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Alleviating Depression Symptoms Through Science-Based Video Gaming

MASTER DISSERTATION

Diana Carolina Gonçalves Mendes
INTERNATIONAL MASTER OF INTERACTIVE MEDIA DESIGN

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ORIENTATION

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Resumo

A depressão representa um grande encargo econômico na Europa e em todo o mundo, é esperado que se torne a segunda doença mental mais comum em todo o mundo até 2020. Os tratamentos de primeira linha incluem medicação e psicoterapia, os quais podem produzir efeitos colaterais indesejáveis, ou serem ineficazes por várias razões que vão da escassez de profissionais treinados, até ao desconforto dos pacientes com os resultados. Terapias alternativas, como a música e terapias baseadas em tecnologia, têm sido propostas como tratamentos alternativos. Esta tese propõe o uso de um jogo casual afim de ajudar pessoas com sintomatologia depressiva. Foi realizado um estudo inicial com uma amostra de indivíduos com sintomas de depressão, leve a moderada, para entender a sua relação com videojogos, tendências de jogos e qual o tipo preferido de jogos. Concluímos que jogando no seu tempo livre, sozinhos e num computador ou dispositivo móvel tiveram maior preferência. Com base na informação coletada, criamos um jogo para dispositivos móveis chamado Symphony, baseado em resolver puzzles e audição musical, como meio de fornecer dicas para o bem-estar mental. Tentamos também promover a estimulação cognitiva, a melhoria de humor, e estratégias de regulação de emoções. Um teste de usabilidade foi realizado com 5 indivíduos da população geral para testar sua jogabilidade, onde eles preencheram questionários pré e pós-intervenção para avaliar seu humor e perceção do jogo. Uma experiência final foi realizada com uma amostra da população-alvo de 8 voluntários, que também completaram questionários pré e pós-intervenção para avaliar o impacto de jogar Symphony em seus níveis de depressão, humor e também para conhecer sua perceção do jogo. Os dados dos questionários e os comentários e observações informais dos terapeutas, revelaram respostas emocionais positivas e mudanças de humor resultantes de jogar Symphony. As quais, sugerem melhorias para tornar Symphony mais eficaz e adaptável a cada indivíduo.

Palavras-Chave: Depressão, Música, Regulação das Emoções, videojogos, puzzles.

Abstract

Depression is a heavy economic burden in Europe and worldwide, and it is expected to reach second place as the most common mental illness worldwide by 2020. First-line treatments include medication and psychotherapy, but they may either bring undesirable side-effects or be ineffective for several reasons that go from the shortage of trained practitioners to lack of compliance. Alternative therapies, such as music and technology-based therapies, have been proposed as adjunctive treatments. This thesis proposes using a casual-game to aid people with depressive symptomatology. We conducted an initial study with a sample of individuals with mild to moderate depression symptoms to understand their regards to video-games, gaming tendencies, and preferred type of games. Playing in their free time, alone and on a computer or mobile device were mostly preferred, so we created a mobile casual game called Symphony based on puzzle-playing and music-listening to give tips for their mental well-being, promote cognitive stimulation, mood improvement, and emotion regulation strategies. A usability test conducted with 5 individuals from the general population was conducted to test its playability, where they completed pre- and post-intervention questionnaires to assess their mood and perception of the game. A final experiment was conducted with a sample of the target population of 8 volunteers, who also completed pre- and post-intervention questionnaires to assess the impact of playing Symphony on their depression levels, mood, and also to gather their perception of the game. Questionnaire data and therapists' informal comments and observations reveal overall positive emotional responses and mood changes resulting from playing Symphony, and suggest improvements to make Symphony more effective and adaptable to each individual.

Keywords: Depression, Music, Emotion Regulation, Video Games, Puzzles.

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1. Introduction

1.1. Motivation

On a daily basis, we may hear people saying, or even find ourselves expressing, how 'depressed' we are: after a break-up, failing an exam, losing a loved one, or after simply having a bad day. But is it correct to use this term under such circumstances? Truth be told, it is sometimes used lightly, until we realize what being depressed actually means. According to the WHO (World Health Organization) report in 2017 (*Depression and Other Common Mental Disorders: Global Health Estimates.*, 2017), clinical depression is expected to reach the second place as the most common illness around the world this year 2020. Of course, even though official numbers have not yet been reported by WHO this year, these numbers might be even larger than expected then, considering the COVID-19 pandemic that hit the world at the end of the year 2019. WHO has already warned in their official website, more specifically its regional office for Europe, that *"the main psychological impact to date is elevated rates of stress or anxiety"* (*Mental Health and COVID-19*, 2020). Moreover, fighting the disease has led to lockdown measures in many countries, which have affected people's routines and usual activities, so *"levels of loneliness, depression, harmful alcohol and drug use, and self-harm or suicidal behaviour are also expected to rise"* (*WHO/Europe | Coronavirus Disease (COVID-19) Outbreak - Mental Health and COVID-19*, 2020), making it a priority.

Research has shown that many individuals suffering from this illness do not receive appropriate treatment for many different reasons, a large number also quit or discontinue treatment, and some do not even accept their condition and refuse any treatment (Maina et al., 2016). Right now, even individuals going through treatment find themselves unable to, for instance, see their therapists face to face, and the WHO has stated that *"issues of service access and continuity for people with developing or existing mental health conditions are also now a major concern"* (*WHO/Europe | Coronavirus Disease (COVID-19) Outbreak - Mental Health and COVID-19*, 2020). Given the existing limitations in real settings, the introduction of computerized or digital solutions in treatment has been recommended, and even urged, in an attempt to increase adherence. These attempts have included web pages, mobile apps, and even serious games. In particular, serious games have proven to be a useful tool for rehearsing real situations in several therapies and have shown promising results, including games to treat and raise awareness of clinical depression (Fleming et al., 2017) (Fleming et al., 2014) (Granic et al., 2014). In this area, music does not stay behind. In fact, the musical component has always been important in video game design, and it might play an even more relevant role in serious games for mental health purposes. It has been identified as essential in many aspects of our lives: it helps us relax by inducing a pleasurable experience, and it is for many a strategy to regulate mood and emotions (Saarikallio, 2010). This last characteristic is key, as research has shown that individuals with depressive symptoms usually have difficulties regulating their emotions, and they seem to find the same difficulties when using music for this purpose (Sakka, 2018) (Stewart et al., 2019). For these reasons, we set out to investigate the potential of combining video games and music to tackle depressive symptomatology.

1.2. Objectives

Considering everything stated before, our objective is to create a digital tool that promotes the mental wellbeing of young adults, more specifically university students who have depressive symptoms, to complement traditional treatments. We are aimed to explore the characteristics of the technology, game design components, and music therapy-focused elements that should be implemented onto a digital platform of easy and effective use for the young adult population.

1.3. Proposal

In order to achieve our goal, we have designed and developed a video game called 'Symphony', a casual game based on puzzle-solving activities and popular music-listening, that feeds from principles of Cognitive Behavioral Therapy (CBT). We propose that a game with the characteristics of 'Symphony' can help young adults improve their mood, feel more competent and achieved, and that regulating emotions using music in a realistic setting will raise awareness on how music can affect our mood.

1.4. Research Questions

The questions we want to answer aim to validate puzzle-solving, music-listening, and CBT as implemented in Symphony as means to complement traditional approaches in the treatment of depression:

1. Does Symphony improve the mood of young adults with depressive symptomatology?
2. Does Symphony raise awareness of the positive or negative impact of music on our mood?
3. Does Symphony promote using music to manage mood and regulate emotions?
4. Which elements are more valued by the participants and why?

1.5. Thesis Outline

Our research starts by reviewing the existing literature about depression, its more traditional treatments, and the alternative use of video games and music to help fight this illness and/or raise awareness about it within people with a loved one suffering from such illness.

In **chapter 2**, we reflect on what depression is, its typical symptoms and how it is classified according to its severity. We also go through what the literature accounts for as risk factors or possible causes of this disease in children, adolescents, and young adults. Even though our aim is university students, a depressive episode in adulthood could be correlated with previous diagnoses or experiences during childhood and adolescence, so we have included some considerations on the matter. Geriatric depression is, therefore, out of the scope of this investigation, especially because it is usually accompanied by other medical conditions, requiring a different approach.

We devote **chapter 3** to the most common approaches to treat depression and the main types of treatment mentioned in the literature. We also reflect on the problem of

compliance and common difficulties when treating depression; in other words, what the most common causes to pause, quit or change treatment are. We also mention a few common alternative therapies that are available, focusing on the ones that we believe could help us achieve our main objective.

In **chapter 4**, we review the use of music for therapeutic and/or medical purposes. This includes music therapy's principles and mechanisms and a quick overview of the neurological responses and psychological responses we have to music. This chapter also includes considerations in the literature regarding the relation between music and emotions, the mechanisms involved, and how these seem to work in an individual with depression. We also reflect on the use of music to regulate emotions, being emotional regulation one of the key objectives of many therapies, and how familiarity and meaningfulness can influence, not only our perception of a song, but also its emotional impact.

Finally, in **chapter 5**, we review the use of video games for therapeutic purposes, their health benefits, and potential barriers to use video games for therapy. This includes the use of video games to regulate emotions, and how different genres of video games have shown to be beneficial to improve specific cognitive and motor areas. We also highlight relevant studies that have been made regarding the use of video games to treat mental health, including studies and projects which involved the creation of video games to treat depression, and reflect on the lessons learned through their results. All in all, this leads us to consider how games have been used for treatment and what we can learn from them to help make games for health appealing and effective for the users.

Once we have walked through the relevant literature of interest, in **chapter 6** we introduce the iterative process that includes a study of the target population, important considerations from the therapists involved in their treatment, and how the knowledge acquired translates into a playable prototype. We go from small tests such as our music selection, through our low-fidelity prototype, to the high-fidelity final prototype that was tested with the participants of this study.

Usability tests were made with this prototype, a process we devote to in **chapter 7**. We describe the participants of this study, what we measured and with which tools, and summarize the feedback obtained and conclude which changes were to be made.

Finally, it is in **chapter 8** where we dedicate to what was the final prototype and its testing by a sample of our target population. We describe the participants' background and likes/dislikes in terms of video games, which might affect the results, and refer to what we want to evaluate and the instruments used for that purpose. We also describe the guidelines of the testing process, and summarize the results obtained and what they entail.

In **chapter 9** we reflect and discuss what we have learned from this experience, what was successful and what needs some work, and reflect on the limitations of this work. We also discuss the possibilities this project has for future improvements, and other areas that could be explored based on our findings.

2. The Basics of Clinical Depression

Depression is, nowadays, among the five leading causes of disability in the world, affecting any age range, from children to elders. According to the World Health Organization's (WHO) calculations in 2017, it was predicted to reach the second place by 2020 (Bhowmik et al., 2012), with an estimated of 350 million of the world's population affected by this illness by 2012 (Marcus et al., 2012). By 2016, this illness had already affected one of every five women with 17% prevalence, and one out of twelve men with a 9% prevalence (Smit et al., 2016). As for the underaged population, 2% of school children and 5% of teenagers also suffer from depression (Iyer & Khan, 2012). These numbers and the wide range of the population affected by this disorder have fired the alarms of medical institutions and emphasized the need for effective treatment plans and methods. Furthermore, Major Depressive Disorder (MDD), the most critical type, represents a higher burden of disease in Europe than the rest of the world (Cesar & Chavoushi, 2013).

While sadness is a natural feeling that every human being feels every now and then, and fades out as time passes by, we talk to others about our feelings, and continue doing things we normally enjoy. But when sadness does not go away, for weeks or for months, it might be a sign of depression. As referred by Cesar and Chavoushi, The Oxford English Dictionary defines depression as *"a mental condition characterized by severe feelings of hopelessness and inadequacy, typically accompanied by a lack of energy and interest in life"* (Cesar & Chavoushi, 2013, p. 5). The Cambridge Dictionary also defines Clinical Depression as *"a mental illness that causes feelings of sadness and loss of hope, changes in sleeping and eating habits, loss of interest in your usual activities, and sometimes physical pains*" (Clinical Depression, 2020). While sadness is a natural emotion that dissipates in time, depression is a clinical condition that, without treatment, tends to become chronic, affecting the individual's daily routines and physical and mental state, all of which tend to end in increasing loneliness and social isolation.

More importantly, it affects the individual and those who surround him/her, being frequently related to marital problems and divorce, school or university dropouts, and work disability; in the worst scenario, depression may lead to suicide. According to Debjit Bhowmik et al., clinical depression also translates into neurovegetative signs: *"the nervous system changes in the brain cause many physical symptoms that result in diminished participation and a decreased or increased activity level"* (Bhowmik et al., 2012, p. 39). This, moreover, leads those affected with such disorders to be affected by unexplained pain, and more propensity to developing other medical illnesses due to its adverse health effects, augmenting the probabilities of dying from these medical conditions (Bhowmik et al., 2012).

2.1. **Classifications and Symptoms**

We believe it is necessary to go through the different classifications of depression, and their characteristics. This, not only because we believe in the importance of this information for our readers, but also for us to be aware of the symptoms, difficulties, and

challenges our target population is going through as part of their daily routine. To do this, we are going to serve ourselves from the now standard classifications used according to the symptoms, severity, nature, and even possible origins of the disease. Typically, diagnosing someone with a depressive disorder requires considering the presence, or combination, of a certain number of symptoms (quite visible or not), and the length and intensity of such. As Alan Galemberg et al. point out, these symptoms must break with the individual's usual behavior and cause significant impairments to be considered clinical, without being attributable to any other disorder, medical condition or substance abuse (Gelenberg et al., 2010).

As Cesar and Chavoushi refer, two frequently used classifications are the ones offered by the International Classification of Diseases (ICD) and the Diagnostic and Statistical Manual of Mental Disorders (DSM). As for this review, we will focus on the one offered by the DSM-VI, where clinical depressive disorders are separated from those that are concurrent with medical conditions or the use of psychoactive substances (Cesar & Chavoushi, 2013).

The ***Disruptive Mood Dysregulation Disorder*** is mostly diagnosed in children, and it is characterized by frequent and severe outbursts of anger, and with persistent irritated and sad mood in different contexts (Maina et al., 2016). A child affected with this condition would respond in an 'exaggerated' way to common situations or stimuli. Its symptoms should have begun to appear before the age of ten, and it is also considered that its appearance may strongly lead to future development of depressive disorders (Maina et al., 2016). In other words, it could be considered as a 'prelude' of more developed depression in adulthood.

The most common in literature is the ***Major Depressive Disorder***, which usually appears between twenty and thirty years of age. In order to be diagnosed, five of the following nine symptoms need to be present (Cesar & Chavoushi, 2013).

- Depressed mood (or irritable mood, in children and adolescents)
- Anhedonia (inability to experience pleasure) in all or almost all activities
- Weight loss (when not dieting) or weight gain, as well as increase or decrease of appetite.
- Insomnia or hypersomnia.
- Psychomotor retardation or agitation.
- Fatigue and loss of energy.
- Feelings of worthlessness, excessiveness or inappropriateness.
- Decreased concentration, diminished ability to think, memory difficulties and indecisiveness.
- Frequent thoughts of death, suicidal ideation without planning, suicide attempt or plans for committing suicide.

The presence of these symptoms must mean a significant change in the individual's normal behavior and interfere with his/her ability to perform on a daily basis. The respective symptoms are to be present every day for about two/four weeks in a row to be diagnosed as an MDD episode (Maina et al., 2016). These episodes can take place one to several times in a lifetime. When recurrent, the episode can be separated by many

years, other episodes can happen in clusters, or their frequency can increase as the affected gets older.

Depending on the degree of depression, major depressive disorder is classified as merely ***subthreshold depressive symptoms***, when there is the presence of fewer than five symptoms mentioned above; ***mild depression***, when there are five or more symptoms that match the diagnosis and they result in minor functional impairment; ***moderate depression***, if the symptoms cause functional impairment and are between 'mild' and 'severe'; and ***severe depression*** when most of the symptoms are present, with or without psychotic symptoms, and they heavily impair the affected functioning. Of course, when the affected of major depression suffers from hallucinations or delusions, this is classified as 'Severe with psychotic features' as specified by Gelenberg (Gelenberg et al., 2010).

The DSM-VI manual also includes the ***Persistent Depressive Disorder*** (more commonly called Dysthymia), which, even though it is equally characterized by persistent depressed mood, has a chronic course along a minimum of two years, in association with two or more of these symptoms: changes in appetite, insomnia or hypersomnia, fatigue, difficulties to focus, belief of hopelessness and low self-esteem (Maina et al., 2016). This disorder is more frequent in adolescence and early adulthood, and seems to be strongly associated with personality disorders and/or substance consumption (Maina et al., 2016). Opposite to Major Depression, this does not disable and is clearly less severe. However, the long-term factor does not permit the affected to function at its one hundred percent or feel good (Iyer & Khan, 2012) (Bhowmik et al., 2012).

It also classifies ***Premenstrual Dysphoric Disorder***, describing it as a phasic fluctuation of mood that appears in the week previous to the menstrual cycle, which tends to resolve during the first days of menstruation (Maina et al., 2016). During this phase, the affected goes through constant affective changes, increasingly sensitive to rejections. Therefore, she is prone to interpersonal conflicts. It is accompanied by typical depressive symptoms, such as changes in appetite, fatigue, together with muscle and joint pain.

As for the ***Depressive disorder due to substances or drugs***, it is characterized by the typical low mood and loss of interest in what was once enjoyable, and can show during or shortly after intoxication, during exposition to the drug, or right after its discontinuation (Maina et al., 2016). These symptoms can be induced by substances such as alcohol, sedative drugs, cocaine or other stimulants, as well as by hallucinogens.

Depressive symptoms can also be related to other medical conditions, categorized as ***Depressive disorder due to other medical conditions*** in the DSM-V. What makes this classification is the fact that depressive symptoms are a direct pathophysiological consequence of other conditions, e.g. a stroke, Parkinson's and Huntington's disease, multiple sclerosis or cranial trauma (Maina et al., 2016).

Generally, the literature before the publication of the DSM-V includes ***Bipolar Disorder*** (also called Manic Depression), and ***Postpartum Depression*** as types of depressive disorders (Iyer & Khan, 2012) (Bhowmik et al., 2012), but they are now classified in this manual separately. For the purpose of focus, we will refer to these as simply 'distinctions' of a Major depression based on its onset or its course in time.

2.2. **Possible Causes and Risk Factors**

Further than traveling through the different symptoms present when affected with a clinical depressive disorder, a large body of literature has been devoted to offering some answers regarding what can cause this illness to understand its functioning and, hence, facilitate treatment. Until this day, the exact cause of depression is unknown, but most of the literature proposes that it might be caused by not one but a series of factors, from genetic, biological and psychological, environmental, and that almost certainly these episodes are triggered by external events.

Bhowmik et al. highlight that statistics seem to show higher rates of depression in socioeconomically disadvantaged groups, as well as immigrants seem to be particularly vulnerable due to the stress generated by changes, especially if they are also isolated by language (Bhowmik et al., 2012). They also mention than men seem to be particularly sensitive to depression when going through unemployment or disadvantaged socio-economic status. Furthermore, the authors also highlight that men who engage with other men seem to be sensitive to this disorder due to the sexual-identification stress, and if they have been victims of anti-gay violence (Bhowmik et al., 2012).

Bembnowska et al. also highlighted how smoking collaborates in developing depressive disorders, particularly among women, concluding that there is a 41% chance that heavy smokers develop these disorders compared to non-smokers (Bembnowska & Jośko-Ochojska, 2015). The author also mentions the influence of the sedentary lifestyle individuals live nowadays, stating that it makes them more likely to experience low self-esteem and mood swings. Many other causes for depression were proposed by Iyer and Khan, including synthetic chemicals that are added to many of our food and drinks, noise pollution (already linked to increased stress levels, disruptions in sleep and hypertension), and electrical pollution, in other words, exposure to electronic devices working off radio waves (Iyer & Khan, 2012).

Some studies suggest that depressive illnesses could be associated with genes occupying specific positions in particular chromosomes (Bembnowska & Jośko-Ochojska, 2015). In other words, particular genes can make individuals more vulnerable to low mood, and they can even influence the response to medication therapy. Following this line, other authors like Bhowmik et al. report that some types of depression might run in families, caused by chemical changes in the brain due to the previously mentioned problem with genes, and that are later triggered by external stressful events, such as a break up, divorce, death or illness of a close one, and/or job loss (Bhowmik et al., 2012). These authors also expressed that Major depression tends to be an 'inherited trait', present generation after generation in some families. In spite of this tendency, this is not a rule and, indeed, not all members in families with recurrent cases of depression suffer this illness, and it can occur to people with no family history of depression whatsoever (Bhowmik et al., 2012).

