stepMessage>

<step>2. RESPONDER SEM PROBLEMAS OU NÃO CONSIGO AGORA </step>

<variant>

<message>

Agradeço muito! Aposto que vai ficar uma delícia!

</message>

</variant>

<variant>

<message>

Tudo bem, assim que eu conseguir levantar,arranjo-me.

</message>

</stepMessage>

</variant>

<variant>

<description> COZINHA - FAZER PEQUENO ALMOÇO 2 </description>

<stepMessage>

<step>1. INÍCIO DE OBJETIVO </step>

<message>
Olá! Vim lhe informar que eu acabei com o leite sem ver se havia mais.
Espero que não precise dele para tomar seu pequeno-almoço Creio que temos ingredientes para outros pratos.
Pode deixar que mais tarde os compro! Fica por minha conta.
</message>
</stepMessage>

</variant>
</objective>

<objective>
<description> EPISÓDIOS CASA DE BANHO </description>

<variant>
<description> CASA DE BANHO - ESCOVAR OS DENTES </description>

<stepMessage>
<step>1. ENTRAR NA CASA DE BANHO </step>

<variant>
<description> CASA DE BANHO - CHÃO ESCORREGADIO </description>

<message>
Olá! Olha, cuidado com o chão na casa de banho! Se tiver algo no chão é porque estive a passar pano mais cedo e caí feio.
</message>
</variant>

<variant>
<description> CASA DE BANHO - USEI SUA TOALHA </description>

<message>
Olá! Na correria acabei por esquecer-me da toalhe e tive que usar sua. Não se preocupe! Já coloquei para lavar!
</message>

<stepMessage>
<step>2. RESPONDER QUE ISSO NÃO É HIGIÊNICO </step>
<message>

Peço desculpas, pode deixar que vou lhe recompensar.
</message>
</stepMessage>
</variant>

<variant>
<description> CASA DE BANHO - PASTA DE DENTES </description>

<message>
Olá! Vi que estava sem pasta de dente e comprei uma para você!
</message>

</variant>

</stepMessage>

</variant>
</objective>

<objective>
<description> EPISÓDIOS SALA DE ESTAR </description>

<variant>
<description> SALA DE ESTAR - ORGANIZAR LIVROS </description>

<stepMessage>
<step>1. INÍCIO DE OBJETIVO </step>
<message>
Olá! Tem andado a ventar muito esses dias! Cá venta tanto que os livros caem todos, então cuidado ao fechar as janelas!
</message>
</stepMessage>

Cenas não sequênciais - SALA DE ESTAR

</variant>

<variant>
<description> SALA DE ESTAR - VISITAR A SALA DE ESTAR </description>

<stepMessage>
<step>1. INÍCIO DE OBJETIVO NA SALA DE ESTAR </step>
<variant>
<message>
Olá! Notícias!
Vi na televisão que hoje faria um lindo dia! Queria eu passar um tempo no jardim para relaxar, aposto que seria magnífico!
</message>
</variant>

<variant>
<message>
Olá! Não sei se já viste mas tenho uma grande coleção de jogos na sala de estar. Fique à vontade para joga-los! Se quiser me convidar para uma partida através do computador (TV ou outro que for), eu adoro o jogo do galo!
</message>

<stepMessage>
<step>2. JOGAR E GANHAR OU PERDER </step>
<message>
Parabéns pela vitória! Darei meu melhor na próxima.

</message>
<message>
Essa foi difícil. Não sei se ganharei a próxima!
</message>
</stepMessage>
</variant>
</stepMessage>
</variant>
</objective>

<objective>
<description> EPISÓDIOS JARDIM </description>

<stepMessage>
<step>1. INÍCIO DE OBJETIVO NO JARDIM </step>
<variant>
<message>
Olá! Tudo bem?

Comprei uma plantinha para o nosso jardim, a nomeei de Alface(Um cacto). Acho que ela ficará linda com as plantas da casa!

</message>

</variant>

<variant>

<stepMessage>

<step>2. OBJETIVO ARRANCAR ERVAS DANINHA </step>

<message>

Olá! Fui em nosso jardim e vi que começou a crescer algumas plantas lá que não conheço. Acho que são ervas daninhas Poderia dar uma olhada?

</message>

<stepMessage>

<step>2.1 ARRANCAR ERVAS DANINHA </step>

<message>

Eram ervas daninhas, certo? Muito obrigado(a) por cuidar do jardim!

</message>

</variant>

<variant>

<stepMessage>

<step>3. OBJETIVO REGAR PLANTAS </step>

<message>

Olá! Preciso de ajuda! Hoje era dia de molhar Alface, minha plantinha! Poderia fazer esse favor?

</message>

<stepMessage>

<step>3.1 REGAR AS PLANTAS </step>

<message>

Muito obrigado(a)!