Further studies and trials show that some areas in the brain play a key role in depression, such as:

- ***The amygdala*:** part of the limbic system, it is a group of structures deep in the brain associated with emotions, and sexual arousal. It is activated

when the individual recalls emotional memories, such as frightening or pleasurable situations. The activity in this area seems to be higher when a person is sad or clinically depressed (*What Causes Depression? - Harvard Health*, 2019).

- ***The thalamus***: it receives most of our sensory information and sends it to the appropriate part of the cerebral cortex, which itself directs functions such as speech, thinking, movement, behavioral reactions and learning. Research relates it to bipolar disorder, which might result from problems in this area (*What Causes Depression? - Harvard Health*, 2019).
- ***The hippocampus:*** also part of the limbic system, it has a central role in processing and recollection of long-term memory. It registers fear when confronted with bad experiences, which may influence the wariness of similar situations across our life span (*What Causes Depression? - Harvard Health*, 2019).

The hippocampus, for instance, seems to be smaller in some depressed people, and experts believe that stress is the main cause of this anomaly, since it can suppress the new production of nerve cells in this area (*What Causes Depression? - Harvard Health*, 2019). Other studies have suggested that an increased expression of MKP-1 (Mitogen-Activated protein kinase-1) located in the hippocampus has triggered depression as a response to stress (Bembnowska & Jośko-Ochojska, 2015). Authors like Bhowmik et al., report that the mother's circulating stress hormones can influence the fetus' brain during pregnancy, predisposing the child to depression as an adult (Bhowmik et al., 2012). If the mother has suffered from depression during pregnancy, it is likely the child will suffer a decrease of cerebral activity, making it probable for the child to develop unexplained fears and a depressive personality (Bhowmik et al., 2012).

On this line, research proposes that depression itself is related to the functioning of certain nerve cell connections, growth, and circuitry, as well as the work of certain neurochemicals and neurotransmitters (Bhowmik et al., 2012), more specifically:

- ***Norepinephrine***: it works by constraining blood vessels, raising blood pressure, which may trigger anxiety and some types of depression, since it determines motivation and reward (Bhowmik et al., 2012).
- ***Serotonin***: it works by regulating sleep, appetite, mood and inhibiting pain. Research has shown that serotonin transmission is reduced in depressed individuals, and that these low levels might be related to an augmented risk of suicide (Bhowmik et al., 2012).
- ***Dopamine***: it is essential for movement and strongly influences motivation. It also influences how the individual perceives reality (Bhowmik et al., 2012).
- ***Acetylcholine:*** works by improving memory, and it is related to learning and information/memory recall (Bhowmik et al., 2012).

Research done by Katherine Taber suggests that anomalies in the reward system (also known as 'reward pathways') play a role in depression, being that reward-related events lead to electrical stimulations that activate dopamine projections (Taber et al.,

2012). But then again, it is unknown whether the low levels of these in the brain cause depression, or vice versa, depression causes these systems to alter their functioning (Bhowmik et al., 2012). It has also been proven that certain medications are more likely than others to cause depression as a side effect. These include treating seizures, cancer, high blood pressure, extreme pain, alcoholism, anxiety, and some to achieve contraception (Bhowmik et al., 2012).

Personality has also been considered a factor that can cause or facilitate the development of depression, as well as others see depression as the cause of a 'depressive personality'. Gelemberg et al. mention that paranoid, obsessive-compulsive, schizoid and avoidant personality disorders may also play a role in developing depression, being the most common among the MDD affected population (Gelenberg et al., 2010).

We can also find some literature that supports what are called Cognitive models, which, as described by Laura Sakka, assume that *"networks or depression-related mental schemata would lead to cognitive biases, and these biases would be uniform and global, in the sense that they would be common for all emotional disorders (e.g., depression, anxiety), and would cover all domains of cognition (including, e.g., attention, interpretation, and memory)"* (Sakka, 2018, p. 35).

In other words, they propose the existence of a 'cognitive vulnerability' in some individuals that leads them to develop this disorder once the stressor is present. Following these theories, a 'negative bias' in the individual's mind leads to the development and further maintenance of depressive disorders, suggesting that when the individual is depressed, information received will go through and be processed by a 'negative filter'.

These models, inspired by Bower's associative networks, and Beck's schema theory of depression, propose that once depressed individuals detect and attend negative information, they are less likely to disengage from this 'negativity' than non-depressed (Sakka, 2018). As a result, most of their time and energy is spent attending negative rather than positive information. They describe depressed individuals as particularly sensitive to negative emotions, and likely to interpret negatively any ambiguous or neutral emotion (Sakka, 2018). Finally, there tends to be an exacerbated preoccupation with past events, a reason why this illness is usually called the 'disorder of the past' (compared to anxiety, the 'disorder of the future')

2.3. **Depression in Children, Adolescents and Young Adults**

As mentioned before, depression is an illness that affects the population of all ages, and it has different possible origins, triggers and risk factors. As a start, research by Marta Bembnowska et al. has proposed that in some cases, depression could find its roots in childhood neglect or abuse, especially in the case of women (or men) who have suffered emotional, physical and/or sexual abuse (Bembnowska & Jośko-Ochojska, 2015). Regarding child depression, they refer to several studies conducted in Norway in 2005 which demonstrated that there was a correlation between depression and school stress, well-being in the classroom, relationship with the teachers, and the school grades in students aged 12 to 15 years; this was particularly significant in girls. It also suggested that higher depressive symptoms affected children involved in bullying and moral

harassment, both as the perpetrator and the victim (Bembnowska & Jośko-Ochojska, 2015).

When it comes to adolescence, these issues previously mentioned, plus the mental and emotional instability that characterize this stage of development, can cause depressive symptoms; besides, the attempt to escape reality and daily difficulties benefit from the use of cigarettes, drugs, boosters and alcohol, which aggravate the illness. According to Wyatt, by the time students are coming to college, many have previously-diagnosed conditions, while others experience the first symptoms of mental illnesses while at college (Wyatt et al., 2017). Focusing on depression in college students, the author points out that previous studies suggest that these individuals experience a higher rate of depression than the general population, and that many of them do not receive treatment (Wyatt et al., 2017).

These findings were also shared by Villate et al., who reported that depression is one of the most common mental illnesses diagnosed in post-secondary students, and that in Canada, according to the American College Health Association surveys between 2012 and 2014, almost 50% of these students reported difficulties functioning due to depression and 13% had seriously considered suicide at some point of their studies (Villate et al., 2017). Universities in the United States have also begun to give special attention to students' mental health since depression, anxiety, as well as loneliness and overwhelm have become significant problems faced by American students (Wyatt et al., 2017).

Going to college is a very important step for an individual, characterized by profound social and academic changes, plus a high risk of suffering serious and prevalent depression, translated into an increase in family problems, academic failure, substance abuse, absenteeism and, in some cases, suicide (Hysenbegasi et al., 2005). Once in college, as Villate et al. point out, these students are overwhelmed by an increased workload, both in and outside class, higher academic expectations, the need to choose a vocation for life, and increased freedom compared to their secondary school years (Villate et al., 2017). The authors believe that depressive symptoms in college emerge from "t*he combination and accumulation of a significant number of factors (personal, family-related, social, and academic)"* (Villate et al., 2017, p. 127).

The authors state that the family environment is of utmost importance, as the presence of at least one depressed parent can result in depression later in adulthood, the same way as family problems, lack of trust within the family, and the discouragement of autonomy from their parents heavily influence the appearance of depressive symptoms (Villate et al., 2017). Previously, Hysenbegasi sampled on his paper "The impact of depression on the academic productivity of university students" a group of undergraduate students from Western Michigan University (WMU), which revealed that, even though in a minor degree, family problems and low grades were reported as main causes of depression (Hysenbegasi et al., 2005). More than half of the participants claimed that their parents had a history of depression, and many others reported that their parents had a history of anxiety or substance abuse.

Villate et al.'s research also confirmed that the previously mentioned causes or risk factors highly influence depression in college, such as the social exclusion that may happen in college for discrimination due to the students' ethnicity, physical disability,

sexual orientation, religion, gender or for being an immigrant (Villate et al., 2017). Especially the gender and sexual orientation revealed to influence a lot on the appearance of depressive symptoms, being highly frequent in women than in men, and in students attracted to the same or both sexes, once again due to the stress of acceptance and discrimination they suffer from their peers (Villate et al., 2017).

Villate et al. also mention the possibility of depressive symptoms being linked to romantic relationships, mentioning that the literature results are hard to interpret, as some discover a high influence, others imply that it is minor (Villate et al., 2017). However, Hysembegasi's research showed that two-thirds of the cases believed the cause of their depression had to do with relationship problems (Hysenbegasi et al., 2005). Complementing these findings, Wyatt's research also reported that the use of maladaptive coping strategies, such as withdrawing from the stressful situation, or avoiding seeking solutions, were primary predictors of illnesses such as anxiety, depression and stress in undergraduate students (Wyatt et al., 2017).

Both Wyatt, Villatte et al. and Hysenbegasi agree that these illnesses seem to influence academic success, retention, and students' involvement in academic activities (Wyatt et al., 2017) (Hysenbegasi et al., 2005) (Villate et al., 2017). According to Hysenbegasi's research, students suffering from depression missed a greater number of classes, exams and assignments, as well as dropped out of a significantly greater number of courses and missed more social activities than their "healthy" colleagues (Hysenbegasi et al., 2005). As expected, the author indicates that these disruptions caused by untreated depressive symptoms during college can be detrimental to the students' life after college, *"by delaying entry into the job market or inhibiting the job search process"* (Hysenbegasi et al., 2005, p. 146).

Villate et al. refer to previous studies that have revealed that 50% of the students suffering from a mental disorder claim that their symptoms started simultaneously as they started college (Villate et al., 2017). However, Wyatt believes that, during the first year of college, students are better able to overcome the adverse effects of depression while the curriculum is 'less rigorous' and, therefore, few of them report their symptoms, and there seems to be less negative impact from depression compared to the other years (Wyatt et al., 2017). Therefore, the author proposes that the first-year of college is the prime time to raise awareness on the risk of mental health issues and their impact on the students' academic success in years to come (Wyatt et al., 2017). In other words, an introduction to prevention strategies should be promoted in colleges to improve the students' quality of life.

According to these same authors, previous studies found that students who completed a course on applied emotional concepts and skills during their first year of studies, stayed longer at university and reported an increase in their ability to cope with and regulate their emotions than those who did not have any preparation (Wyatt et al., 2017). They also refer to the benefits of improving the students' social network and sense of control over their personal and academic life is important, and that counselling services through traditional and non-traditional methods will benefit the students (Wyatt et al., 2017).

2.4. **Summary**

Depression is an illness that can be very detrimental to one's health, especially if it becomes chronic and/or is accompanied by suicidal thoughts, and it has taken the life of many people and affected many others' well-being. A large number of young adults are affected or at high risk of developing clinical depression in different levels of severity. Therefore, it is important to understand it, raise awareness of it, and find effective strategies to fight it, so it is tackled from the moment the first symptoms appear to avoid its worsening, whether it is in childhood, adolescence, college, or even late adulthood. Even though there are many types, and subtypes, of clinical depression, the MDD (Major Depressive Disorder) is the most common form of this illness, whose symptoms usually appear between the ages of twenty and thirty. It also has different levels of severity, whose names may vary from author, or manual used, but the most basic way to classify them is mild, moderate, and severe (with or without psychotic features).

These factors are important to select our target population: young adults between eighteen and thirty years old, since they make up a high percentage of the affected population. Furthermore, it highlights the importance of taking into account the severity of the illness. What level of severity encompasses fewer risks to our study? Considering that this is the first trial of this project, we believe the best population for this project are individuals with subthreshold depressive symptoms, mild or moderate depression, so any aspect from our final product that could be negatively received has the least detrimental effect possible. While anything that triggers our game in the affected individual might be slightly detrimental or even be useful for psychotherapeutic treatment, individuals with severe MDD are much more vulnerable to suffering psychotic episodes or suicide ideations if we 'click on the wrong button', situation we need to avoid.

Unfortunately, a sole cause for depression has been impossible to find, and so far, a series of factors could be involved in its development, whereas genetic, biological, psychological, and even environmental, but something seems to be common among cases, and is the fact that depressive episodes are triggered by external events. We do not want to remind the affected individuals of what triggered their episodes, so at least on this first version of the project, we should avoid topics or situations that might make the player feel unsettled (e.g., war, suicide, break-ups, stressful cities), even though facing these situations could perfectly be part of a more personalized tool in the future. However, we must be aware that there are always risks since, something as simple and positive as establishing contact with nature, might be related to whatever triggered a patient's depressive symptoms. Therefore, it is important that the patients maintain good communication channels with their psychologists throughout this process, whatever type of treatment they are going through.

It is also important for us to remember the most common symptoms of depression in order to reflect on the ones that we believe our game could help tackle, or which could affect the performance of the player. It is not possible for us to address all symptoms, but it is possible to improve the typical depressed mood, decreased concentration, psychomotor retardation or agitation, and anhedonia (inability to experience pleasure) in all or almost all activities.

3. Treating Clinical Depression

As we saw in the previous chapter, depression can affect our lives negatively, being very prejudicial both for the mind and the body. The uncertainty of what causes it, the several facts that can play a role in its development, the varied risk factors, and different symptoms make this illness somehow difficult to treat. The nature of this illness, and how much it relates to the individual's personal characteristics, experiences, and biology make it hard for general practitioners and even for professional and trained psychologists to select the best treatment. And treatment is of extreme importance, an importance that most people and even the own affected fail to understand. Maina et al. have expressed the following: *Depression is more disabling and resistant to treatment the longer it continues over time, and a chronic course or highly recurrent disorder is related to increased risk of substance abuse, physical illness, suicide risk and social difficulties* (Maina et al., 2016, p. 240).

In simple words, depression is an illness that needs to be fought against as soon as possible to prevent further and more severe outbursts. Hence, the treatment given is aimed to remission of the disease and, ideally, a full return of the patient to an appropriate level of functioning. Literature, in fact, show four main objectives of the treatment: eliminate the symptoms, reduce or eliminate associated impairments (e.g. memory loss, pains, appetite loss or gain), improve social functioning and quality of life, and prevent future relapses or any recurrence of the illness (Maina et al., 2016).

3.1. First-Line Treatment

In order to guarantee that treatments are applied appropriately, most practitioners follow what is called a 'stepped care model' (Cesar & Chavoushi, 2013). It provides a framework to support patients, practitioners, and caregivers when identifying and organizing the most effective interventions for a patient. This model proposes to start treatment with the least intrusive and most effective intervention available. If this first intervention does not benefit the patient, or the patient him/herself declines such intervention, then a 'next step' intervention is offered (Cesar & Chavoushi, 2013); which intervention(s) should be the first step of treatment vary according to the severity of the symptoms. Among these first-line treatments we can find self-help, psychoeducation, varied psychological interventions, medication, and electroconvulsive therapy (Cesar & Chavoushi, 2013).

In most cases, the first-line of treatment consists in antidepressants, psychotherapy, or both of them combined. Most literature recommends starting treatment with either depression-focused psychotherapy or medication when the major depression is mild or moderate (Cesar & Chavoushi, 2013). Gelenberg et al. refer to the most clinically-proven efficient as a start for psychotherapy treatment: Cognitive- Behavioral Therapy, Interpersonal Psychotherapy, Psychodynamic Therapy, or Problem-Solving Therapy, whether in individual or group format (Gelenberg et al., 2010). Nevertheless, They highlight that benefits have been found from combining antidepressants and psychotherapy, even though it has not proven to be significantly higher than psychotherapy or medication alone (Gelenberg et al., 2010).

For Gelenberg et al., the use of medication is essential for those with severe major depression, and it must definitely be accompanied by psychotherapy, especially if the illness has a recurrent pattern. When the patient is affected with mild major depression, with visible psychosocial or interpersonal problems, the author recommends a combined therapy as well (Gelenberg et al., 2010). However, combined therapy may not be the first line treatment in many cases; for instance, if marital and family problems are the core of a major depressive episode, they should be identified and addressed in marital or family therapy. Also, if the patient is pregnant, is breastfeeding, or wishes to get pregnant, medication therapy should be avoided and use depression-focused as a first step as long as the severity of the symptoms permits it (Gelenberg et al., 2010).

Furthermore, frequent visits early in treatment are essential in order to assess the effectiveness of the intervention, whether a change of medication or psychotherapy is needed, and be attentive to any side effects or suicidal ideations (Gelenberg et al., 2010). Before considering a treatment as inefficacious and changing to a next-step therapy, a trial of 6-12 weeks is needed. The chosen therapies need to be continued between 9-12 months to make sure that the illness' incidence has decreased and avoid any relapses (Gelenberg et al., 2010). Related to this, it is important the General Practitioner keeps constant contact with the patient, informs him/her about possible side effects and makes sure the therapy is not interrupted (Gelenberg et al., 2010).

3.2. **Pharmacological Treatment**

Before prescribing any medication, the General Practitioner should consider, first, the severity of the symptoms and an individual approach. Essentially, the patient gets the more benefits from pharmacological treatment the more severe the symptoms are; and an initial individualized approach is the best when it comes to factors such as tolerability, safety, the patient's clinical picture and, in some cases, previous responses to therapy (Gelenberg et al., 2010). Common medications used for depression are ***SSRIs (Selective Serotonin Reuptake inhibitors)***, ***SNRIs (Serotonin and Norepinephrine Reuptake inhibitors)***, ***MAOIs (Monoamine Oxidase Inhibitors)***, and ***TCAs (Tricyclic Antidepressants)*** (Bhowmik et al., 2012) (Maina et al., 2016).

Overall, medication alone seems to be enough in some cases. Nevertheless, as reported by Maina et al., many patients affected with clinical depression do not respond or partially respond to antidepressants, and complete remission is only found in 30% to 65% of cases (Maina et al., 2016, p. 240).

3.3. **Psychotherapeutic Treatment**

The same as with pharmacological treatment, general practitioners need to consider a number of aspects before recommending specific psychotherapy as part of the patient's treatment. Depending on the disorder, and the symptoms, specific psychotherapeutic approaches are recommended (e.g. family therapy when the depressive episodes involve family problems), as well as it is also important to consider the accessibility of the desired psychotherapy in the healthcare system in question. There is always the risk of patients failing to achieve the therapeutic goals, as well as of

underutilizing or using incorrectly the selected approach. For treating depression, the most common psychotherapies, or talk therapies, are, according to literature, Cognitive Behavioral Therapy (CBT), Interpersonal Psychotherapy, Family and Couple Therapy, Psychodynamic Psychotherapy, Group Psychotherapy, and Problem-Solving Therapy (Maina et al., 2016).

Cognitive Behavioral Therapy (CBT) is a combination between cognitive psychotherapy and behavioral therapy, and considers that depression is perpetuated by depressive affect and compromised functioning due to "i*rrational beliefs toward the self, the environment and the future"* (Gelenberg et al., 2010, p. 47). It is aimed to reduce depressive symptoms by reversing these attitudes and helping patients to change maladaptive behaviors, preconceptions, and negative interpretations of their reality, for more functional and positive beliefs. It involves scheduling activities that are enjoyable for the patient, training social skills, problem solving, reducing unpleasant or prejudicial activities, and certain practices from self-control therapy (Gelenberg et al., 2010). According to Gelenberget al., it has proven to be more efficient the less severe major depressive symptoms are (Gelenberg et al., 2010). In other words, individuals with severe major depressive disorder need highly skilled therapists to benefit from this treatment. In spite of this, it is believed to be more likely to reduce the risk of relapse than medication alone, and it is very beneficial to continue through the maintenance phase.

Together with CBT, ***Interpersonal Psychotherapy (IPT)*** is among the most studied and frequently used as an initial therapy of mild-moderate major depression. It is focused on current life events or events that have triggered the depressive episode and most likely maintains it, such as losses, social isolation, lack of social skills, or role changes. Its main goal is to identify the trigger in order to facilitate mourning and reflect on the relating effects, building social skills and improving interpersonal relations and role issues (Gelenberg et al., 2010). Gelenberg et al. suggests that it is very beneficial and efficient, especially for adolescents, elders, and pregnant or postpartum women, and most importantly, for patients who are going through severe life events. It is also recommended as a monthly maintenance therapy to avoid relapse after remission (Gelenberg et al., 2010).

Family and Couple Therapy -also called Marital and Family Therapy- seems to be helpful in cases of more severe depression whenever is given in conjunction with medication and hospitalization (Gelenberg et al., 2010). It uses behavioral and problem-focused approaches, together with strategic marital therapy, and according to Gelenberg et al., has proven to lead to significant reduction of suicidal ideation in very severe cases (Gelenberg et al., 2010).

Psychodynamic Psychotherapy refers to long-term psychotherapeutic intervention, and is based on the belief that depression is related to psychological vulnerability, personality development, and symptom formation caused by conflicts during the individual life cycle since early childhood (Gelenberg et al., 2010). It is aimed to treat conflicts such as guilt, shame, anxiety, or repressed impulses; also addresses problems resulting in low self-esteem, psychological cohesiveness or emotional self-regulation (Gelenberg et al., 2010). The expected result is the modification of these psychological conflicts that increase vulnerability and facilitate the development of

depressive affect and, further, depressive disorder. Gelenberg et al. mentions that this therapy is sometimes prefered by patients and it is plausible to be effective in group format (Gelenberg et al., 2010).

Problem-Solving Therapy alone is a manual-guided treatment used to prevent depression in elderly or ill patients, and patients with mild major depressive symptoms. It usually lasts six to seven sessions, and addresses negative assessment of situations, as well as focal problem-solving techniques (Gelenberg et al., 2010).

Gelemberg et al refer that, even though most of these psychotherapeutic approaches -especially CBT and IPT- seem to be effective both in individual and group format, according to different meta-analyses, mostly European research, most of these studies have not involved patients rigorously diagnosed with major depressive disorder (Gelenberg et al., 2010). As a final consideration, we must consider, first, that one episode needs a minimum of 6-9 months of treatment; second, the more episodes the patient goes through, the biggest risk of recurrence of the illness; and third, several years of maintenance treatment are required when the patient has suffered several episodes (Gelenberg et al., 2010). There are other approaches, such as *Transcranial Magnetic Stimulation (TMS)* and *Electroconvulsive Therapy (ECT),* which are considered more invasive and are out of the scope of this project (Bhowmik et al., 2012) (Gelenberg et al., 2010).

3.4. General Compliance and Difficulties for Treatment

When it comes to treating depression, there are certain limitations and difficulties that are worth mentioning. One of them is the difficulty to actually diagnose depression, since this illness' symptoms are not easily visible or considered a problem or 'abnormal', hence, many affected individuals go 'under the radar'. Iyer and Khan refer to the social stigma, and the general opinion of depression being the result of a weak personality, as factors that result in the patients' resistance to accept the diagnosis (Iyer & Khan, 2012).

Once the individual has accepted this condition, there are still obstacles for treatment. We should keep in mind the factor of compliance, which refers to *the extent to which the behavior of a person, in terms of taking medication or lifestyle changes, corresponds to a medical prescription* (Maina et al., 2016, p. 245). In other words, lack of or unsatisfactory compliance means that the treatment procedures are not followed properly, such as outpatient visits, unperformed monitoring tests, discontinuation of treatment in an early stage, or rejection of the prescribed treatment.

Overall, 10-30% of the clinically-depressed population does not respond either to pharmacotherapy or psychotherapy, being therefore at a high risk of mortality and increased morbidity (Maina et al., 2016, p. 240). Cesar and Chavoushi also mention how depression is particularly characterized by reduced adherence to treatment (Cesar & Chavoushi, 2013). According to reports by Bull et al. mentioned by Maina et al., up to 68% of patients under treatment for depressive disorders stop taking antidepressants after only three months of treatment (Maina et al., 2016, p. 246). The reasons for this could be many, and the authors pointed out some of them on his research:

- One frequent reason is that patients 'feel better', relying on the apparent immediate relief and 'cure' antidepressants and/or psychotherapy seem to bring (Maina et al., 2016).
- Other common reasons are the side effects of antidepressants, which include lethargy, fatigue, weight gain, and loss of sexual interest (Maina et al., 2016).
- The chronic and asymptomatic characteristics of depression, as well as the long-term treatment requirement leads to lower compliance. The longer remission takes, the lower will be compliance to treatment (Maina et al., 2016).
- Memory problems are a common symptom of depression, which makes it easier to forget to take medication. Also, feelings of hopelessness and demotivation also affect the 'belief' in treatment (Maina et al., 2016).
- Unsatisfaction with physicians tends to make the patient less compliant (Maina et al., 2016).
- Lack of efficacy of treatment also creates frustration and hopelessness in the patient (Maina et al., 2016).

Another important aspect to keep in mind is the side effects of prolonged treatment that Iyer and Khan refer to, more specific for treatments with antidepressants (Iyer & Khan, 2012). The authors reinforce that medication is crucial for treatment in the acute phase when symptoms are not treated and at their worst, but also warns that with long-term use, the brain works to compensate for the drug-induced changes through a process known as 'oppositional tolerance' (Iyer & Khan, 2012). Since medication boosts production of neurochemicals artificially, the system reacts by reducing its own production of neurotransmitters. As a result, when the patient stops taking antidepressants due to lack of response, the brain compensates once more due to the reversal of the symptoms by withdrawing the drug (Iyer & Khan, 2012).

3.5. Some Alternative Therapies

Given the side effects of medication, low adherence, and other issues mentioned before that affect compliance, multiple alternative therapies have been developed. Even though it has been suggested that, in most cases, patients seek for alternatives that are *"more in line with their own values, beliefs and philosophical orientations"* (Maratos et al., 2009, p. 2). Among them, we may find alternative activities, rather than therapies, to help them relieve their symptoms: relaxation, guided imagery, hypnosis, meditation, yoga, biofeedback, acupuncture, and chiropractic treatments (Iyer & Khan, 2012).

Apart from these, we shall highlight other very popular treatments that have shown to reduce depression symptoms, though they are not usually considered suitable for a first-line treatment:

- ***Light therapy*** is mostly considered to relieve depression symptoms whenever the individual is affected by a seasonal type of depression, especially in the wintertime. (Bhowmik et al., 2012) An earlier review by Parry et al., also found that light treatment also has benefits in non-seasonal depression, especially because of the augment of blood serotonin through exposure to bright and dim light during the day (Parry & Maurer, 2003).

- ***Aromatherapy*** exploits the properties of different fragrances and essential oils derived from plants and/or their aromatic compounds, such as lavender, rose, jasmine, ylang, bergamot, and sandalwood (Conrad & Adams, 2012). According to Pam Conrad and Cindy Adams, it has proven to be successful in the clinical environment, especially for anxiety or depression in pregnancy and childbirth (Conrad & Adams, 2012).
- ***Reminiscence therapy*** encourages the individual to review past experiences, preferable of a pleasant nature, in order to restore and strengthen self-esteem and personal satisfaction, found especially beneficial for late-life depression, or geriatric depression (Latha et al., 2014).
- ***Dance Movement Therapy (DMT)*** uses dance to facilitate the depressed patient's access to difficult and harmful feelings and thoughts that might be internalized. It intends to tackle disconnections between body, thoughts and feelings usually present in depression and aims for the creative expression of these feelings as a step forward to healing (Karkou et al., 2019). In the process, it also generates vitality and joy in the patients and promotes the excretion of endorphins and enhancement of chemical neurotransmitters through exercise. It has been proven to decrease the severity of depressive symptoms in young adults, but its efficiency for children, teenagers and seniors has not been studied in depth. (Karkou et al., 2019)
- ***Music therapy (MT)*** uses music in order to ameliorate depressive symptoms, taking advantage of music's different facets within a therapeutic interpersonal process (Maratos et al., 2009). It has shown to be effective for people of all ages, and comprises activities such as listening to, writing and playing music (Iyer & Khan, 2012).

3.6. **Summary**

The longer we take to tackle depression, the harder it is to treat it and the more damaging it is for the patient's wellbeing. Therefore, the immediate objectives of treatment are to eliminate symptoms and reduce resulting impairments, followed by improvements in the patient's quality of life and the prevention of any future relapses. In many cases, first-line treatments include antidepressants, psychotherapy, or a combination of both. Cognitive Behavioral Therapy is among the most clinically-proven efficient and, therefore, is regularly chosen as a first approach. It focuses on reversing the negative attitudes that characterize depression, and aims to change the patient's maladaptive behaviors for more positive ones.

However, there are different reasons why the health system is unable to provide a 100% consistent treatment in the clinical setting, such as few specialized practitioners and difficult allocation for the patient. Also, lack compliance is high in depression for many different reasons, from adverse responses to pharmacotherapy to the patient's beliefs and personality. As a result of this lack of compliance, both therapists and patients sometimes search for alternative therapies, such as Music Therapy. Even though they are not usually considered for first-line treatment, depending on the patient's background, beliefs, and likes, they have proven to give positive results and be beneficial for many patients. One

of the most common symptoms of depression is fatigue or loss of energy, some of the most common side effects of antidepressants are fatigue, lethargy, and weight gain.

Considering this, we propose to develop a system that is compatible with these first-line treatments, reinforcing the concepts of CBT as the approach with more clinical evidence of efficacy, and complementing it with music therapy, an alternative that has high levels of compliance and that is potentially in line with the patients' preferences. Our aim is to create a tool that can be accessed from the patients' home or work and that includes a feature that promotes or makes patients leave their homes and exercise. Overall, we propose a tool that is helpful and appealing to use also prior a depression diagnosis, when mild or moderate symptoms are present, as a contribution to preventing further development of the illness.

4. Using Music to Aid Depression Treatment

As referred to in our previous chapter, research has proven that music is essential in many aspects of our lives; it helps us relax by inducing a pleasurable experience, and it is for many a strategy to regulate our mood and emotions. In fact, research has shown that young adults are one of the greatest consumers of music an average of 18 hours per week, and has been listed as the number one emotion management strategy by 18-25 year old Australians (Dingle & Fay, 2017, p. 2). Together with this, it has also been documented that distracting yourself and listening to music was a common strategy to leave a depressive state by Americans (Thoma et al., 2006, p. 1089). In this chapter, we will focus on different ways music has been used for therapeutic purposes, how it is believed to be perceived by our brain and its connection to perceived and felt emotional states, and the importance of familiarity and emotional awareness.

4.1. Music Therapy and Music Medicine

According to Anna Maratos et al., Music Therapy is a popular alternative among all ages and is inspired by behavioral psychoanalysis, and humanistic therapy; by listening to music, the therapist guides the patient through an interpersonal process to restore, improve, and maintain the patient's mental health (Maratos et al., 2009). These interventions can be categorized as ***Active*** or ***Receptive***. An ***active*** technique involves the patient improvising, composing, or simply recreating music; improvisation is the most commonly used activity of this category. The therapist uses clinical techniques to stimulate and guide the patient, as well as respond to him/her using their voice or any instrument of choice. This co-creation patient-therapist process not only allows the patient to experience his/her own existence differently, but also to have some insight into and communicate his/her emotional problems by dialoguing through music (Maratos et al., 2009).

A ***receptive (or passive)*** technique involves mainly the patients listening to music, whether live or recorded, and it is based on the idea that different types of musical stimuli induce emotional and physical changes in the patient. Depending on its application, it may be accompanied by other activities, such as guided imagery, meditation, relaxation, discussion about pre-composed music, drawing, or reminiscing (Maratos et al., 2009). Maratos et al. state that contemporary mental health practitioners seem to give emphasis on using active Music Therapy in cases of severe major depression; while the passive (or receptive) approach is preferred for mild-medium major depression cases (Maratos et al., 2009). According to Daniel Leubner and Thilo Hinterberger in their paper *Reviewing the Effectiveness of Music Interventions in Treating Depression*, both passive and active techniques have led to a significant reduction of depression levels in participants in comparison to control groups (Leubner & Hinterberger, 2017).

Their review shows several aspects of Music Therapy of importance for us, as it seems that music has proven to improve sleep quality and episodic long-term memory in cases of adults with insomnia (Leubner & Hinterberger, 2017). Another positive aspect mentioned is that participation levels in music-based therapy seem to be high, with most of the participants of the different studies completing treatment and rare dropouts

(Leubner & Hinterberger, 2017). This is considered very significant for Maratos et al., taking into account the difficulties depressive symptoms bring, making it difficult for people to be motivated and actively involved in any activity (Maratos et al., 2009).

Leubner and Hinterberger also refer to the influence of the length, frequency, and music intervention type in its success: for patients treated in an individual setting, a seven-week intervention led to better results, with sessions of about thirty minutes; while within groups, the most convenient length would be of six weeks, being the best results gotten after about seventeen sessions, with an average duration of sixty minutes each (Leubner & Hinterberger, 2017). In the authors' opinion, group settings have the strength of promoting social interactions, compared to individual settings, which provide motivation. However, there is no evidence of significant advantages over the other (Leubner & Hinterberger, 2017). Their review also showed interesting aspects regarding the type of music provided by board-certified therapists among the different studies found. Three styles were the most frequently used: percussion, classical, and jazz (Leubner & Hinterberger, 2017). When using ***percussion***, the instruments were mostly selected following the participant's preferences, whether egg shakes, paddle drums, drums or many others, including sound created digitally by external MIDI. ***Classical*** music was present in half of the studies reviewed whose depressive symptoms' improvements were above the average (Leubner & Hinterberger, 2017). However, the authors also proposed that the fewer intervention sessions, the better were the results, and the variety within music titles would avoid a 'saturation effect'(Leubner & Hinterberger, 2017). As for ***jazz***, all five studies reviewed using this type of music had very positive results in terms of depression reduction, but there is no clear evidence to tell that it is more recommendable than any other genre mentioned before (Leubner & Hinterberger, 2017).

There is not much literature that explains the mechanisms of these interventions or what principles they are based on. However, Elizabeth Stegemöller proposed in her work *Exploring a neuroplasticity model of music therapy* (2015) that the brain's neuroplasticity is the most important aspect of Music Therapy (Stegemöller, 2014). First of all, **neuroplasticity** refers to the ability of our brain to change throughout our lifespan by the emergence, and pruning, of neuronal connections as a response to new sets of stimuli (such as sensory input, motor actions, rewards, or awareness), and also subsequently determines the perception and response to stimuli in the world that surround us (Stegemöller, 2014). It is the goal of this therapy to elicit behavioral changes in a patient which are subsequently linked to changes in the brain, and the author believes that three principles of neuroplasticity explain how Music Therapy works (Stegemöller, 2014):

- ***Dopamine Modulation*:** dopamine has proven to be the primary neurotransmitter involved in neuroplasticity, as well as with dopaminergic neurons in the reward networks. Hence, music therapy aims to activate these reward networks by listening to enjoyable music (Stegemöller, 2014).
- ***Neural activity synchronization:*** It implies that pairing music (which taps in the brain reward pathways) with activities such as vocalization, heart rate or movement, allows therapists to elicit simultaneous firing of

neurons, increasing neural connectivity, and promoting a faster and more permanent change in the patient (Stegemöller, 2014).

- ***Noise reduction*:** defining noise as a sound that is 'unwanted or unpleasant' (Cambridge Dictionary, 2020), research has proven that it is negative for neuroplasticity. According to previous research, noise exposure can induce stress, memory problems and impaired cognition because it suppresses potentiation in the hippocampus. In comparison, it has been shown that listening to music as training has led to brain changes in areas related to motor and auditory processing (Stegemöller, 2014).

Although Stegemöller warns that neuroplasticity can be maladaptive (e.g. pathological brain changes in case of a stroke), it has helped patients change behaviors, for example, when going through painful procedures, trauma, fatigue, or anxiety (Stegemöller, 2014). The majority of studies found by Maratos et al. investigated the use of Music Therapy focused on adolescents or older adults, while less examined music therapy to treat young adults (Maratos et al., 2009). The author also points out that a patient under CBT, adequately instructed, trained, and regularly supervised by his/her therapist, can self-administer Music Therapy as 'homework' (Maratos et al., 2009).

Overall, the literature gives an account of how Music Therapy is a viable and effective option for treatment (Leubner & Hinterberger, 2017). Nevertheless, it is crucial that we clearly establish the difference between Music Therapy (MT) and Music Medicine (MM) at this point, since music has been used as a tool in many different ways and for many different reasons: to evoke emotions, to help the patient relax, and others in the ambit of medicine. Leubner and Hinterberger explain that there are many differences between Music Therapy (MT) and Music Medicine (MM). ***Music Therapy*** is considered those sessions provided by board-certified music therapists, a credentialed professional who has completed a Music Therapy program (Leubner & Hinterberger, 2017). The use of music interventions is based on clinical evidence and, as it has been mentioned before, aimed at an individualized goal to create a therapeutic relationship with the patient. It usually requires an individual-specific music selection developed by the patient and the therapist during their sessions (Leubner & Hinterberger, 2017). On the other hand, ***Music Medicine*** is carried out by non-qualified professionals independently, such as relaxation therapists (Leubner & Hinterberger, 2017). Basically, it refers to the use of music for medicine and other therapy, focusing on the physical and physiological evaluation of the musical element (Leubner & Hinterberger, 2017). In spite of their differences, they have a common ground: implementing the different acoustic stimuli music is made-of to ameliorate the symptoms of a defined group of patients affected with depression or other conditions that might respond to it.

4.2. Music and Its Relation with Emotions

We have seen how Music Therapy seems to be a viable form of treatment, at least for milder conditions, and its potential role as an extension from already established traditional psychotherapeutic or pharmacological treatments. Moreover, this effect might

be related to the fact that music allegedly significantly influences our mood and emotional state. Most studies identified by Maratos et al. involved recorded music to alter mood states (Maratos et al., 2009), and Leubner and Hinterberger also expressed that the emotional state of the individual influences how music would be interpreted (Leubner & Hinterberger, 2017). Also, according to Patrick Hunter and Glenn Schellenberg in their paper "*Music and Emotion*" (2010), music listeners, in general, tend to express that music induces feelings and/or emotions, the most commonly mentioned being happiness, nostalgia, excitement, and in some cases sadness (Hunter & Schellenberg, 2010). Among the literature found, Juslin and Laukka concluded from a meta-analysis that *"listeners perform better than chance at interpreting happiness, sadness, anger, fear, and tenderness in music"* (Hunter & Schellenberg, 2010, p. 139), being anger and sadness the emotions that are usually identified more easily.

However, whether listening to music actually leads us to have determined feelings or emotions has been questioned for a long time, and the perspectives regarding this problem have taken two main currents: cognitivist and emotivist. Sakka, and Hunter and Schellenberg summarize these two perspectives, indicating that authors following a ***cognitivist perspective*** argue that rather than inducing emotions in the listener, music simply expresses emotions that the listener will later perceive (Sakka, 2018) (Hunter & Schellenberg, 2010). Authors such as Peter Kivy, one of the main proponents of the cognitivists, claim that music does not evoke genuine emotions in listeners, but simple 'responses stems', thinking that they feel happiness or sadness because it expresses such feelings (Hunter & Schellenberg, 2010). Hunter and Schellenberg also mention Leonard B. Meyer, who expressed that our responses to music were not actual emotions, but simple responses to the fulfillment, or disappointment, of the expectations we have from a particular musical piece; rather than affective, our responses are simple experiences of relaxation and tension that result when expectations are or are not met (Hunter & Schellenberg, 2010). On the other hand, ***emotivist perspectives*** support the idea that music does 'evoke' real emotions in the listeners (Hunter & Schellenberg, 2010). Among many supporters of emotivism, Stephen Davies admits that feelings may indeed reflect the music's feelings, and that these are or can be experienced contagiously (Hunter & Schellenberg, 2010).

Whether these emotions can be considered real or not, the fact is that listeners' report real, felt, feelings whenever listening to a piece of music, whether liked or not, and there have been many attempts as to what influences these responses. For instance, Hunter and Schellenberg expressed how the different dimensions of music (e.g. tempo, loudness, mode, timbre, pitch.) might influence emotional responses (Hunter & Schellenberg, 2010). They concluded that the tempo and mode of the songs strongly defined the emotions perceived in music. Even though fewer studies have researched other dimensions such as loudness, they report how louder music has been described by users as more animated and triumphant, while the opposite was reported to be perceived as sentimental, melancholic and mournful (Hunter & Schellenberg, 2010). They also claim that crescendos and decrescendos in musical pieces influence the arousal levels, being crescendos strongly believed to induce chills. Furthermore, it seems that soft timbres evoke sadness and tenderness, while sharp timbers are associated with anger (Hunter &

Schellenberg, 2010). Studies suggest that this capacity to identify basic feelings such as anger, sadness and happiness based on different musical components is present across several cultures (Hunter & Schellenberg, 2010). The same happens with consonance and dissonance, being consonant preferred cross-culturally, though literature has not been able to show certainty about whether this preference is learned since very early infancy or an innate characteristic (Hunter & Schellenberg, 2010).

Despite this, we need to clarify that perceived and felt emotions are not the same. Laura Sakka refers to previous studies where a big percentage of participants alleged that, whenever they perceived an emotion in music, they often felt that same emotion (Sakka, 2018). Other listeners, argue Hunter and Schellenberg, may recognize a sad musical piece and have no emotional response to it, especially if they are in a happy mood (Hunter & Schellenberg, 2010); and the same may happen to happy-sounding music, which may even evoke negative feelings, particularly when associated with a sad past event. Another aspect to consider is that, even pieces that express negative emotions can reportedly evoke pleasant and positive feelings in listeners (Hunter & Schellenberg, 2010).