</message>

</stepMessage>

</variant>

</objective>

<objective>

<description> EPISÓDIOS ALEATÓRIOS </description>

<variant>
<stepMessage>
<step>1. ENCONTRAR PET ENTALHADO </step>
<message>
Olá!
Lhe contei que uma vez estive a praticar o entalhe?
Cheguei a começar a fazer nosso animal de estimação mas não terminei pois me destraí fazendo carinho nele.
Nunca mais achei o entalhe! Pena que agora já não uso mais as ferramentas.
</message>
</stepMessage>
</variant>

<variant>
<stepMessage>
<step>1. ENCONTRAR RETRATO </step>
<message>
Olá!
Já viste não é mesmo? Estou a passar vergonha, esqueci minha foto na sala de estar... Ela foi de quando tentei aprender a surfar, caí com tudo na água e na imagem só sobrou foi a prancha!
</message>
</stepMessage>
</variant>

<variant>
<stepMessage>
<step>1. ENCONTRAR PET FELTRADO </step>
<message>
Olá! Uma vez fiquei indignado com tanto pelo que encontrei no meu quarto que acabei por fazer uma feltragem de nosso animal de estimação e dei pra ele!
Onde foi parar não sei, mas ele dormiu com o feltro por bastante tempo.
</message>
</stepMessage>
</variant>
</objective>

Attachments

Immersive Tendencies Questionnaire

ITQ

(Witmer & Singer, 1998 – adaptação de alguns termos ao contexto do paciente)

1. Fica extremamente envolvido/a em projetos que lhe são atribuídos pelo seu chefe / professor / instrutor / terapeuta, com exclusão de outras tarefas?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
2. Com que facilidade pode mudar o foco da sua atenção da tarefa na qual está envolvido/a no momento para uma nova tarefa?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
3. Com que frequência se envolve emocionalmente (com raiva, tristeza ou felicidade) nas notícias que lê ou ouve?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
4. Quão bem se sente hoje?								
Nada Bem	1	2	3	4	5	6	7	Extremamente Bem
5. Envolve-se fácil e profundamente com filmes ou séries de televisão?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
6. Já se envolveu tanto com um programa de televisão ou livro que as pessoas têm dificuldade em chamar a sua atenção?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
7. Quão mentalmente alerto/a se sente neste momento?								
Nada Alerto/a	1	2	3	4	5	6	7	Extremamente Alerto/a
8. Já se envolveu tanto com um filme que não percebeu o que acontecia ao seu redor?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
9. Com que frequência se identifica intimamente com os personagens de uma história?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente

1. Fica extremamente envolvido/a em projetos que lhe são atribuídos pelo seu chefe / professor / instrutor / terapeuta, com exclusão de outras tarefas?								
10. Já se envolveu tanto com um videojogo que é como se estivesse dentro do jogo, em vez de usar um controlador e olhar para o ecrã?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente

11. Em média, quantos livros lê por mês para se divertir?				
Nenhum	1 a 3		3 a 6	Mais de 6
12. Que tipo de livros lê com mais frequência?				
Espionagem	Fantasia	Ficção científica	Aventura	Romances históricos
Mistério	Policiais	Outra ficção	Biografias	Autobiografias
Outros não-ficção				

13. Quão bem se sente hoje fisicamente?								
Nada Bem	1	2	3	4	5	6	7	Extremamente Bem
14. Considera que é bom bloquear distrações externas quando está envolvido/a em algo?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
15. Quando assiste a desporto, fica tão envolvido/a no jogo que reage como se fosse um dos jogadores?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
16. Já se abstraiu tanto em pensamentos que não percebe as coisas que acontecem ao seu redor?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
17. Já teve sonhos tão reais que fica desorientado/a ao acordar?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
18. Ao praticar desporto, fica tão envolvido/a no jogo que perde a noção do tempo?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente

19. Distrai-se facilmente ao trabalhar numa tarefa?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
20. Concentra-se bem ao realizar atividades agradáveis?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente

21. Com que frequência joga videojogos? (Frequentemente deve ser entendido como todos os dias ou a cada dois dias, em média.)								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
22. Quão bem se concentra quando realiza tarefas desagradáveis?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
23. Já ficou entusiasmado/a durante uma cena de perseguição ou luta na televisão ou no cinema?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
24. Até que ponto se debruçou sobre problemas pessoais nas últimas 48 horas?								
Nenhuma Vez	1	2	3	4	5	6	7	Várias Vezes
25. Já se assustou com algo que está a acontecer num programa de televisão ou filme?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
26. Já ficou apreensivo/a ou com medo por muito tempo depois de assistir a um filme de terror?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
27. Evita montanhas-russas ou parques de diversões porque são muito assustadores?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
28. Com que frequência assiste a telenovelas ou docu-dramas (documentários com dramatização de eventos feita por atores) na televisão?								
Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente
29. Já se envolveu tanto a fazer algo que perdeu a noção do tempo?								