4.3. The Mechanisms of Music-Evoked Emotions

Overall, we agree from now on that music has the capacity to induce and make us perceive emotions. In other words, it generates an affective response (emotion induction) and involves the process of understanding emotions expressed by others (emotion perception). **Music-evoked emotions** are those induced in the individual when listening to music, and they go from arousal responses, such as "chills", through basic emotions (e.g., sadness or happiness), to more complex like nostalgia (Hunter & Schellenberg, 2010) (Juslin & Västfjäll, 2008). Such inductions are believed to be mediated by specific mechanisms that vary among different theorists. Juslin and Vastfjall believe that this 'cognitive appraisal' is only one of six mechanisms that induce emotions in the listener, (Brain Stem Reflexes, Conditioning, Contagion, Visual Imagery, Episodic Memory, and Expectancies) (Juslin & Västfjäll, 2008), mechanisms that Sakka would increase to eight in a later revision of the theory, named the **BRECVEMA framework** (Sakka, 2018): Brain Stem Reflexes, Rhythmic Entrainment, Evaluative Conditioning, Emotional Contagion, Visual Imagery, Episodic Memory, Musical Expectancy, and Aesthetic Judgement; this framework represents the mechanisms that mediate the induction of emotions, apart from the default cognitive appraisal (Sakka, 2018), and the most important for us are the following:

- **Emotional contagion** is defined as the *process where the listener perceives the music's emotional expression, and then 'mimics this emotion internally* (Sakka, 2018, p. 18).
- **Visual imagery** is the *process whereby mental visual images are evoked in the individual while listening to the music* (Sakka, 2018, p. 18).
- **Episodic memory** describes the *personal memory of a specific event from the individual's past* (Sakka, 2018, p. 18).

We have already mentioned or given hints on 'emotional contagion' in different parts of this document and discussed whether these emotions are actually felt or not. Nevertheless, we have not yet reflected much on the part that episodic memory plays,

despite eventual mentions of how familiarity with a musical piece can have a great influence on someone's emotional response.

4.4. Music-Evoked Memories and Familiarity

When it comes to memory, there are different types of memory that help us function on a daily basis, such as working memory, and long-term memory among others. They are all important in terms of how we store and retrieve information. Nevertheless, it is our main goal to keep focused on the relation memory-music, hence, we will from now on focus on the different types of memory that are relevant and related to music. These are briefly defined by Lutz Jäncke in his article *Music, Memory and Emotions* (2008), being the most relevant ones *Explicit memory* and *Implicit memory* (Jäncke, 2008).

Explicit Memory refers to our conscious memory of experiences. Within ***Explicit memory***, we can find ***Episodic memory,*** which is ***"****the memory of events, places, times, associated emotions and other concept-based knowledge of an experience"* (Jäncke, 2008, p. 2)*;* and ***Semantic memory***, which deals with "*meanings, understandings and other concept-based knowledge unrelated to specific experiences"* (Jäncke, 2008, p. 2). Semantic memory is also associated with musical information since it gives us the ability to identify a song through humming, or whistling its notes. ***Implicit memory*** is the one which is *"not easily verbalized but can be used without consciously thinking about it"* (Jäncke, 2008, p. 2). ***Associative memory,*** being the *system in which a specific piece of memory information is linked to other memory information by associative links* (Jäncke, 2008, p. 2), is also essential to understand the relation of music-autobiographical memory.

But what is it that we call Episodic memory for music? This is the ability to recognize a musical piece or simply an excerpt of a song that recalls a specific spatiotemporal context it was formerly heard (Juslin & Västfjäll, 2008). Jäncke mentions that music activates our entire limbic system, which works on, not only processing emotions, but also controlling our memory (Jäncke, 2008). In other words, the music we may choose to listen to, our preferences, our liked or disliked songs, are part of our autobiographical information, and they are particularly linked to past episodes or events in our lives in which music played a significant role. This author also reminds us that research has proven that music can be used as a memory enhancer (Jäncke, 2008). Sakka also reports from her trials on depressed individuals that, while listening to a personal music selection as a stimulus, about 77% of participants got to recall autobiographical memories (Sakka, 2018). According to Pereira et al., experiments have also shown that the time participants took to make an emotional judgment of a song was shorter for the music they were familiar with than that with unfamiliar ones (Pereira et al., 2011).

But can we 'predict' which songs are more likely to bring more memories? Belfi et al.'s paper titled *Music evokes vivid autobiographical memories* (2016) brings up the importance of what are called 'cascading reminiscence bumps', widely found in music-evoked memories (Belfi et al., 2016). According to the cited work of Krumhansl and Zupnick (2013), there are two variations for these bumps. The standard reminiscence bump refers to the typical facility seen in participants to evoke more autobiographical memories when listening to music from their childhood and adolescence than other life

periods (Belfi et al., 2016); it seems that there is a tendency to recall more easily memories between the ages of ten and thirty. Another variation refers to the ability music has to evoke memories with no generational constraints, which is believed to set music apart from many other stimulus categories (Belfi et al., 2016). Basically, it refers to the autobiographical memories evoked when listening to music which was popular when the individual's parents were adults or simply from their parents' generation (Belfi et al., 2016).

However, Belfi et al. clarify that familiarity and autobiographical aspects of a song, even though strongly connected with memories, will not necessarily evoke one: an unfamiliar song, even though not connected 'directly' with any specific situation or period of our life, can bring out autobiographical memories (Belfi et al., 2016). Keeping this in mind is essential as it shows us that selecting music from the patient's childhood or adolescence, although meaningful, will not necessarily bring the strongest autobiographical memories or emotions, while popular music from different decades may. Even taking this into account, meaningful 'popular songs' for a patient, may not mean much for another. No matter how much one would like to cover, the patient's own selection seems always to have a stronger emotional impact.

All the previous facts lead us to conclude that the enjoyment or perception of a musical piece is strongly defined by individual factors; memories, familiarity, personality traits, taste, and current mood significantly influence the individual's perception and affective reaction. We have already referred to the importance of familiarity before, but more importantly music has a personally meaningful nature. As Sakka highlights, the valence of music, or more specifically a particular piece of music, lies on its personal significance for an individual (Sakka, 2018). In her study, Marie JaeDee Wood reflected on how her musical selection in her study *Music, emotion regulation, & distress tolerance: Investigating how music may influence distress tolerance in college student* (2015), which was limited to classical music, did not influence the participants' affect as it was predicted to, inferring that this was related to the fact that the participants did not select their music (Wood, 2015). She proposed that music of the preferred music genre and/or selected by the patient for medical purposes would probably have changed the results, as it has been shown that it decreased levels of anxiety and distress (Wood, 2015, p. 19).

Sakka also argues that music is ideal for exploring emotional reactions in depressed individuals, considering how important personally significant stimuli is, and how similar listening to music is to an everyday scenario, making it more realistic and seeking no time-limited responses (Sakka, 2018). Following this idea of music 'in context' is important to whomever intends to study the relation music-emotion-memory since, as Petr Janata has claimed, it is inevitable that the experimental context 'contaminates' the result to a certain extent: when subjects are asked to identify songs that make them recall strong memories, this will generate a memory now linked to the present 'experiment' (Janata, 2009). Furthermore, many songs with the potential to form Music-Evoked Memories may not come to mind when participants are asked to remember them: one may remember neither the name nor the performer of a song that has the potential to evoke memories or emotions (Janata, 2009). Wood also supports this idea,

arguing that listening to music in the lab, no matter the selection, *"may not translate to real world musical experiences"* (Wood, 2015, p. 20), because the setting is very different from listening to music on the radio while driving or in a live concert, for instance.

Music listening can be more significant for patients for the sole fact of being able to do it in their own personal space. Listening to music in their homes, while commuting, is closer to a real-life situation than doing it in a laboratory; the results are expected to be completely different. It is more representative of how people experience music on a daily basis, and provides realistic music-listening scenarios. Also, using individually-tailored music is essential, not only age-sensitive but also personally chosen music, which increases the probabilities of meaningful music-evoked memories.

4.5. Music and Emotion Regulation

Music listening is a crucial activity in our everyday life, as mentioned before, even though its overall importance will vary across the different ages of adulthood. This fact was mentioned by Suvi Saarikallio in *Music as emotional self-regulation throughout adulthood* (2010), who reports on the importance of music in adolescence, adulthood and after retirement (Saarikallio, 2010). According to the author, music starts acquiring great personal importance in our adolescence, when it is the key to our social and emotional development. When teenagers, music serves to contemplate and build our self-identity and deal with daily stress and arousing negative emotions, thanks to its potential to bring positive and relaxing experiences. As we grow and live into adulthood, music becomes more and more connected to our emotional processing and conceptualization of our self (Saarikallio, 2010).

The author mentions how several studies have shown that our use of music in everyday life is related to mood, emotions and memory, self-identity and, more importantly, for emotional self-regulation (Saarikallio, 2010). Saarikallio also reports that three types of changes occur as we live more and more in adulthood, and they are defined by the nature of the change: ***changes by age*** **(**those features that seem to change in a specific direction as we grow up), ***event-related fluctuations*** **(**features that become highlighted in some periods of time, and faded in others), and ***retirement transition*** **(**larger amount of time we have for music after retirement) (Saarikallio, 2010).

The use of music for emotional regulation has been corroborated by Sakka, who claims that research has effectively found that listening to music is a widespread strategy used for emotion and mood regulation (Sakka, 2018). With emotional regulation, or **emotion regulation**, we refer to, as Saarikallio defines it, the process of *"modifying various aspects such as valence and intensity (or time course) of emotions"* (Saarikallio, 2010, p. 307). Genevieve Dingle and Carla Fay complement this, conceptualizing emotion regulation as *"the ability to modify emotion in flexible and adaptive ways in response to social context"* (Dingle & Fay, 2017, p. 1). In other words, we shape our emotions and moods to control our physiological behaviors and how we express these emotions. This process, as Mirjam Thoma et al., pointed out, can be aware, unaware, automatic, or controlled, and it can take place before, during, or after the emotion is felt (Thoma et al., 2006). Regulating our emotions is of utmost importance in our daily life

since, according to Dingle and Fay, having good emotional regulation skills is vital for becoming a socially competent individual, translating into better quality friendships and prosocial behaviors (Dingle & Fay, 2017). On the other end, poor emotion regulation skills, or emotion dysregulation, can become a risk factor for developing mental disorders, especially in adolescents (Dingle & Fay, 2017).

According to the literature, there are various strategies that individuals use to regulate their emotions, and they can be both adaptive or maladaptive. A summary by Sakka divides such strategies between those that are part of our **Cognitive Processes** (*Attention Deployment* and *Cognitive Change*) and those that belong to our **Response Modulation** (*Emotional Expression* and *Physical Modulation*) (Sakka, 2018). Strategies that imply ***Attention Deployment*** are *Distraction* (giving attention to different aspects or moving it away from the whole situation.), *Rumination* (focusing on our feelings and consequences); and *Reflection* (focusing on our feelings and trying to understand them). ***Cognitive Change*** strategies include *Reappraisal* (changing the meaning of a situation to alter its emotional impact); and *Acceptance* (accepting the situation and giving up to it) (Sakka, 2018). When it comes to Response Modulation, the author specifies those related to ***Emotional Expression*** such as *Discharge* (releasing the emotion), and *Suppression* (inhibit the emotion-expressing behavior); as well as ***Physical Modulation*** alone (controlling our bodily expression of the emotion) (Sakka, 2018).

According to Dingle and Fay, longitudinal studies with young people indicate that using strategies such as Suppression is linked to negative social connectedness and well-being. On the other hand, adaptive strategies such as Reappraisal result in positive social connectedness and well-being (Dingle & Fay, 2017, p. 3). Some strategies to regulate emotions with music derive from the general strategies previously mentioned, such as distraction, suppression, discharge and reappraisal. As both Saarikallio and Sakka mention, people listen to music mostly to enhance positive emotions or diminish negative ones, in other words, to feel more positive (Sakka, 2018) (Saarikallio, 2010); this idea is supported by other authors such as Juslin & Laukka (Sakka, 2004). Nevertheless, Saarikallio has reported that occasionally, happy-sounding music made listeners feel 'irritated', preferring to listen to music that better matched their mood (Saarikallio, 2010). Something similar was reported by Sakka, when some individuals actually reported listening to music to strengthen a negative emotion (Sakka, 2018). Wood, for instance, reported how some people use sad music to distract from stress and give room to the clarification and understanding of such emotions, since apparently by doing so, individuals feel *"they are not alone in their struggles"* (Wood, 2015, p. 7).

These results seem to show that some individuals are more inclined to ruminate on their negative emotions, while others quickly look for distraction from negativity or improve their mood. Wood also highlighted how, in previous studies featuring adolescents, they reported using music both to change their emotional state and maintain it when the emotion they wish to modify is negative (Wood, 2015). It has also been found that, in general, people seem to prefer to use music that mirrors their felt emotions(Wood, 2015). This leads us to the general conclusion that listening to music as a strategy for emotional regulation has many upsides, and it is relevant in our daily life. However, a downside could be its use in maladaptive emotion regulation strategies, such as

rumination, which is harmful to the individual. But what happens when an individual is suffering from clinical depression?

Joanna Stewart et al. mention how research has demonstrated that young individuals are much more likely to recur to the media whenever they are in a negative mood, and such increase in media use and withdrawal from social activities tends to increase in cases of clinical depression (Stewart et al., 2019). Among this increase in media music-listening and, more importantly, an increase in emotional dependency on music (Stewart et al., 2019). Moreover, according to Sakka, while healthy people tend to have a positive bias, depressed individuals are negatively biased (Sakka, 2018). In other words, their cognition focuses on negative information, which influences their perception and emotional reaction to music pieces. A study by Sakka concluded that it is possible the negative cognitive biases that characterize depression affect the activation of cognitive mechanisms such as stem reflex, emotion contagion and episodic memory, and, therefore, determine the emotional outcome (Sakka, 2018). As mentioned in chapter one, depressed individuals find difficulties in enjoying or responding to previously enjoyable activities, which leads to a major susceptibility to feeling negative emotions and cognition in general (e.g. negative self-talk, focus on negative events.). Therefore, it is expected that having a depressive disorder makes it difficult for an individual to regulate his/her emotions.

Sakka concludes that the same way music can alleviate depressive symptoms, it might give the opposite results (Sakka, 2018). For instance, ambiguous information is believed to be interpreted negatively more easily than in a positive way. This is believed to be true not only for information in general but also for recognition of emotions expressed by other people (e.g. voices, facial expressions).

Stewart et al. highlight that, while feelings of sadness can motivate behavioral motivation and self-reflection in a healthy individual, motivating realistic thinking that is believed to be useful for problem-solving, this 'adaptive function' works differently in depression (Stewart et al., 2019). This malfunction results in increased negativity, pessimism, and decreased motivation to solve the problems at hand. Moreover, previous studies have confirmed that depressed individuals tend to fail when selecting music to help them feel better (Stewart et al., 2019). They also mention how studies by Garrido and Schubert have suggested that their inability to use adaptive coping strategies translates to their music choices, using music for rumination or social withdrawal (Stewart, p. 2). However, this view is disputed by Laura Sakka, who argues that music for emotional regulation is not necessarily different from healthy to depressed individuals, even though depressed individuals seem to be less successful at it (Sakka, 2018).

4.6. Music-Evoked Emotions and Emotional Awareness

How aware are we about the positive and negative effect that their music listening choices can have on our emotions and, subsequently, mental health? Joanna Stewart et al. focus on this problem in their paper *Music use for mood regulation: Self-awareness and conscious listening choices in young people with tendencies to depression* (2019), where they describe the importance of self-awareness and emotional awareness (Stewart et al., 2019). Stewart defines **self-awareness** as a *"clear awareness of one's own feelings,*

emotions, and behaviors", while **emotional awareness** is *"the ability to identify emotional experiences"* (Stewart et al., 2019, p. 2). According to this author, both self-awareness and emotional awareness in general are vital to maintaining a healthy mental and emotional state. Appropriate levels of emotional awareness allow the individual to acknowledge the necessity to activate appropriate emotion regulation strategies and lower the risk of psychopathologies (Stewart et al., 2019). On the other hand, low levels of emotional awareness are a significant risk factor in developing depression and anxiety, since the individual's access to effective emotion regulation to deal with negative affect and social difficulties is reduced (Stewart et al., 2019). Dingle and Fay also support this claim stating that *"effective emotion regulation relies on an individual's awareness of their own and other's emotions, the development of a lexicon to label a range of emotional states, and strategies to modulate emotions to suit the context"* (Dingle & Fay, 2017, p. 1).

Stewart et al.'s results based on the participant's reports seem to suggest that most young individuals who suffer from depression had at some point listening behaviors that showed limited awareness and unconscious motivations when it came to their music choices, with frequent negative results (Stewart et al., 2019). This until they were made aware of the consequences of their habits by friends, family, their therapist or through self-reflection. They also corroborate the most common strategies used to manage negative mood mentioned by Sakka (Sakka, 2018), reducing them to two categories:

a) Selecting music that differs from the negative emotion felt in order to change it
b) Selecting music that mirrors the negative emotion felt in order to deal with such feelings.

Stewart's paper addresses whether these strategies are effective or not (Stewart et al., 2019). Many participants reported listening to music that differed from the negative mood they were experiencing to change it; e.g., using calming music to reduce anxiety; listening to upbeat music when feeling down (Stewart et al., 2019). According to the author's findings, this strategy was often used in order to distract from or hide undesired emotions, but participants reported it to be a short-term solution (Stewart. p. 6). Regardless, Stewart et al. state that, despite being a temporary solution, it has been suggested that accumulating these temporary moments of relief can still be beneficial for depressed individuals, since they reduce the time spent ruminating on negative events and can reduce suicidal or self-harm thoughts: *"the cumulative benefits of positive moments can serve as protective factors that eventually lead to improved well-being"* (Stewart et al., 2019, p. 9).

However, a majority of participants reportedly used music that mirrored their mood to deal with negative emotions, but not necessarily aiming to change them. Some participants reported changing the degree of the negative emotion being felt to a little above to be slowly brought up; a strategy called iso-principle, which implies selecting music that matches our current mood as the beginning point and then gradually changing to more positive music (Stewart et al., 2019). Stewart et al. report that using this strategy has proven beneficial and seems to produce a more lasting result in mood repair (Stewart et al., 2019). Nevertheless, other participants simply aimed to intensify their negative emotions in attempts to get to the highest point of this emotion to come down. These

strategies would sometimes have positive results, but at other times the outcome could be negative (Stewart et al., 2019).

Whether these strategies lead to successful results or not might depend on many variables. We had already mentioned Sakka's theory that a negative bias affected the mechanisms that regulate our perception of emotion in music, such as episodic memory, emotional contagion and reflex stem (Sakka, 2018). Summing to this, Stewart et al. identify three properties that they believe could influence the outcome of these attempts (Stewart et al., 2019):

- ***the message conveyed by the lyrics*** - the author reports how previous research has demonstrated that *"thoughts triggered by music have a greater impact on mood outcomes than features of the music itself"* (Stewart et al., 2019, p. 8). According to self-reports, listening to songs that were emotional, but which expressed some optimism or had a positive message had better effects than songs whose lyrics closely related to what they felt (Stewart et al., 2019). Even if such songs mirror their mood, its content could determine their effect on mood. Dingle and Fay also acknowledge this fact and refer to how analyzing song lyrics can help explore difficult feelings and experiences, and how lyrics, together with imagery, resulting from music listening are related to our emotional response to music (Dingle & Fay, 2017).
- ***the frequency and duration of listening to a certain music*** - there seems to be a correlation between the frequency or intensity we listen to music and their impact on our mental wellbeing, especially if the song reflects negative thoughts (Stewart et al., 2019). In other words, listening to a song mirroring our current negative feelings for an excessive period of time or extreme frequency is likely to aggravate negative emotionality rather than help undercome it.
- ***the nature and intensity of the prior affective state of the listener*** - according to self-reports by participants in Stewart's study, being in a very low negative mood was a factor that could result in a negative or neutral effect on mood (Stewart et al., 2019). Some participants *"described being more able to use music to change states such as anxiety or anger even when these were quite severe, but were less inclined to use this strategy when feeling depressed"* (Stewart et al., 2019, p. 8).

Nevertheless, would training individuals into emotion recognition and emotion regulation strategies really make a difference? Considering how vital emotion recognition is for effective emotion regulation, Dingle and Fay developed what they called the **Tuned In** program, whose goal was to *"train young people in emotion awareness, labeling, and regulation, using music listening as an engaging and meaningful way of evoking emotions during sessions"* (Dingle & Fay, 2017, p. 1). Participants were asked to select a song that made them feel the focal emotion of the coming session and bring it in their portable device. After this, the participant would choose music that they believed would help them achieve the desired level of valence and arousal, or even choose other strategies such as exercise if they believed it more suitable. According to their analysis, the participants of this particular intervention reduced the use of maladaptive strategies such as emotional

suppression much less post-intervention, even though this did not translate into an increase in adaptive strategies like reappraisal (Dingle & Fay, 2017).

During the program sessions, the participants reportedly showed improvements in self-reported emotional awareness, better labelling their own emotions, and increasing their confidence using a more comprehensive range of emotional regulation strategies (Dingle & Fay, 2017). However, the use of music for regulating emotions did not increase post-intervention. Whether the skills learned during the program were generalized to other environments, such as their home, and were sustained over time was beyond the scope of such study.

4.7. Music-evoked Memories for Emotion Regulation in Depression

In general, everyone is different in how they process information. Not everyone experiences music-evoked emotions with the same intensity, and not everyone experiences visual imagery the same way. When it comes to mental health, for instance, individuals who suffer from a psychopathology where memory is affected are, according to Sakka, less likely to experience episodic memories while listening to music (Sakka, 2018). When it comes to emotional disorders a cognitive bias is believed to affect the individual's attention and interpretation, influencing and determining which musical information, and memories attached to it, are relevant and how they are processed.

There is an important connection between depression and memory to take into account. Let us not forget that one of the characteristic symptoms of depression is memory impairment. Studies suggest that depressive individuals tend to recall less autobiographical memories than healthy ones (Sakka, 2018). Furthermore, as both Sakka and Speer et al. argue, individuals affected with depressive disorders tend to recall more negative than positive memories due to the negative cognitive biases that characterize the illness, which seems to be particularly pronounced in severely depressed individuals (Sakka, 2018) (Speer et al., 2014). This factor is of capital importance for the maintenance of depression since, according to D. J. Hallford et al. in their paper *Adaptive autobiographical memory in younger and older adults: The indirect association of integrative and instrumental reminiscence with depressive symptoms*, clinically depressed individuals, not only recall more emotionally negative memories, but also acquire a markedly depressive explanatory style when recalling them (Hallford et al., 2013).

However, depression is characterized by two different types of memory deficits: first, the already mentioned difficulty in recalling positive over negative memories and emotions. Second, according to Sakka, it is believed that the affected individuals have difficulties recalling specific details about these events, retrieving overgeneral autobiographical memories (Sakka, 2018). Nevertheless, the author highlights that implicit memory seems to be unaffected, which has led subsequent researchers to suggest that the negative bias might act during the process of the Explicit memory retrieval (Sakka, 2018). The author also mentions that this negative bias affecting memory retrieval seems to persist even after the depression has remitted, which means that it will always be a risk factor of reincidence (Sakka, 2018).

However, recalling positive autobiographical memories has also been proposed as an important strategy for emotion regulation, especially when it comes to coping with negative affect, and Speer et al. explain the neural mechanisms involved in this process (Speer et al., 2014). Speer et al. propose then that recalling pleasant autobiographical memories may evoke positive emotions and, as a result, engage the reward-related brain circuitry. *"A simple contrast of positive compared to neutral autobiographical memories revealed increased activity in corticostriatal circuits in reward-related processing* (Speer et al., 2014, p. 849). This influences the process of memory formation, and improves memory recall. The authors also highlight that, in some individuals, an increase in striatum activity during the recall of autobiographical memories influences mood very positively (Speer et al., 2014). As a result, the recall of positive past events leads to positive emotions and rewarding experiences; which makes reminiscing very valuable and important for an individual. Speer argues that it is the inability to maintain the activity in the striatum and the rewards systems that make it difficult for a depressed individual to maintain positive emotions (Speer et al., 2014).

4.8. Summary

Music Therapy has become a very popular alternative therapy and is characterized by a high rate of participation and rare dropouts. We have learned that a receptive approach is preferred for mild to medium Major Depression cases. Since we are intending to work with individuals who have mild to moderate Major Depression symptoms, a passive approach (music listening) seems the most suitable. It is also considered that Music Therapy can be good homework for patients in CBT treatment if properly instructed, so we want to focus on listening to music in this project without any intention to create a fully stand-alone therapy, but rather a kind of 'homework' style video game to complement normal therapy.

Literature shows that there is little awareness of how our music-listening behaviors can affect our mood, which impedes and appropriate selection of emotion regulation strategies. This leads us to that increasing awareness on these effects can have really positive results and could be an important contribution of our project, showing through game play how, depending on the emotion and its intensity, a song that differs completely from the negative mood felt helps improve it, and music that mirrors the feelings that is slightly more positive, can help improve mood as well. Also, considering that listeners seem to interpret better than chance feelings such as anger, sadness, anger, fear and tenderness, it seems safe to work with the most basic categories of emotion for a first approach into the use of music for emotion regulation.

Episodic Memory, Emotional Contagion, and Visual Imagery are relevant mechanisms that are at play when an individual listens to music: during game play, the emotions expressed by all songs in the game may 'contaminate' the player, the lyrics of these songs could trigger visual imagery of the situations presented, and episodic memory may act by recalling a memory connected to a particular song. To promote a depressed individual's wellbeing, reminiscing about past positive events is essential to maintain positive emotions, and personal selection has more chances to deeper emotional reactions and music-evoked memories for being a daily-life activity. However, it is known that

depressed individuals tend to fail selecting music that will make them feel better, and have a tendency to recall more negative memories than positive when listening to music selected by them. Considering these factors, it might be better to try to reduce these risks, and make the music selection less personalized for this first approach.

The time and frequency of listening to a song also influence the outcome. Therefore, establishing a limit, just enough for the player to recognize the emotion and train its use to improve emotions, might reduce this risk of rumination while listening to a negatively-classified song.

5. Video Game Play to Aid Depression Treatment

So far, we have presented established and more alternative treatments for depression that are of interest to this research. Established pharmacological treatments and psychotherapies such as CBT (Cognitive Behavioral Therapy), are prevalent and considered highly effective for many cases of depression. However, alternatives have been studied and also shown a positive effect. Besides, as Wahle et al. state, given the high numbers of affected, *"in many parts of the world there is only one mental health professional for over 200 people"* (Wahle et al., 2016, p. 1), which translates into patients having to wait, sometimes for several months, to receive treatment. Therapy is also often expensive and hard to approach for economically disadvantaged individuals (Wahle et al., 2016).

Theresa M. Fleming et al. give account on the fact that a variety of computerized therapies have been created as a response to issues mentioned above (Fleming et al., 2017). They report how the National Institute for Clinical Excellence (NICE) has recommended using Computerized Cognitive Behavioral Therapy (CCBT) as part of the treatment of depression and anxiety. The authors also argue that online interventions have been proposed to increase adherence to presential human-contact-based therapies (Fleming et al., 2017). Day by day, technology is more present in our lives, and it is expected to come to a point where it will be basically invisible and adapted to the context. As computerized equipment grows smaller and powerful, and embedded in our everyday surroundings, accessing a computer becomes easier, which has a strong influence when it comes to treating mental illness.

A Personal Digital Assistant has the potential, not only remind the user to do beneficial activities for his/her mood, but also identify thoughts by using speech recognition, and present a challenge to that thought when it occurs, as well as it could also present exercise routines to the patient and tick it off once the target has been met. This chapter investigates video gaming technology in therapy, relying on playing as a tool to train and modify behaviors to help in the patient's recovery.

5.1. The Benefits of Video Games

Among the available media, there is something that distinguishes video games from the others, which is the fact of being interactive. Opposite to what happens when watching television, movies, or reading books, when we play a video game, we do not passively receive the information provided in the storyline. The player is to be actively engaged in the story, give input to the system to, in return, receive a response from his/her actions or intervention.

The extent to which the player intervenes in the video game varies among the many different themes and goals that make up a game piece, whether the gameplay is to be collaborative or competitive, and if they play alone, physically accompanied by other players or online with thousands of other players. Also, these environments can be accessed through a wide variety of devices that come from consoles (ex. PlayStation, Nintendo, and others) to their own mobile phones. As Granic et al. cite: "*Video games are controlled training regimens delivered in highly motivating behavioral contexts (...)*

because behavioral changes arise from brain changes, it is also no surprise that performance improvements are paralleled by enduring physical and functional neurological remodeling" (Granic et al., 2014).

T. Attila Ceranoglu has also reported that through interactions with these, sometimes virtual, environments, players rehearse social and problem-solving skills (Ceranoglu, 2010). Granic et al. also support this idea by expressing how video games are excellent means to develop problem-solving strategies (Granic et al., 2014). The authors insist that the way the player learns in a video game is quite positive since, instead of following a manual with explicit instruction, the player needs to do so through trial and error, evidence collection and experimentation (Granic et al., 2014). The player develops capacities by gathering information, evaluating the options, making a plan and executing, later considering the change of strategy or goal depending on the outcome of their decision (Granic et al., 2014). This is also possible because game designers usually provide little instruction on how to solve problems, allowing the player to explore many possible solutions that will derive from the individual's experience and/or intuition (Granic et al., 2014).

Other authors such as Fleming et al. give an account of how individuals susceptible to rejection may acquire and rehearse needed skills, and receive feedback in a non-threatening environment where choices lead to clear results (Fleming et al., 2017). Another positive aspect accountable in video games is the immediate feedback they offer, (e.g. points, coins, and others) which rewards the player's continual effort and keeps him/her interested. This is what Lev Semenovich Vygotsky would call the "zone of proximal development", as cited by Granic et al., where levels of challenge and frustration are balanced with success and accomplishment (Granic et al., 2014). Crystine Serrone's work also proposes that these feelings of competence and autonomy that video games offer, not only motivate greater engagement in the task, but also lead to positive psychological outcomes, such as improvements in self-esteem, mood and vitality (Serrone, 2012). This is also related to the intermittent reinforcement players receive from the video game, which according to Granic et al., are the most effective for training new desired behaviors, as they show that *"persistence in the face of failure reaps valued rewards"* (Granic et al., 2014, p. 71). This balance is also managed through difficulty calibration that video games usually allow, whether by own choice or increasing the difficulty as the player learns the necessary skills for the game, demanding quicker reaction times, smarter solutions to game problems, and more general complexity (Granic et al., 2014).

Research carried out by McFarlane et al. (2002) and Rebetez & Betrancourt (2007) supports video games as a potential tool by providing scenarios for the individual to exercise social and cognitive abilities, and also by carrying out tasks derived from instructional objectives (Carrasco, 2016). Integrating the desired topic in a ludic environment will allow the player to explore its content within a narrative, increasing the player's motivation to deal with such topics.

5.2. Emotion Regulation Through Video Game Play

As mentioned in previous chapters, media consumers choose among many entertainment media to manage their mood, reduce negative affect, control emotions and subsequent physical responses. Crystine Serrone refers to how, according to the Mood Maintenance Theory (MTT), a positive or negative state is *"maintained by cognitive rehearsal of the circumstances surrounding the mood"* (Serrone, 2012, p. 21). In other words, maintaining a positive mood may involve rehearsing an event that has recently occurred and has led to the current good mood. In the same way, maintaining a negative mood implies fixating and rehearsing an adverse event or experience that caused these feelings. It is predicted that highly absorbing media, such as video games, could be effective tools for mood management, since they interrupt such cognitive rehearsals, alleviating and repairing, at least temporarily, their mood (Serrone, 2012).

Certainly, games do not only elicit positive emotions, since they can also trigger negative ones, such as frustration, anxiety, sadness, and anger. As mentioned before, the pretend context of video games is, apart from real enough for the player's goal accomplishments to matter, safe enough to train and rehearse, controlling these negative emotions to achieve their goals. Granic et al. also highlight that adaptive regulation strategies, such as acceptance and reappraisal, are linked to more positive emotions and reduced levels of depressive symptoms; and these are fundamental to succeed in many video games (Granic et al., 2014). For this author, video games typically promote flexible and efficient reappraisal of emotions, teaching players to deal with negative affect such as frustration and anxiety; au contraire, maladaptive regulation strategies such as rumination impede fast reaction and flexibility to changing challenges, hence, they are less likely to be rewarded throughout game-play (Granic et al., 2014). It is important to consider that without reappraisal, frustration and anxiety would increase while playing.

Another factor that is believed to impact mood is the **'excitatory potential of a media type'**, which basically refers to the possibility of adjusting your mood state by increasing or decreasing sympathetic nervous system arousal (Serrone, 2012). As Serrone depicts, a frustrated or stressed individual will not benefit from overly exciting media, but rather a calm one (e.g. non-violent, self placed, problem-solving games). In the same way, a bored individual will benefit from faster-paced, exciting media (Serrone, 2012). Task demand is another factor that is believed to influence mood repair, and it is believed that high demand increases mood repair, but excessive task demand has the opposite effect, negatively affecting mood repair. According to Serrone's research, *"bored participants experienced a greater improvement in mood as a product of task demand than stressed participants experienced"* (Serrone, 2012, p. 20). Performance during gameplay can also influence game enjoyment and post play psychological results: when players can use controls easily and effectively, and therefore perform better, psychological outcomes are more favorable. Together with effective use of controls, interactivity, immersion, time distortion and challenge are other factors that seem to influence performance (Serrone, 2012).

5.3. Video Game Genres for Different Objectives

Nowadays, a very popular way of ameliorating stress is casual gaming (Russoniello et al., 2009). Casual Video Games (CVGs) are games based around game concepts that are already familiar for consumers, such as the ones many of them played as children. They are usually played in short times at home or work, so they must be quick to access, easy to learn, with no regular time commitment to play, and usually easy to pause, stop and restart (Russoniello et al., 2009). It is also suggested that playing puzzle video games improves the player's mood by promoting relaxation and reducing anxiety; with puzzle games Russoniello et al. refer specifically to games with minimal interfaces, a high degree of accessibility, and short-term commitment.

Russoniello researched how casual games could ameliorate stress-related symptoms of medical disorders including depression, by helping them manage their allostatic load (Russoniello et al., 2009). In other words, they wanted to know whether playing the following casual games could result in changes in the central nervous system consistent to improve mood and decreased stress. These researchers tested this using three popular casual games:

- ***Bejeweled 2***: a matching-sequencing game where the player string jewel-like objects together in order to get points (Russoniello et al., 2009).
- ***Bookworm Adventures***: a crossword/scrabble type of puzzle game, players gather points by building words while they progress through an animated adventure (Russoniello et al., 2009).
- ***Peggle***: pachinko/pinball type of game, it allows the player to get control as they clear-out strings of multi-colored balls for points (Russoniello et al., 2009).

Analyses revealed that the three games decreased depression scores compared to control groups. Out of these three games, Bejeweled 2 had the most outstanding impact on stress measures, as they not only experienced decreases in their Autonomic Nervous System activity, but also increases in variables associated with positive cognitive engagement (Russoniello et al., 2009). For Russoniello, these results show that CVG can become part of health interventions, and encourages further research on the impact of these games on many different conditions. Furthermore, the author highlights that significant differences in subscales of depression, tension, anger, fatigue, stress and confusion by some games compared to others suggest that specific changes might be associated with particular types of games (Russoniello et al., 2009).

Simone Khün et al. also refer to the fact that, even though puzzle-like video games have not been systematically associated with cognitive benefits compared to other types of games in healthy individuals, puzzle-like video games can be more rewarding and less frustrating than other genres, which might make them better suited to entertain patients and improve or at least change their mood (Khün et al., 2018). According to Cristyne Serrone, themes in a game influence the feelings and thoughts activated in the player, as also do personal and situational variables, being personal variables those *"relatively static tendencies, beliefs, and emotions of an individual"* (Serrone, 2012, p. 13), including age, skill level and self-esteem; and situational variables being those related to the environment, such as the media, other people, and settings. All of these variables also

influence the extent to which the individual learns from the game's content. The author also mentions that players' possibilities to learn from the game increase the more the longer they are *"able to capture their attention"* (Serrone, 2012, p. 13).

Apart from mood repair and ameliorating stress, Khün et al. highlight how the cognitive impairments that accompany mental disorders such as depression or anxiety (e.g. executive functions, attention, short and long term memory) are persistent, even after successful treatment and remission (Khün et al., 2018). Granic et al. propose that video games are also effective tools to work on these impairments and benefit the patient in many different ways, mentioning how new evidence supports that video-game playing, violent or not, enhances children and adolescents' creative capacities (Granic et al., 2014). Some of the most significant research outcomes and evidence on the influence that different video game genres have on the player reported in the literature are:

- ***Shooter Video Games:*** On trials, results have shown that players who played a shooter video game ended up having faster and more accurate attention allocation, and spatial revolution in visual processing (Granic et al., 2014). Playing shooter games also enhanced their mental rotation abilities, cognitive advantages measurable through changes in neural processing (Granic et al., 2014).
- ***Strategic Video Games***: It has been reported by Granic et al. that previous research showed that playing strategic games seems to be related to improvements in problem-solving skills (Granic et al., 2014). The more adolescents reported playing this type of games, the more improvements were self-reported on this skill the following year (Granic et al., 2014).
- ***Action Video Games***: Khün et al. refer to how prior studies showed how interventions using action video games had been associated with improvements in attention, processing speed, and executive functions (the ability to inhibit ongoing actions or thoughts), including updating of task-relevant information (Khün et al., 2018). Khün et al.'s results after their study suggest that training with fast-paced action video games (*Boson X* being the one used for this particular trial) contributes to a reduction in rumination and an increase of subjective cognitive abilities (Khün et al., 2018). Even though it seems to be less effective in treating affective symptoms of depression, the author insists that it is a potential way to reduce or suppress rumination thanks to executive function improvements.
- ***Adventure Video Games***: Aiming to modify cognitive distortions that characterize depressive disorders and the consequences this has in the patients' behavioral patterns, Carrasco studied the effects of playing adventure video games as psychotherapy tool through a video game named Maya (Carrasco, 2016). This experience resulted in the game's capacity to stimulate the patients' reflections on their own lives according to the therapists. The feedback gathered from the players also showed that they would prefer a narrative that would not address directly to typical adolescent situations, and that preferred situations presented more metaphorically (Carrasco, 2016). The author also mentions how game elements should provide information to stimulate self-reflection and avoid possible negative interpretations from the depressed player (Carrasco, 2016).

- ***Racing or Fighting Video Games***: the only information gathered until today regarding the effects of racing or fighting video games comes from Granic et al., who claims that, compared to strategic video games, these video games have not provided any evidence to think that they help develop problem-solving skills (Granic et al., 2014). However, more research is needed regarding the effects of these types of video games on depressed players.

Even though not strictly a video game genre, we believe it is important to mention some considerations that exist about ***violent video games*** and mood management that could be important to keep in mind. The consequences of violent video games are a topic that is always on tune, and sometimes even polemic, with many different and contradictory opinions in the literature. Without any intentions to add up to this debate, we will only mention the positive outcomes some research has found regarding violent game-play. Ferguson and Rueda referred to Olson, Kutner, and Warner's findings in 2008 on how young boys reported feeling calmer, less aggressive or angry, after playing a violent video game (Ferguson & Rueda, 2010). The authors believe that this might be because they offer an environment to explore negative feelings, such as disappointment, powerlessness, helplessness, and lack of control, where the player can assert control and power, and reach the objectives rapidly (Ferguson & Rueda, 2010).

This might also come in hand with what Serrone refers to as The Catharsis Hypothesis, which suggests that in some occasions a negative affect or mood can be modified through what the author describes as "*safe or vicarious expressions of aggression"* (Serrone, 2012, p. 81), such as playing a violent game. However, mood repair has been observed both playing violent and non-violent video games, which might indicate that this 'release' that violent video games offer might not be the only way games reduce frustration, stress and hostility (Ferguson & Rueda, 2010). Overall, regardless of semantic affinity, playing video games, violent or not, seems to provide the feeling of autonomy and competence that can lead to higher self-esteem and a healthier mind.

5.4. Serious Games to Aid Depression Treatment

Initial examples of video games in therapy were computerized versions of available board games believed to benefit the therapeutic process (Ceranoglu, 2010). However, the creation of video games for purposes different from entertainment and more inclined to health-related objectives has led to the concept of 'serious video games', or sometimes using other terms, such as 'interactive computerized interventions', 'interactive digital rehabilitation technology' or 'virtual reality'.

In the literature, these concepts are often used interchangeably to refer to games used for health purposes, but Ho Ming Lau et al. in their review on the subject reflect on the important differences between them (Lau et al., 2017). Even though virtual reality can be used for games, virtual reality interventions are not to be considered games unless they possess significant features of gaming. **Virtual Reality Exposure Therapy**, for instance, uses virtual reality to simulate real-world situations in order to treat specific phobias, and they are not particularly characterized for having any competitive elements as video games do. In the same way, interactive computerized interventions do not necessarily contain features that make them games (Lau et al., 2017).

We will focus on the concept of Serious Games for our purposes, defined by Fleming et al. as games or programs that utilize gaming *"as a central and primary medium"* (Fleming et al., 2017, p. 2), opposite to simple Gamification, which does not operate as a full game experience, but simply adds gaming elements (e.g. scoring of points, rewards, or quests). Lau et al., complements this concept, considering Serious Games those that *"are designed to educate, train, or change behavior as they entertain players"* (Lau et al., 2017, p. 2). It is important to clarify that Serious Games can be digital or non-digital, even though most of those found in the literature are delivered via stand-alone computer technology or online.