Nada Frequente	1	2	3	4	5	6	7	Extremamente Frequente

ITQ

(Witmer & Singer, 1998 – Adaptação de 2004 por UQO Cyberpsychology Lab – adaptação de alguns termos ao contexto do paciente)

1. Envolve-se fácil e profundamente com filmes ou séries de televisão?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
2. Já se envolveu tanto com um programa de televisão ou livro que as pessoas têm dificuldade em chamar a sua atenção?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
3. Quão mentalmente alerto/a se sente neste momento?								
Não Alerto/a	1	2	3	4	5	6	7	Completamente Alerto/a
4. Já se envolveu tanto com um filme que não percebeu o que acontecia ao seu redor?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
5. Com que frequência se identifica intimamente com as personagens de uma história?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
6. Já se envolveu tanto com um videojogo que é como se estivesse dentro do jogo, em vez de usar um controlador e olhar para o ecrã?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
7. Quão bem se sente hoje fisicamente?								
Nada Bem	1	2	3	4	5	6	7	Extremamente Bem
8. Quão bom/boa é a bloquear distrações externas quando está envolvido/a em algo?								
Não Muito Bom/ Boa	1	2	3	4	5	6	7	Muito Bom/Boa
9. Quando assiste a desporto, fica tão envolvido/a no jogo que reage como se fosse um dos jogadores?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
10. Já se abstraiu tanto em pensamentos que não percebe as coisas que acontecem ao seu redor?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente

11. Já teve sonhos tão reais que fica desorientado/a ao acordar?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
12. Ao praticar desporto, fica tão envolvido/a no jogo que perde a noção do tempo?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
13. Concentra-se bem ao realizar atividades agradáveis?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
14. Com que frequência joga videojogos? (Frequentemente deve ser entendido como todos os dias ou a cada dois dias, em média.)								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
15. Já ficou entusiasmado/a durante uma cena de perseguição ou luta na televisão ou no cinema?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
16. Já se assustou com algo que está a acontecer num programa de televisão ou filme?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
17. Já ficou apreensivo/a ou com medo por muito tempo depois de assistir a um filme de terror?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente
18. Já se envolveu tanto a fazer algo que perdeu a noção do tempo?								
Nunca	1	2	3	4	5	6	7	Extremamente Frequente

Presence Questionnaire

PQ

(Witmer & Singer, 1994 – Adaptação de 2004 por UQO Cyberpsychology Lab – adaptação de alguns termos ao contexto do paciente)

QUANTO AO AMBIENTE DIGITAL EXPERIENCIADO:

1. Quanto conseguiu controlar os acontecimentos no jogo?								
Nenhum Controlo	1	2	3	4	5	6	7	Controlo Total

1. Quanto conseguiu controlar os acontecimentos no jogo?								
2. Quão responsivo era o ambiente para com as ações que iniciou (ou executou)?								
Nada Responsivo	1	2	3	4	5	6	7	Completamente Responsivo
3. Quão naturais pareceram as suas interações com o ambiente digital?								
Extremamente Artificiais	1	2	3	4	5	6	7	Completamente Naturais
4. Quão envolvente pareceram os aspectos visuais do ambiente?								
Nada Envolventes	1	2	3	4	5	6	7	Completamente Envolventes
5. Quão natural foi o mecanismo de controle de movimento pelo ambiente digital?								
Extremamente Artificial	1	2	3	4	5	6	7	Completamente Natural
6. Quão convincente era o seu sentido de objetos a mover-se pelo espaço?								
Nada Convincente	1	2	3	4	5	6	7	Completamente Convincente
7. Quanto é que a sua experiência no ambiente virtual pareceu consistente com as suas experiências no mundo real?								
Nada Consistente	1	2	3	4	5	6	7	Muito Consistente
8. Foi capaz de antecipar o que aconteceria a seguir em resposta às ações que desempenhava no jogo?								
De Modo Algum	1	2	3	4	5	6	7	Completamente
9. Quanto foi capaz de explorar ou pesquisar ativamente o ambiente utilizando a sua visão?								
De Modo Algum	1	2	3	4	5	6	7	Completamente
10. Quão convincente foi o seu sentido de movimento dentro do ambiente virtual?								
Nada Convincente	1	2	3	4	5	6	7	Muito Convincente

11. Quão perto foi capaz de examinar objetos?								
De Modo Algum	1	2	3	4	5	6	7	Muito Perto
12. Quão bem pode examinar objetos de vários pontos de vista?								