Regarding depression, several studies have investigated the use of video games in the context of depression treatments, and according to Fleming et al.'s review on the subject, most of them focused on children, adolescents and young people, while some of them have investigated the use of computer gaming programs to alleviate cognitive decline in older individuals (Fleming et al., 2017) (Fleming et al., 2014); studies of serious gaming for depression treatment in other age groups are very limited. Some programs tested on children or adolescents with depressive symptoms included supported interventions and total self-help interventions. Amongst supported interventions the most significant ones found in the literature are the following:

- ***Think Feel Do*** *(See Fig. 1)*: it is based on Cognitive Behavioral Therapy, designed at the University of Bath and aimed at children. It has three characters that work as the program's interface: Tom (The Thinker), Becka (The Feeler), and Izzy (The Doer). These three 2D cartoon heads guide the player throughout the session. A facilitator describes the program content, gives support and reflects on the program content with the patients, which comprises topics such as links between thoughts, feelings, and behaviors, identifying and challenging negative thoughts, problem-solving skills and ways to help you feel better (Fleming et al., 2014). The selections they make during the game influence what happens later in the sessions, so the user sees the consequences of such decisions, and later selects different options. This way, the patient learns how different types of feelings or thoughts can lead to positive or negative results. The open trial of this program made by Attwood et al. in 2012 showed improvements in the self-rated Adolescent Wellbeing Scale, more specifically in depression-related aspects (Fleming et al., 2017).

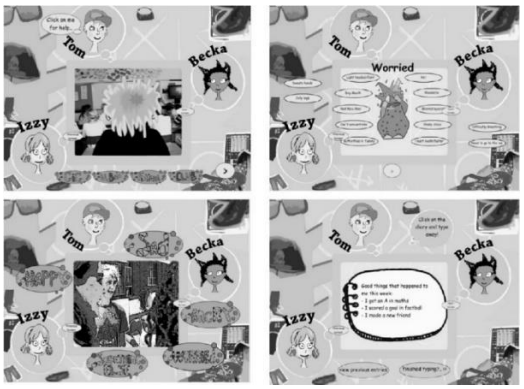


Figure 1. Examples of ***Think Feel Do*** content. From Stallard et al. 2011

- ***ReachOut Central:*** it is delivered online, and uses CBT principles. It was launched in September 2007, and it is part of Reach Out (Visit: http://www.reachout.com), a web-based mental health service aimed at people aged 14-25 years old. Its goal is to teach life skills using real-life scenarios. It is a role-playing game where the user plays as someone who is new in town and needs to work out how to settle, make new friends, and get to know the place (Fleming et al., 2014). The player completes a short survey every time he/she logs in to measure positive affect and keep track of his/her mood. It has a mood meter that is manipulated through the player's different activities during the game, which at the same time affects the character's social interactions (Fleming et al., 2014). According to Jane M Burns et al.' own analysis, even though this game was very successful in attracting young men, it failed to keep them engaged, being necessary to explore how to sustain engagement (Burns et al., 2010).

- ***Journey to the Wild Divine series***: they were published by Wild Divine (now Unyte Health: https://unyte.com/) in 2001; they are based on bio-reading (heart-rate and skin-conductance level), and their objective is to train remaining calm during 'real-world' stressful events. These journeys provide activities such as guided imagery and relaxing sounds, and building walls, bridges, making a fire, floating in a hot air balloon and many others (Fleming et al., 2014).

- ***gNAT Island*** *(See Fig. 2)*: it is also based on CBT, and is delivered over two to four sessions together with face-to-face therapy. The player must go through a world full of creatures that can sting people and cause them automatic negative thoughts, the gNats (Negative Automatic Thoughts) (Fleming et al., 2014). Throughout the process, the player finds characters who introduce strategies for dealing with these negative thoughts and beliefs. The players answer questions from these characters during the game and have a notebook where they keep a record of their ideas (Fleming et al., 2014).

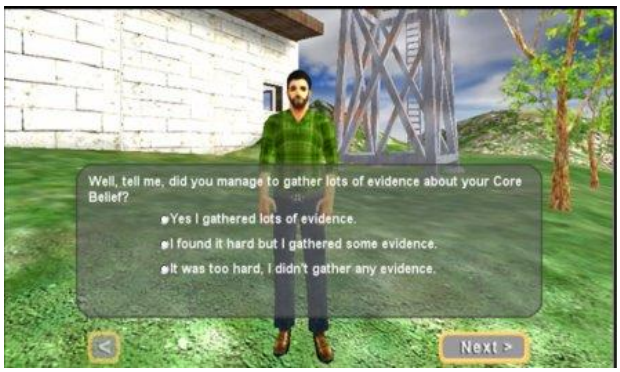


Figure 2. Conversation with a character in ***gNats Island***. From Coyle et al., 2011

As for those interventions designed to work independently, two are the best known:

- ***SPARX/Rainbow SPARX*** *(See Fig. 3):* it was originally delivered via computer or CD-ROM, and it does not require the involvement of any therapist or facilitator. However, it has made available online a pdf document with training for professionals (https://www.sparx.org.nz/sites/default/files/sparx-training-for-health-professionals.pdf). It is based on CBT, and it comprises seven sessions of approximately 30 minutes each. It was created for adolescents aged 12 to 19, and it has an online version available at https://www.sparx.org.nz/). The player meets a virtual 'guide' who directly talks about depression and applying the skills learned in the game world while they take a series of challenges and give them instruction and their objectives for each of the seven levels of the game (Lau et al., 2017). The player controls a personalized character whose mission is to restore the balance in a fantasy world by solving problems or shooting at negative thoughts (Fleming et al., 2014). According to Fleming et al., it is as effective as the standard treatment in reducing depression in children (Fleming et al., 2017).

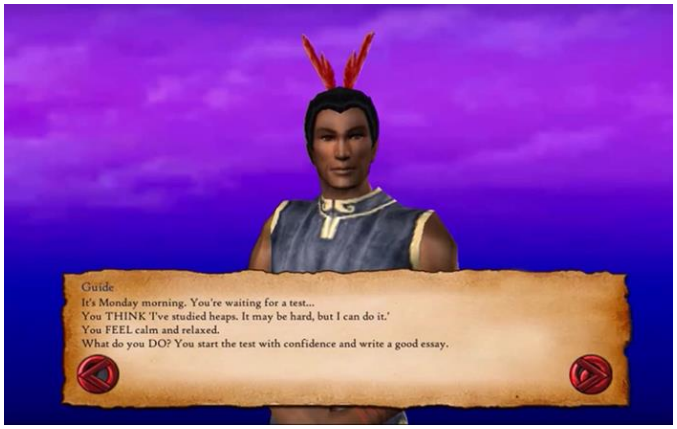


Figure 3. The 'Guide' from the video game ***SPARX***. From Shah, 2019

- ***The Journey***: This is a CBT-based program delivered via CD-ROM only, with no therapist or facilitator required. The player selects a character with the mission of traveling to their homeland, crossing a fantasy world of seven 'magical' lands. As the players complete tasks, they are rewarded with points and mini-games to play as part of the journey (Fleming et al., 2014).

Another related area that deserves our attention is the creation of video games designed by the gaming community independently to help to deal with or at least understand the struggles of mental illness. The same way there is an array of apps available to aid depression which have not really been studied or analysed through clinical trials and have no approval from the medical authorities, there are video games accessible in the market that are worth studying in terms of efficacy, structure and principles. Among these video games, by researching the internet and social media, here are the most recommended and mentioned:

- ***Depression Quest*** *(See Fig. 4)**:*** designed by Zoe Quinn, Patrick Lindsey and Isaac Schankler and released in 2013, it is available for free online

(http://www.depressionquest.com/). This game has the goal to help understand the internal narratives of a depressed individual. The player portrays someone with depression as he/she balances his/her illness, job, relationships and treatment. The story is told through text and decisions for the player to make (Parkin, 2014). The different choices in the narrative change, open and close according to the player's depression level, the content is generated according to the player's decisions, and the ending of the game changes depending on the player's choices. Audio and visuals react to the levels of depression (e.g. glitchier sounds, color taken out of the environment) (*Depression Quest*, n.d.).

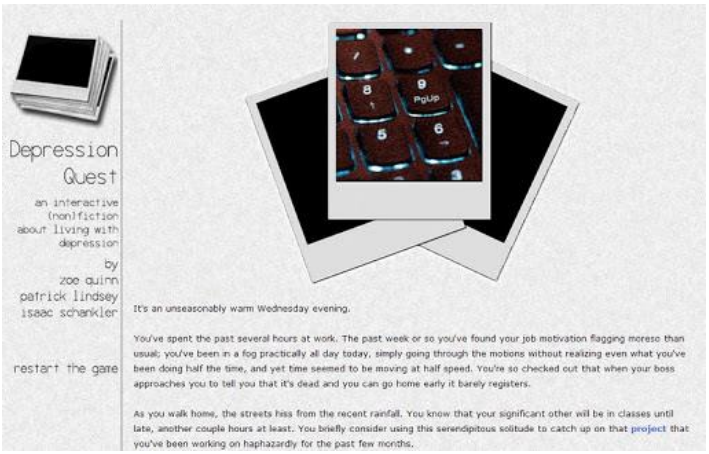


Figure 4. ***Depression Quest***'s screenshot. From DepressionQuest.com

- ***Elude***: created by *GAMBIT Game Lab*, launched in the summer of 2010 and available online (http://gambit.mit.edu/loadgame/elude.php). It portrays depression metaphorically, while the character explores 'emotional' landscapes, moving through woods and fields while looking for 'passion objects' that will help them surpass emotional obstacles. "It was designed to be used in a clinical context as part of a psycho-education package, with the main target of raising awareness in families and friends about what depressed individuals go through.

- ***Actual Sunlight*** *(See Fig. 5)*: it was designed by Will O'Neill and first released in 2013. It is a short interactive story about a man, Evan Winter, who is going through a rough patch of his life, and it is available online (https://willoneill.com/actualsunlight/). The player has to go through the narrative of his daily life, his everyday struggles to maintain relationships while fighting against social anxiety, depression, and suicidal thoughts (Green, 2020).

Figure 5. ***Actual Sunlight***s gameplay screenshot. From Kaharl, 2017

- ***Inner Vision*** *(See Fig. 6)*: created by Sunil Rao and released in 2013, it is an experimental game that aims to reflect on depression and suicide. Throughout the game, the player is an omnipresent protagonist who needs to chat to three characters suffering from depression. The player's objective is to address the problem, help them choose how to overcome them and move on. During the conversation, the player needs to make choices, which will prompt different responses (Donelly, 2015).

Figure 6. Gameplay screenshot from ***Inner Vision***. From Donelly, 2015

- ***Celeste*** *(See Fig. 7)**:*** created in 2018 by Maddy Thorson and Noel Berry, it is a single-player platforming game for several consoles (http://www.celestegame.com/) which explored depression and anxiety through a protagonist named Madeline who had to avoid both physical and emotional obstacles, including other characters such as Badeline (a representation of her depression and anxiety), in order to climb Mount Celeste (Parker, 2019).

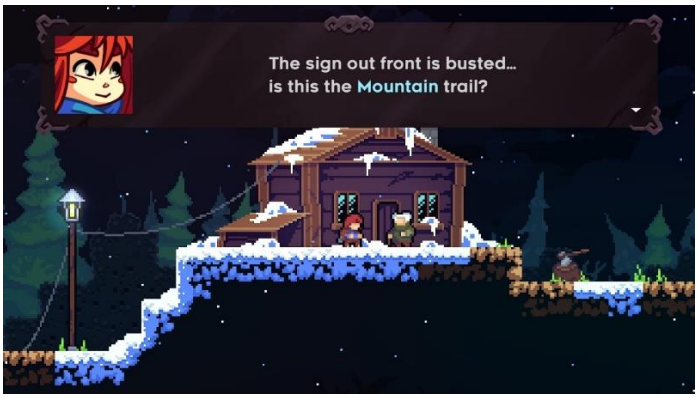


Figure 7. Gameplay screenshot from ***Celeste***. From Celestegame.com

5.5. Potential Barriers to the Use of Video Games for Therapy

Overall, the potential of using video games for therapy is considerably high, and research has shown very positive results in their application. Unfortunately, most of the studies found do not give any detailed description in terms of content and design. Some of them are even inaccessible for the common user, and even difficult to access by other researchers, others are not even available out of the research setting. This, as Fleming et al. point out, hinders the process of learning from previous research, constraining the development of better and more efficient games for therapy, and even reducing the impact these games could have (Fleming et al., 2014). Another issue is that most of these serious games were PC applications that did not require any internet connection, which makes researchers like Fleming et al. and Lau et al. consider that serious games development is lagging behind in terms of devices (Fleming et al., 2017) (Lau et al., 2017). According to Lau et al., a large proportion of users are mostly connected to the internet via their smartphones, and most time spent on smartphones is playing games, at least in the US (Lau et al., 2017). As Lau insists, many health apps are already available, and smartphone-based video games have yet to be explored, the same as the effects of serious games that explore the interaction between players through internet connection are missing (Lau et al., 2017). There is an aspect that Granic highlights that has been missing in these studies: most of them are single-player games, when according to the Entertainment Software Association in 2012, *"more than 70% of individuals play games socially, online or in person, with friends and acquaintances"* (Granic et al., 2014, p. 75).

In a more general scenario, as Fleming et al. point out, *"people playing popular games find it hard to tear themselves away, unlike users of mental health computer-based interventions, where motivating people to complete the intervention has been troublesome"* (Fleming et al., 2014, p. 229). Granic et al. argue that this probably happens because medical practitioners, researchers, teachers that many times create the core of these games are not designers (Granic et al., 2014). Therefore, the final results often miss the most essential characteristic of games that is key to players' engagement: fun. In other words, many times, these games end up being "chocolate-covered broccoli": *"the games look great, they are good for you, but they ultimately fail to work because the creative game dynamics that induce transportation and immersion are missing, making them simply not fun"* (Granic et al., 2014, p. 74). The author finds this problem particularly

common in video games based on Cognitive Behavioral Therapy, relying on educating by giving psychoeducation information through a didactic style, giving interactive lessons.

Even though Granic et al. assert that learning about the cognitive biases that affect their judgement and thoughts, and knowing how they can affect their behavior and problem-solving skills is important for patients, this is something we need to handle with care (Granic et al., 2014). Children and adolescents, for example, often find these lessons boring, according to this author. Even young adults, whether because they do not recognize they have a health problem, are not motivated to change, or are simply affected by hopelessness and rumination, might not get the expected advantages out of these experiences (Granic et al., 2014).

Other than motivational matters, Ceranoglu clustered the barriers to the use of video games in psychotherapy in three groups:

- ***The content of video games and the style of play they require:*** reflecting on the different emotions and fast-game style that many games have, Ceranoglu believes that most video games may absorb both patient and therapist, especially if the patient is a child, interfering then in the therapy process (Ceranoglu, 2010). Another aspect is that most video games allow the player to identify easily with the main character, influencing a very important aspect of psychotherapy, which is free association. The author even mentions that the therapist's position with respect to the patient, mostly side-by-side when playing, may interrupt direct engagement between each other; interaction might end up fading and might unintentionally facilitate unproductiveness (Ceranoglu, 2010).
- ***General attitudes toward video games:*** there is a generally hostile reception of video games from parents and health practitioners due to the possibility of their association with aggressive behavior, obesity, and negative school performance as a result of an excessive play, which makes it difficult to display this type of resources in medical facilities (Ceranoglu, 2010). Also, the same way a very small percentage of children report playing video games with their parents or caregivers, a similar situation might occur in the clinical environment (Ceranoglu, 2010).
- ***Access to these video games:*** lack of familiarity and, sometimes, economical constraints can become a barrier to the use of games in therapy (Ceranoglu, 2010).

Fleming et al. have reported some other challenges, such as cost and speed of implementation, issues of validity, and user preferences. In other words, gamers are very familiar with commercially produced video games whose development involved massive budgets (Fleming et al., 2017). Another issue is that the technology undergoes constant advances and it can be a challenge to release new versions of these technologies frequently. Together with this, we have the issue of the implementation, as the traditional scientific method requires a series of steps before they are even released to the public, which makes these games lag behind when it comes to hardware and software (e.g. piloting, refinement, testing, publications, etc.) (Fleming et al., 2017, pp. 5–6).

5.6. Summary

As therapists gain familiarity with video games and the varied equipment available to access them, they are more likely to be used in psychotherapy. Often individuals needing care are unable or have a hard time accessing treatment, due to living in hard-to-reach rural locations, working or going to school during treatment hours, or finding it physically and psychologically impossible to transport to clinical settings. Also, a large proposition of individuals are connected to the internet via their smartphones on a daily basis. Therefore, a mobile game would facilitate accessibility and adaptability to the participant's daily routine.

Another positive aspect is that video games are less associated with social stigmas than conventional therapy, which may facilitate acceptance of therapy. They are also generally used for stress management and mood repair, and among the most common games chosen for this purpose, we have Casual Games. Many of these games include puzzles, such as Match-Three or mazes, and they are believed to be more rewarding and less frustrating than other genres, which makes them ideal to entertain players and improve the players' mood. Moreover, puzzles have other benefits for the mind of a depressed individual, such as promoting cognitive stimulation, and giving a space to train problem-solving skills and strategic thinking. Therefore, our proposal could be a video game with clear tasks that do not take very long to complete, that can be stopped and restarted at any time, and that includes puzzles as part of the game play.

It is also important to remember that the tasks need difficulty calibration, whether by their own choice or increasing automatically as the player advances in the game and learns the skills necessary for the game. The level of 'excitement' of the world, the story, the tasks, and the background music itself that will compose our game might affect the level of mood repair of the individual. It should not be overly calm, but also not extremely exciting, since a player who is feeling stressed will benefit from a calm environment, while a participant with a low mood will benefit from a fast and exciting one. Moreover, as the players might get more benefits from games that were previously enjoyed or similar, it is essential to have a general vision of the trends within the population of young adults with depressive symptomatology.

Most serious games created to raise awareness or diminish depressive symptoms depict the interaction of the player with a fantasy world where the player goes through a journey in an interactive world, and we believe that this is a good idea to keep. Since the feedback gathered from the players in one example seen showed that they would prefer a narrative that would not address directly to typical situations, and that preferred situations presented in a more metaphorical way, an environment unrelated to a real context to avoid associations with negative experiences could be beneficial. Also, the fact of playing with other players online is also something to be careful with, at least for this first approach, since a depressed individual might not be willing to play a game with other people due to the characteristic preference for isolation and whatever triggered a major depressive episode varies among individuals, and if such episode is based on a social situation or difficulty, we might be pushing a button we do not want to.

6. Methodology - Iterative Design Process

To design our proposal, we followed an iterative approach, starting by meeting with the Psychology Service of the University of Madeira to discuss the concept of our project, what has been found in the literature, and subsequently get their feedback, opinions and suggestions. We also created a profile of the target population, both clinically and as video game players, to help us define the style, mechanisms, and general content of our game. Several tests were made to define various smaller elements of the game, such as the tasks, which were the base for the creation of a low-fidelity prototype that was tested both by the therapist and the general population, to finally create our final/high-fidelity prototype that was to be tested with a sample of the target population. This process is described in the following sections.

6.1. The Concept

We were aimed to create the prototype for a casual video game that aids individuals with depressive symptomatology in different areas. We want to facilitate tips on the keys to have a healthy life through the story; and provide cognitively-stimulating mini-games, such as classic puzzles, to interrupt detrimental cognitive rehearsal. Part of our concept is the use of every-day popular music to raise awareness on the effects of music on our emotions and mood, and promote effective music listening strategies and behaviors. Even though it is not a central part of the concept, we intend to incentivize physical activity by introducing walking as part of the gameplay.

6.2. Target Population

Our target population, or the group we believe will benefit more from this concept, is individuals between 18-30 years old who present minimal to moderate depression symptoms, and are university students. The amount of stress they are subject to in their academic life makes it imperative to promote a healthy mind and healthy habits, for adequate personal and professional development. Moreover, this population makes up a big part of the video game market, and tends to recur both to this media and music to deal with negative feelings and experiences.

6.3. Input from the Therapists

Working in partnership with the Psychology Service of The University of Madeira, we discussed the concept in various sessions, and their staff gently facilitated written information about the illness and tips that would help us through our creative process.

6.3.1. Methodology

After a few sessions discussing the concept, a written document was specially prepared by the psychologists for this project. We were instructed on the risk factors associated with depression, the difficulties these individuals have, and the common elements present in university students with depressive symptomatology. This material

also included tips for family and friends that they believed are important to keep in mind for the development of the project, and what the individual suffering from depression can do.