11. Quão perto foi capaz de examinar objetos?								
De Modo Algum	1	2	3	4	5	6	7	Extensivamente
13. Quão envolvido/a esteve na experiência virtual do ambiente?								
Nada Envolvido/a	1	2	3	4	5	6	7	Completamente Envolvido/a
14. Quanto atraso teve entre as suas ações e os resultados esperados?								
Nenhum Atraso	1	2	3	4	5	6	7	Atrasos Longos
15. Quão rapidamente se adaptou à experiência no ambiente virtual?								
Não me Adaptei	1	2	3	4	5	6	7	Menos de 1 minuto
16. No fim da experiência, quão proficiente/capaz sentiu-se em mover e interagir com o ambiente virtual?								
Nada Proficiente	1	2	3	4	5	6	7	Muito Proficiente
17. Quanto é que a qualidade do ecrã interferiu ou distraiu da realização das tarefas atribuídas ou atividades necessárias?								
Não Interferiu	1	2	3	4	5	6	7	Preveniu a Realização das Tarefas
18. Quanto é que os dispositivos de controle interferiram com o desempenho das tarefas atribuídas ou com outras atividades?								
Não Interferiu	1	2	3	4	5	6	7	Preveniu a Realização das Tarefas
19. Quão bem pode se concentrar nas tarefas atribuídas ou nas atividades necessárias, em vez de nos mecanismos utilizados para executar essas tarefas ou atividades?								
De Modo Algum	1	2	3	4	5	6	7	Completamente

SE O AMBIENTE VIRTUAL INCLUI SONS:

20. Quanto é que os aspectos auditivos do ambiente o/a envolveram?								
De Modo Algum	1	2	3	4	5	6	7	Completamente
21. Quão bem conseguiu identificar sons?								
De Modo Algum	1	2	3	4	5	6	7	Completamente
22. Quão bem conseguiu localizar sons no espaço?								
De Modo Algum	1	2	3	4	5	6	7	Completamente

SE O AMBIENTE VIRTUAL INCLUI HÁPTICO (SENTIDO DO TOQUE):

23. Quão bem conseguiu explorar ou pesquisar ativamente o ambiente virtual utilizando o toque?								
De Modo Algum	1	2	3	4	5	6	7	Completamente
24. Quão bem conseguiu mover ou manipular objetos no ambiente virtual?								
De Modo Algum	1	2	3	4	5	6	7	Completamente

EGameFlow

EGameFlow

(Fong-Ling, Rong-Chang & Sheng-Chin, 2009 – adaptação de alguns termos ao contexto do paciente)

CONCENTRAÇÃO

1. A maior parte das atividades do jogo são relacionadas com a tarefa de aprendizagem.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
2. Não sobressaiu nenhuma distração das tarefas em mão.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
3. De forma geral, consegui manter-me concentrado/a no jogo.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente

1. A maior parte das atividades do jogo são relacionadas com a tarefa de aprendizagem.								
4. Eu não fiquei distraído/a de tarefas que o jogador/a devia estar concentrado/a em.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
5. Eu não fiquei sobrecarregado/a com tarefas que não parecem estar relacionadas.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
6. A carga de trabalho no jogo está adequada.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente

CLAREZA DO OBJETIVO

7. Os objetivos gerais do jogo foram apresentados no início do jogo.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
8. Os objetivos gerais do jogo foram apresentados com clareza.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
9. Os objetivos intermediários foram apresentados no início de cada cena.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente

10. Os objetivos intermediários foram apresentados com clareza.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente

FEEDBACK

11. Eu recebi informação sobre o meu progresso no jogo.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
12. Eu recebi informação imediata sobre as minhas ações.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
13. Eu fui notificado/a sobre novas tarefas imediatamente.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
14. Eu fui notificado/a sobre novos eventos imediatamente.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
15. Eu recebi informação sobre o meu sucesso (ou fracasso) nos objetivos intermediários imediatamente.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente

DESAFIO

16. O jogo forneceu “dicas”, em texto, vídeo ou áudio, que me ajudaram a superar os desafios.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
17. A dificuldade dos desafios aumentaram consoante o aumento das minhas capacidades.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
18. O jogo fornece novos desafios com um ritmo apropriado.								
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente

AUTONOMIA

19. Eu senti controle e impacto sobre o jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
20. Eu sabia os próximos passos no jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
21. Eu senti controle sobre o jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente

IMERSÃO

22. Eu não senti o tempo passar enquanto estava a jogar o jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
23. Eu fiquei abstraído/a dos meus arredores enquanto jogava o jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
24. Eu temporariamente esqueci-me das minhas preocupações do dia-a-dia.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
25. Eu experienciei uma sensação alterada do tempo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
26. Eu consegui ficar envolvido/a com o jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
27. Eu senti-me emocionalmente envolvido/a com o jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente
28. Eu senti-me visceralmente envolvido/a com o jogo.							
Discordo Completamente	1	2	3	4	5	6	7	Concordo Completamente