6.3.2. Results

From this document, the most important considerations to keep in mind during the development of this video game are related to what an individual with depression should do to improve his/her mental state and what external sources should keep in mind. These ideas can be summarized as follows:

- Others should not pressure the person to feel better, criticize, or blame the person for his/her behavior.
- Others shall encourage the person to speak and share healthy activities (for instance., do exercise)
- The individuals suffering these symptoms should:
    - Cultivate supportive relationships: do not isolate, keep themselves active even though they do not feel like it, and do something for others.
    - Exercise regularly.
    - Expose themselves to the sun, and stay in contact with nature.
    - Manage stress, making a plan to avoid or minimize stress, including relaxing exercises.
    - Develop emotion regulation strategies. Give a name to feelings. Allow themselves to express what they feel.
    - Do activities that give them pleasure.

Overall, doing exercise and keeping active, promoting supportive relationships, helping others, keeping contact with nature, managing stress and developing emotional regulation strategies are very important for the patients' mental health and our project should, therefore, reinforce and promote such behaviors.

6.4. Input from the Target Population

To create a profile that works as a basis for our game design, we requested volunteers who had the characteristics of our target population to profile them as video game players. A total of 9 clients from the University of Madeira's Psychology Service volunteered to be part of this initial study. The participants were 6 males and 3 females whose ages ranged from 18 to 28, being 8 students, and 1 unemployed.

6.4.1. Methodology

The participants were given the PHQ-9 questionnaire in order to determine the severity of their depressive symptoms. Since this population's native language is Portuguese, we used the Portuguese version of the PHQ-9 (Patient's Health Questionnaire - 9), a self-report instrument designed to evaluate the severity of depressive symptoms *(See annex 1).* It is constituted by 9 items, with a four item Likert scale: 0 (Never), to 3 (Almost Every Day). The total score is obtained by summing up all 0, 1, 2, and 3 along with the 9 items, and the maximum score possible is 27 points (0-4 - Minimal/5-9 - Mild/10-14 - Moderate/15-19 - Moderately Severe/20-27 - Severe). The last item includes

the extent to which these 9 previous items influenced, or made more difficult, their daily life performance in terms of work, taking care of their home, or dealing with other people.

To build a profile of their video game play tendencies, we created the questionnaire "The Use of Video Games by Young Adults" *(See Annex 2)*. Information that we considered essential to create a 'player profile', such as whether they have ever played a game or not, if they enjoy such activity, the types of games they enjoy, how they usually consume or get their video games, their behaviors during game play, and their preferences for music in a video game was collected with this material.

6.4.2. **Results**

We were able to confirm that these 9 subjects meet the criteria established: 1 participant shows minimal signs of depression, while 4 show to have mild symptoms, and the last 4 show moderate levels of depression. The table with the complete results can be found annexed. *(See Annex 3)*

Based on the results of the questionnaire "The use of video games by young adults", we were able to determine that 7 out of 9 participants played video games, and that almost half of them played video games whenever they felt like it, while almost the other half played either frequently or every day. 44.4% of the participants reported playing up to one hour a day, and 33.3% played about 1-2 hours a day. All nine participants reported playing video games at home in their free time, and 'relaxing" and 'spending my free time' were the most common reasons to play. It is also important to mention that 44.4% of participants prefer to play video games alone, while 33.3% prefer playing with others face to face. 44.4% strongly agreed that they were influenced by other people's mood while playing, and 55.5% enjoyed playing with others, while the rest of the participants were less positive about this.

When it comes to game preferences, 55.6% of the participants reported to like 'puzzle games' and 'whatever is online and can be played with others', while 44.4% mentioned that they prefer 'fast-paced ones' and 'with a deep and complex story'. Where they obtained the games from also varied, 77.8% stating that they downloaded their games, and 55.6% reporting to use 'PlayStore and other similar engines'; 44.4% also mentioned getting games at 'Online game stores' and 'free online platforms' respectively. In terms of their feelings while playing video games, 55.5% to 77.7% reported high levels of happiness, challenge, nostalgia, competence, confidence, and calmness while playing video games. Also, negative feelings like revenge, frustration, and anger were reportedly low, according to 88.9% of participants.

Finally, when it comes to their reaction to music in video games, 55.5% reported that they put some of their own music while playing, while 44.4% reported to like the music in some video game menus; only 33.3% of participants reported listening to video games music all the time. Among the preferred music genres, the most mentioned were pop, rock, and electronic music; more general descriptions, such as animated, motivational, fun, and relaxing were also given.

6.5. **The Proposal**

Based on what we learned from previous literature, the insight from the therapists from the Psychology Service of the University of Madeira, and data from our target population, we propose the development of a casual game using puzzle-solving activities, popular music, and some principles of Cognitive-Behavioral Therapy (CBT) to help young adults improve their mood, raise awareness on how every-day music can affect our emotions and mood, and how it can be used to regulate their affective state. More in detail, our proposal has three main characteristics:

6.5.1. **Psycho-educating through the story**

As mentioned before, and advised by therapists, promoting contact with nature, exercising, training our problem-solving skills, and seeking alternative lines of thought are essential to fight depressive symptoms. Considering this, we created a world affected by an unknown force that shattered the relics that made its core engine work. This engine is known as the Self-Knowledge Mechanism, and the relics (or jewels) that powered it represent four important principles to maintain a healthy mind:

- ***Relic of Nature*** - obtains energy from our contact with the sun, the earth, the ocean, and other elements from nature.
- ***Relic of Friendship*** - obtains energy from the company and support of our friends and loved ones.
- ***Relic of Resilience*** - obtains energy from patience, discipline and physical wellbeing.
- ***Relic of Creativity*** - obtains energy from the creative solution of problems, generation of ideas, and multiplicity of perspectives.

Each of these relics was broken into three pieces, which the player will need to gather throughout the game to put them back together. When a relic is complete and restored, the environment in the game suffers small improvements. The game starts with the game world being a place where nature is dead, dry, empty, and the sky is cloudy and dark. As the relics are restored, the sky gets less cloudy and the sun rays are more visible, as well as nature gets more hydrated and greener, and the world gets more filled with plants and flowers. The world's full beauty comes back once all four relics have been placed in their corresponding place of the Self-Knowledge Mechanism. These environment changes are intended to represent emptiness, lack of energy, lack of joy, and anhedonia, feelings that characterize depression.

Throughout the game we will have non-player characters (characters not controlled by the player), including a helper who explains to the player what happened, what he/she has to do, gives tips and instructions, and introduces the other characters and what the relics represent. This helper is the inner voice of this world, who is asking the player for help. The other characters of the game have no significant interaction with the player, but they are characters who the player either needs to help or avoid:

- ***The guardians:*** originally protected the relics, and when they shattered, they kept their pieces and locked themselves to protect them. However, such isolation and lack of the energy the relics provided made them fall into profound negative states from which they cannot get out of unless they are helped. Guardians are the

equivalent of positive thoughts and feelings, that without proper behaviors represented by the relics, can become negative and hopeless. To get the pieces of the relics they hold, the player must set them free both from their cage and from their negative mood.

- ***The voids:*** represent negative thoughts and feelings, and while they usually work together with the guardians and are part of the balance, the lack of the relics made them stronger, but at the same time blind and more hostile. During the game, it is emphasized that 'voids' are an important part of this world as a reminder that bad situations and emotions are an integral part of our emotional life, which cannot, and should not, be 'killed'. They can be seen in the game together with the guardians after stability has been restored, and the players need to either avoid them or make them run away by throwing stars (condensed positive energy) which the players get in their journey and throughout different tasks.

6.5.2. **Improve mood through puzzle-playing**

In previous chapters, we have seen that puzzles like Match-3 or scrambled words have shown to result in mood improvement. An initial design included 5 puzzle games that provided a variety of tasks: maze, nonogram, Match-3, word scramble, and jigsaw puzzle. To move between areas and get to the guardians, the player needs to cross a maze, but not without collecting all the stars inside the maze. The player must collect all the stars because they will be needed later on to cope with the challenges of later levels. The mazes augment in difficulty as the player advances in each level, both by increasing in size and with the eventual presence of 'voids'. As the player advances in the game, the voids' behavior changes from intermittently appearing and disappearing, randomly walking around the maze, and finally being able to detect and go after the player if the player gets too close. This, not only to avoid boredom, but also to provide a situation where the player needs to be patient and think about the best and more efficient course of action to cross the maze successfully in a shorter time.

Once they have reached the guardian, they need to open their cage by solving a nonogram. These nonograms have an image that represents the guardian and the relic whose piece they are holding. Before opening the cage, our helper gives the guardian's name to the player in order to give hints of what the image could be and help him/her reveal the image more easily. In this initial concept, the player needs to help Lumina remember the name of the relics, therefore guides the player to a Lost and Found area where memories are stored, and the player needs to play a Match-3 to make objects disappear and get all the letters he/she needs to give the name to the relic. Once all letters are collected, the player puts the scrambled letters in the correct order to name the relic, completing its restoration. To end the game, the players need to reconstruct the Self-Knowledge Mechanisms, which is now broken in pieces, and the player needs to rebuild as a jigsaw puzzle.

6.5.3. **Raise awareness of music-listening effects**

No references were found on how to build a game based on emotional regulation using music, nor game mechanics that had been tested and proven efficient for this matter.

Therefore, this is a very first proposal of a game to raise awareness about the effects of listening behaviors in our mood, and how to use it more efficiently, in a way that it challenges the player and keeps the gaming element.

As mentioned before, the guardians are trapped in a negative mood the player needs to help them get out of. Such feelings are represented in a song that has been classified with negative valence. The player first needs to listen to the song and choose, out of three basic negative emotions, the one that is expressed in the song in order to continue. Later on, the player needs to try to guess the strength of such feelings in the guardian according to what the song expresses (e.g. mildly sad, or strongly sad). The objective of these two steps is to train the player to recognize feelings and their degree as a first step towards their regulation. Since everybody perceives music differently, and their emotions evoked by music vary, it is established from the beginning that these songs and the emotions evoked belong to the guardian, a third person, and not to the players.

After these two steps have been completed, a mood bar representing the current mood of the guardian appears, together with a set of songs that come from our helper's memory are provided for the player to select and see how much this song improves or worsens the guardian's state. Once the mood bar is positive, the guardian is free, joyful, and the player gets the shard of a relic. Once again, in these songs, the emotions represented belong to the guardian.

6.5.4. **Incentivize exercise through walking**

As we have said before, an important concern of therapists is the lack of exercise and outdoor activities that many individuals with depression suffer, as they tend to stay home and avoid contact with the outside and others. We have also learned that one of the most concerning aspects of using video games for mental health is the perception of them being particularly addictive and promoting a sedentary lifestyle. To tackle this problem, we propose that, to enable the different levels, the player must walk a certain number of steps. This requirement goes hand in hand with the lack of energy in the world, and the helper has to keep the world open to the player. Therefore, after tasks have been completed, the player is instructed to walk a specific number of steps or time to 'recharge the batteries' and come back to continue the journey. Since all players have different physical conditions, different levels of difficulty are provided for the player to choose and reduce the possibility of exhaustion. To use a sensible requirement in terms of steps demanded for walking, we researched the topic and decided to base on the information gathered by Catrine Tudor-Locke et al. in her review on the subject. Based on her findings, *"healthy adults can take anywhere between approximately 4,000 and 18,000 steps/day, and that 10,000 steps/day is a reasonable target for healthy adults"* (Tudor-Locke et al., 2011, p. 14).

6.6. Initial User Tests

6.6.1. **Tests for maze and nonogram design**

We started by testing the puzzles that we considered as the most essential for the storyline, to gather preferences and behaviors towards these games: the Maze, and the

Nonogram. This test consisted of two participants: 1 male and 1 female, between 30-45 years old.

6.6.1.1. **Methodology**

For this test, paper versions of 10x10 and 15x50 mazes were used, with and without checkpoints (equivalent of the stars to collect), and nonograms of 10x10 and 15x15 were also printed on paper, to be completed every time a player reached a checkpoint; two tokens representing each player were given, and a dice *(See Fig. 8)*. First, the participants tested only moving around the mazes taking turns and using the dice to determine the number of steps they could give each turn. The first test was with a 10x10 maze with no checkpoints. Then, a 15x15 maze with no checkpoints was tested. Later, they played a 10x10 maze with checkpoints and a 10x10 nonogram to complete. After this, they made a 15x15 maze with checkpoints, but with no nonogram to complete. After that, they played a 15x15 maze, with checkpoints where they would have to play a 10x10 picross of easy difficulty, and then a 15x15 picross of medium difficulty respectively. During and after each game ended, the participant would give his/her opinion orally on how difficult the tasks were for them, and the time they took to finish the nonograms were measured.

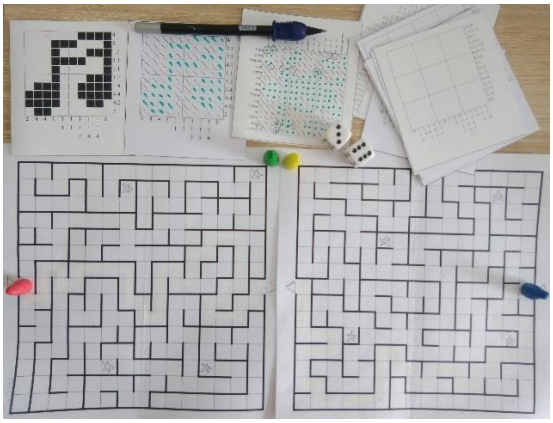


Figure 8. Materials used for initial user test on mazes and nonograms. Picture by Diana C. G. Mendes, 2019

6.6.1.2. **Results**

Based on the oral feedback from the participants, a 10x10 maze with no checkpoints was too simple, and was not a challenge for them; while a 10x10 with checkpoints was a bit more entertaining. 15x15 mazes with no checkpoints were considered entertaining, even though not particularly challenging, but the participants responded better to a 15x15 square maze with checkpoints. On the nonograms, a 10x10 nonogram took 3 minutes on average to be completed and they were completed with minimal errors and a sense of achievement, but 15x15 nonograms took over 10 minutes to finish, were more tiring for the participants, and had more errors.

Overall, these observations seem to suggest that a 10x10 maze with checkpoints could be appropriate for a beginner level or for the beginning of an increasingly demanding set, since it was entertaining but not particularly challenging. A 15x15 maze with checkpoints to reach seemed fun, and entertaining for the participants and might be

the ideal size, as it is not particularly challenging. When it comes to nonograms, 10x10 seems to be the ideal size, augmenting the difficulty by using more challenging images, with more empty squares than filled, or 15x15 as the maximum level of challenge.

6.6.2. **Tests for emotion classification**

Part of emotion regulation requires training on recognizing emotions both in body movement, voice, or more generally, facial expressions. However, for our game, our player needs to guess the emotion felt by selecting a 'face' that shows the emotion expressed. To that end, we need to define which emotion the guardian expresses through these songs, and these should be as general as possible. Therefore, we need to assess the emotion of each song to be used in the game for emotion recognition and regulation.

6.6.2.1. **Methodology**

For these tests, we decided to work with the 6 basic emotions proposed by Paul Ekman (Ekman, 2003): happiness/joy, sadness, disgust, fear, anger, and surprise. Since we are not to use music selected by the players, but we do need a selection that makes sense for the characters of the guardians, we created an initial list based on online YouTube Lists (e.g. Top 10 Saddest Songs of All Time), read comments online, and advice from friends for the emotions that were not explicitly found in online lists (anger, fear).

We used smileys used by Kairos (Face Recognition Company based in Miami) to represent Ekman's initial research in the web article "The Universally recognized Facial Expressions of Emotion" by Cole Calistra (2015) *(See Annex 4)*. We added the name of the emotion under the correspondent smiley. Each song on this list was tested by 6 participants, not all the same, who were asked to listen to an excerpt from a song, and point at the smiley that better represented the song. These participants were university students and researchers at University of Madeira (Bachelor's, Master's and PhD), between 18 and 40 years old.

6.6.2.2. **Results**

The minimum criteria required to catalog a song within a certain emotion was 4 out of 6 individuals stating it belongs to the same emotion. The most common emotions mentioned by the participants were happiness/joy, sadness, anger, and fear; disgust and surprise were rarely mentioned and usually mixed with another. Therefore, the number of categories used in our project was reduced to 4: happiness/joy, sadness, anger, and fear. Out of 82 songs, 20 were effectively cataloged as expressing sadness, 44 expressing happiness/joy, 11 expressing anger, and 7 expressing fear. Mixed emotions were accepted for this first test, but they were classified according to the emotion that was mentioned in the greatest percentage. The list of songs selected can be found in the Annexes *(See Annex 5)*.

6.6.3. **Tests for emotion intensity classification**

6.6.3.1. **Methodology**

For this test, participants were asked to select the intensity of the more perceptible emotion. A list of songs was given, which included the title of the song, the artist, and the emotion it is cataloged as (in cases of mixed emotions, the secondary emotion was shown). Three levels of intensity were featured in this list: light, medium, and strong *(See Annex 6).* The participants were asked to listen to the excerpts and tick or cross the intensity of the emotion they perceived in the song. They were not obliged to listen to the full excerpt. We proceeded to the next one once they had done their selection

6.6.3.2. **Results**

The result of this study was a list of songs classified according to the intensity that had the greatest percentage. Out of 82 songs tested, 78 made it to this list, as the songs that had two conflicting values (e.g. 50% strong/50% medium) were discarded. This list can be found in the annexes *(See Annex 7).*

6.6.4. **Tests for emotion-regulation tendencies**

To complement our research, we also tested how different users would use different songs to ameliorate the emotional state in question. Even though the effectiveness of different songs will be defined by what has been established in the literature as beneficial strategies, we would benefit from testing if our players are likely to use such strategies to manage emotions: choose emotions that mirror or differ from the current emotion, and with what objective.

6.6.4.1. **Methodology**

Each of the participants was asked to randomly select a card with the name of a song expressing a negative feeling (sadness, anger, fear) and the song was played for them. After this, they were asked to pick up four cards out of a pack of positive feelings (happiness/joy), and select one that they thought was the best to take an individual out of the state expressed in the previous song. They were finally asked to justify their choice. A total of 6 participants took part in this study, all between 24-40 years of age, 4 males and 2 females, among them Master's students and PhD researchers. 2 faced a song classified as expressing sadness, 2 faced a song classified as expressing anger, and 2 faced a song classified as expressing fear.

6.6.4.2. **Results**

The participants exposed to the songs expressing sadness faced the same song ("Who wants to live forever" by Queen), and happened to pick up the same piece from 4 random happy songs ("Pretty fly (for a white guy" by The Offspring). Their justification can be reduced to the intention of looking for a boost to leave their sad state, avoiding the calmer options.

The participants exposed to the songs expressing fear faced the same song ("Toccata and Fugue in D Minor" by Johann Sebastian Bach), and selected 2 different songs ("Take on me" by A-ha, and "Walking on sunshine" by Katrina and The Waves).

Their justification can be reduced to looking for positive songs that inspire confidence, no worries, calm, and tranquility.

The participants exposed to the songs expressing anger, faced two different songs ("Sabotage" by The Beastie Boys, and "The kids aren't alright" by The Offspring), and selected two different songs as well ("Mr. Blue Sky" by Electric Light Orchestra, and "Wouldn't it be nice" by The Beach Boys). Their justification can be reduced to the intention of looking for positive songs that make anger diminish without creating a big contrast, not very happy or moved, but that permit getting calm step by step.

We can conclude that there is a tendency to face sad songs by listening to happy and moving songs, their opposite, to leave that state behind as quickly as possible. When it comes to face angry songs, the tendency is to look for calm, but not excessively calm music. Facing songs that express fear, there is a tendency to choose joyful songs that express confidence and tranquility, with no mention of whether they are particularly slow or fast-paced.

6.7. **Low-Fidelity Prototype**

This prototype had the name of ***Harmony***, and was composed of a small cardboard pack imitating a mobile phone, with pencil-made drafts of the elements of the game on-screen in a vertical format *(See Fig. 9)*. It was made following the original mechanics selected and series of tasks: when entering the game, the player would write his/her name to be used throughout the game, see and listen to an introduction of the situation, and would cross a maze to reach the guardian, solve a nonogram to unlock it, and identify the guardian's mood and subsequently change it to a more positive one. For this prototype, an example of this emotion identification and regulation game shows the use of both positive and negative feelings for the player to select; at this stage, the possibilities of using mixed emotions were still being explored. Once all pieces of a relic are collected, the player plays a Match-3 to get the letters that form the name of the relic. Once the letters are collected, the player unscramble the letters to get the relic's name and complete its restoration. Finally, the player directs to the Self-Knowledge Mechanism, where he/she completes a jigsaw puzzle to build it back together and insert the relics in their corresponding niches. In this initial version of the game, the player had access to a map, where he/she could see his/her progress.

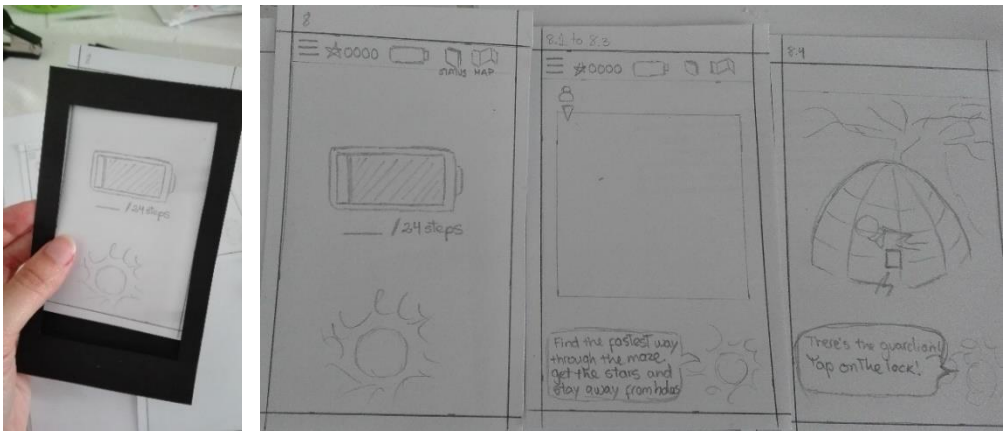


Figure 9. Low-fidelity prototype. Photo by Diana C G. Mendes.

6.7.1. **Low-Fidelity User Tests**

This test had the objective of getting feedback on whether the story was clear, if enough information was given, and whether the mini-games were well connected and made sense within the story. Testing the mini games was not our primary objective. The puzzle games were simulated on a real phone using free applications from PlayStore: *Maze Swipe* (Springcomes); *Nonograms 999 griddlers* (Seventh Rank) and/or *Nonogram Survival* (Gamefox); and *Kids Fruit Puzzles - Wooden Jigsaw* (Skycap), the most similar to what we intended to do. The walking stage was not simulated at this point. Also, the player had access both to a map to see his progress in the story, and a pouch to see the collected items and records (e.g., stars)

6.7.1.1. **Testing with the therapists**

The therapists of the University of Madeira's Psychology Service were the first individuals to test this prototype. All 3 participants were female, 2 in their thirties and 1 in their forties, and only 2 of them played video games, including mobile video games.

As they interacted with the prototype, the researcher would change the screens, and they were asked to give their opinions in real-time aloud and ask any questions they had. We took notes of our observations during gameplay, and after gameplay, they were asked about the aspects they liked the most, and what they would change.

6.7.1.1.1. **Results**

When asked what they liked the most, they mentioned the fact that it had a map, and that the number of guardians was specified. Also mentioned as positive points the connection between the tasks, the connection of the battery with the game, and the well-structured narrative.

When asked about what they liked the least or any proposed changes, they mentioned adding a limit to the game, prizes, background music, and the need to guide the players back to reality in the end. They also suggested a 'skip' button for the player to skip the story if wanted. We could also observe that the name *Harmony*, even though it made sense for the story, reminded them of something completely different and not associated with the story itself. The same happened with the names of some characters. According to our observations, mazes of a maximum of 15x15 were ideal, and 10x10 nonograms were challenging enough for them.

6.7.1.2. **Testing with the general population**

For this second test, modifications were made based on therapists' feedback and observations: the name of the game was changed from *Harmony* to ***Symphony***, a synonym that keeps the meaning of the original name and alludes to music. Some characters' names were also changed and a skip button was added.

This second test had 7 people that belong to the NeuroRehab Lab, part of the Madeira Interactive Technologies Institute. They were 4 male and 3 female, between 24 and 43 years old. The test procedure was very similar to the first test: as they interacted with the prototype, the researcher would change the screens, and they were asked to give

their opinions in real-time aloud and ask any questions they had. We took notes of our observations during gameplay, but after gameplay, they were asked to complete a short questionnaire for more detailed feedback on their player profiles, game's flow, how appealing the story is, and the connections between story, mechanics, and gameplay *(See Annex 8)*.

6.7.1.2.1. **Results**

Based on the results of the questionnaires, out of 7 participants, 6 played video games, and 5 of them reported playing video games on their mobile phones. All 7 participants reported that the game was enjoyable and that there was a good connection between the story, mechanics, and gameplay. They all also expressed that the story was appealing, and 6 believed that the story was fluid. The most appreciated aspects of the game were the variety of mini-games, which provided "more cognitive stimulation and it also challenges the player in a positive way". They also mentioned how fluid the story was, especially appreciating that "all the steps are guided" and that it has "the usual cues and narrator help guiding the game". It was also appreciated the "possibility of hearing enjoyable music" and the mechanics of selecting the music was considered "interesting". Finally, the idea of walking and the fact that "it reflects in the game" was also mentioned as a positive trait.

Amongst what was liked the least and changes they would make, they mentioned how the story was presented, as the introduction was "too long", and "had some repetitions". Therefore, one of the participants expressed it would be better to "reduce the text of the story, more sparse". It was also mentioned the need to "add the puzzle tutorials" and in any case "if the gamer does not need it, add a skip button (even for the story)".

From our observations, we could also note that not only a skip button would be necessary, but more importantly, a 'back' button in case the player misses important information or wants to go back in the dialogue. Also, writing the player's name is not strictly necessary and sometimes confused the player as to whether the name to be written was the one of the character who had previously introduced itself. The way to go through the levels should be consistent, either pass to the next level automatically, or through the map. Adding hints on the best ways or possible strategies to play the games might be useful, even if it is through a simple screen with instructions.

The players went through the maze with no apparent difficulties. They also played a nonogram version that did not give any immediate feedback as to whether the square was really filled or not, which was not very appreciated, but they appreciated a version that gave them feedback as to whether they had pushed the wrong square. Most participants did not know nonograms, and seemed uncertain about whether they were playing them right and what to do despite the hints. Therefore, it is imperative that they start with easy ones and augment the difficulty in subtle ways.

6.8. **Final/High-Fidelity Prototype**

Due to the necessary technical adaptations and time constraints, the high-fidelity prototype presented to the target population suffered significant changes compared to the low-fidelity prototype. The Lost and Found area where the player would find the letters

to identify the relics was removed and no longer having to play a word scramble to spell the relic's name. Once the relic is restored, Lumina identifies the relic and describes it to the player instead. Once all the relics are found, and the player directs to the Self-Knowledge Mechanism, the player does not play a jigsaw puzzle by building back the mechanism, but simply inserts the relics in their corresponding niches, restoring power in Symphony. While in the low-fidelity prototype we gave the player access to a map and a pouch, this feature was not included in this prototype. Even though a 'skip' button was proposed in the previous test, this was not included, since the main aspects of the story were reduced and distributed along with the game; also, it is of our best interest that the player read the story and Lumina's lines for learning and understanding.

Finally, we decided not to use mixed feelings to diminish complexity between song-song dynamics, and used the feeling with the greatest percentage in valence. This prototype includes a step-counter for the walking scenes, and gives the player 3 levels of effort: low (4000 steps a day), medium (8000 steps a day), and high (10000 steps a day), which they choose only once, at the beginning of the game. These steps are distributed in a crescent manner along the three times the player has to walk in one level (e.g. low (1000 steps after fragment 1; 1400 steps after fragment 2; 1600 steps after fragment 3). An extra set of steps are included to open the game for the first time as a warm-up before the actual game starts: low (500 steps), medium (700 steps), and high (900 steps).

6.8.1. **The World and Objectives**

We created a mobile application using Unity (version 219.4.1f1). The player interacts with the world through touch, tapping to activate items or move objects in the scene. For the player to move between levels, he/she has to finish the dialogues and complete the mini-games successfully. The game as a whole is composed of 4 levels devoted to the journey aimed to restore the four relics, each demanding the completion of 3 mini-levels that comprise one maze, one nonogram, and one emotion identification and regulation game to collect a fragment. In the first four levels, the player is asked to take a walking break three times: immediately after a fragment is collected. Each of these levels was designed to have a different environment, which changes according to the restored relics *(See Fig. 10)*. The last level, level 5 comprises one maze, one emotion identification and regulation game, with the final objective of collocating the four relics in the Self-Knowledge Mechanism.

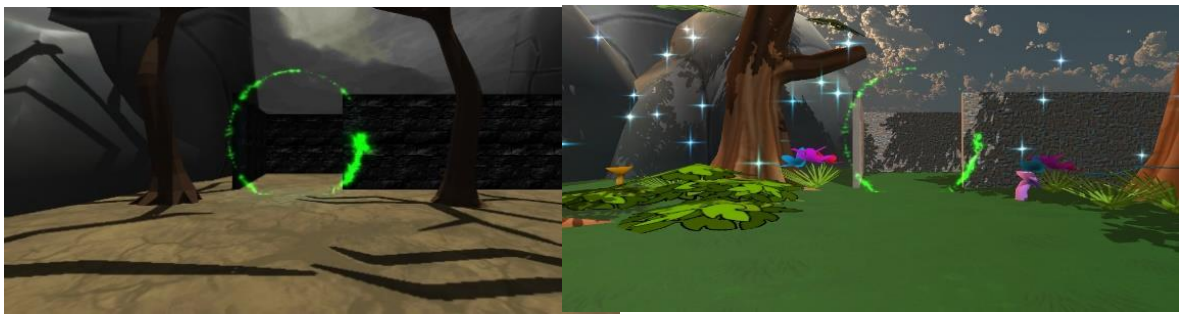


Figure 10. Environment changes level 1 (left) and level 4 (right).

6.8.2. **3D Models**

Most assets for the environment (namely trees, flowers, rocks, skyboxes, and textures) are free assets downloaded from the Unity Asset Store, whose complete list can be found annexed *(See Annex 9)*. The same with both guardians and voids. We used only two models to represent the guardians, one more feminine and one more masculine, whose textures and colors were modified from the original, and any props (e.g., swords, axes) the original models had were removed *(See Fig. 11)*. Voids were also changed in terms of color and texture, abstracting them by disguising the skeletal appearance of their original model and giving them a dark color, as well as props props from the original model were removed (*See Fig. 11*). All relics and the Self-Knowledge Mechanism were modeled by the researcher using ProBuilder (Unity modeling tool) and sprites, and were designed following the low-poly aesthetic of the rest of the game *(See Fig. 12).*

Figure 11. Symphony's Non-player Characters.Left to right: female guardian, male guardian, and void.

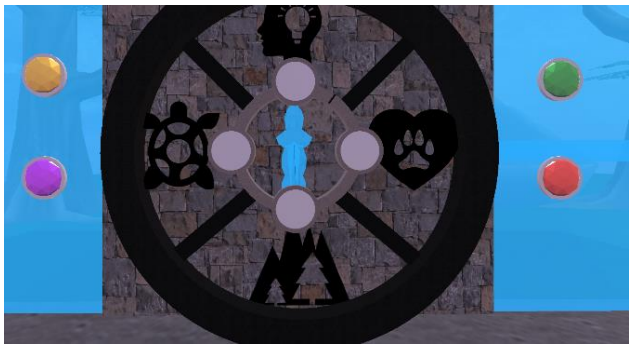


Figure 12. Inactive Self-Knowledge mechanism and the four relics

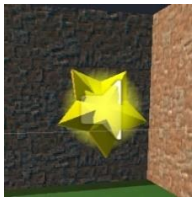
6.8.3. **Mini-games development**

6.8.3.1. **Mazes**

The maze was created using the 'Hunt and Kill' algorithm (Buck, 2011). After creating a grid and defining all its cells, the process implies choosing a starting location, randomly walking and carving passages to unvisited neighbors, until there are no unvisited neighbors in the vicinity. Once it has reached this dead-end, it 'hunts' for an unvisited cell in the grid adjacent to an already visited cell, makes this its new starting location, and restarts the process until there are no unvisited cells in the grid. The maze is programmed to block both the entrance and the exit from the player, and the exit of the maze is unblocked only when the number of stars collected corresponds to the total

instantiated at the beginning of the game. Once the grid and the cells are created, there are basic elements that make up the maze across the levels:

Table 1. Main assets found in the maze mini-games.

Game Object	Description
Player's avatar 	Only used in the maze, it uses ray casts from the camera to determine the point the player taps on. The point the player taps on determines the direction the player will follow at a determined speed, and it will move only as long as the player's tap is detected. It shoots a sphere of light when the Star-Shooter is tapped, and subtracts the number of spheres that are shot from the star-count. When hit by a void, waits for a few seconds, and moves back to the entrance of the maze.
Stars 	We use the cell's floors as possible points to instantiate stars immediately after the maze is created, in random locations, but with a minimum distance between them to guarantee a balanced distribution. These stars are programmed to self-destruct and increase a number to a stars-count once their collider detects the player.
Star-Shooter 	Included in the last three levels, on the left side of the screen. It is programmed to instantiate spheres of light from the player's avatar in the direction of the nearest void and self-destruct once they collide against a wall or a void.
Voids 	Non-player characters are instantiated in the last four levels of the game, and their behavior (AI and Animations) will vary depending on the level.

6.8.3.2. **Nonograms**

The nonogram *(See Fig. 13)* was developed with the technical support and advice of Yuri Almeida. The base of the grid and the buttons of the nonogram were built using ProBuilder. The grid's base is already part of the world, but the buttons themselves are instantiated after building the grid by code. The grid is composed of 10 rows and 10 columns of buttons, and the clue texts corresponding to the filled buttons in a row and in a column that exist in the world, on the left and top of the grid respectively. Once all filled buttons in a column or row have been clicked, the remaining empty buttons of this row or column automatically show without any repercussions for the player. However, when an empty button is pushed by the player, it will be discounted from the total of stars the

player can get from the game (the number of filled buttons in the image). At the end of the game, the number of stars earned is added to the total star-count. Once the grid is clear, the final score is calculated (filled buttons - wrong clicks) and the game ends. Whether a button is filled or empty is determined manually in Unity instantiating the grid beforehand using an Object Builder Editor.

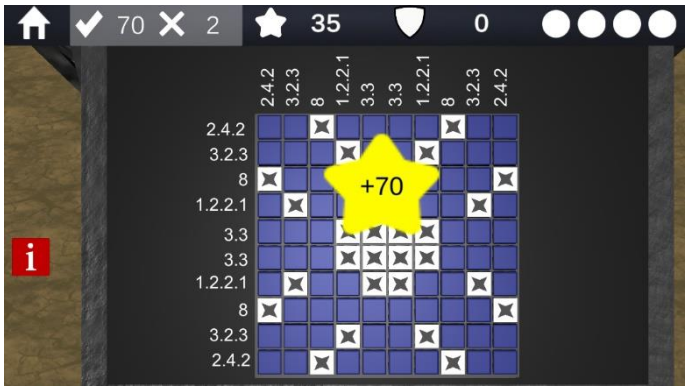


Figure 13. A nonogram mini-game completed

6.8.3.3. **Emotion Identification and Regulation**

The emotion identification and regulation game was also developed with the technical support of Yuri Almeida, and it is composed of many game objects that need to communicate with each other. All these game objects are assigned a category (anger, sadness, fear) and, some of them, an intensity value *(See Table 2)*:

Table 2. Main assets found in the Emotion Identification and Regulation mini-game.

Object	**Description**
Affect Buttons	One per each negative affect. It is instantiated shortly after the enemy, and will check if the affect button pushed by the player belongs to the same category as the enemy. If this is the case, the buttons will disappear and the emoji portraying the enemy is shown, together with an intensity slider *(See Fig. 14).*
Enemies	One per each negative affect. First appears as only audio, and shows once the player has selected its category correctly. Instantiated on the top left *(See Fig. 15).*
Intensity Slider	One per each negative affect. It is interactable and will compare the value where the player moves its handle to with the intensity value of the enemy game object once the player clicks on the button 'Confirm'. Ths slider only has negative values, from strong to neutral (-3 to 0). Only when the values coincide, the slider calls the guardian mood slider and the Allies and destroys itself *(See Fig. 15).*
Guardian Mood-Slider	One per each negative affect. It is the same category as the enemy, and the handle value is set up according to the intensity of the enemy. This slider is not interactable, only moved by code, and it goes from strong negative affect (-3) to a strong positive affect (3). It compares the enemy's and the ally's data and decides from given instructions whether to move the handle back, forward, or not at all.

	Once its value is equal or bigger than 2, all elements of the game are deactivated and the final score is given *(See Fig. 16).*
Allies	One per each positive and negative affect. They are programmed to instantiate in groups of 3, all belonging to a different affect, and they also play a random song from a list of its corresponding category. The Ally's song will only play if its 'play' button is clicked, and only stops playing when its 'stop' button is clicked or the 'play' button of another ally is clicked. After the player clicks on 'play', a few seconds later a button to 'select' the song is activated and sends the slider information about its category and intensity if selected *(See Fig.16).*

The final score depends on the time the player takes to finish the game. A countdown starts at the beginning of the game, starting from the very maximum of stars to get and going to 0, which means no stars are added to the star-count, but neither are stars taken from the total of stars collected during the game nor the game stops. The code also determines whether there is a guardian or a void in the scene to either change the guardian's animation, or destroy the void.

Figure 14. The Affect Buttons in the Emotion Identification and Regulation mini-game.

Figure 15. The Enemy and the Intensity Slider in the Emotion Identification and Regulation mini-game.

Figure 16. The Guardian Slider and Allies in the Emotion Identification and Regulation mini-game.

6.8.3.4. Battery Charging

The battery-recharge scene is based on a ready-made code designed by Kyle Bryant and available in GitHub (https://github.com/bryantk/orca2015/blob/master/Assets/pedo.cs) with minor changes.

This particular step counter uses the acceleration of the device and calculating the movement of the limbs by determining a value when the limb is high and when it is low.

6.8.4. **AI and Animation**

Both guardians and voids use an Animator to determine their different states and links between them. All guardians are set with a default animation of idling with their head down. In the emotion Identification and Regulation game is the active scene, the animation corresponding to the negative song playing activated. Once the mood was corrected by the player, a random positive dancing animation is selected. All the guardians' animations were created by Mixamo, a 3D computer graphics technology company, who has made available many of their animations for free download. All the guardian's states used these animations *(See Fig. 17)*.

Figure 17. The guardians animated to express joy.

The voids use the animations provided with the package of its 3D model, even though not all of the available states were used, and these animations change according to their AI, which were developed with the aid and guidance of Yuri Almeida. The voids AI has three behaviors depending on the level of the game *(See Table 3)*:

Table 3. Voids animations and AI throughout the levels.

Level 2	They are limited to appearing in and disappearing from the maze in random spots where they do not move from and following specific intervals. The voids are animated by default with an 'alert' animation. If a void detects the player colliding with it an 'attack' animation is set
Level 3	They are programmed to walk around the maze with random destinations. A 'walk' animation is set, unless they collide with the player's avatar, in which case they will 'attack'. Before attacking, it will verify there are not any walls in between. They are set to self-destruct and instantiate again in a different spot if shot 3 times by the player.
Levels 4 and 5	They walk in random directions, but if the player is relatively close to the void and is detected by it, it will follow the player until it is out of range and goes back to its random walk. The animations are the same as in Level 3. It also attacks the player during emotion identification and regulation taking decreasing the guardian's mood every time he attacks *(See Fig. 18)*

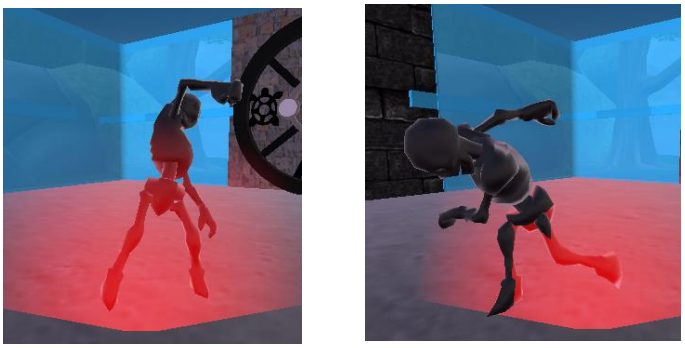


Figure 18. A void animated to attack.

6.8.5. **Music and Audio**

The music used for the emotion identification and regulation game were downloaded from the web, and cut and edited with Audacity (https://www.audacityteam.org/); all excerpts are about 20-30 seconds long. The background music and audio effects were free assets from Unity Store: *Free Music for Puzzle Games* by Aural Space (https://auralspace.home.blog); *Unreleased Game Music Pack* by Cafofo (http://www.cafofomusic.com); and *Free Casual Game SFX Pack* by Dustyroom (http://dustyroom.com).

6.8.6. **Graphic User Interface (GUI)**

The screens, boxes and basic buttons of our UI were obtained from free packs made available in Unity Asset Store: *Modern GUI Skin* by 3d.rina (https://www.artstation.com/3d-rina); *Simple Button Set 01* by That Witch Design (https://thatwitchdesign.wixsite.com/thatwitch)

6.8.6.1. **The Main Screen**

The main menu is a simple screen with three buttons: Enter, Continue, and Quit. The Continue button is only activated when the player has already started the game *(See Fig. 19)*. In the case the game has been previously started, and the player taps on Enter, a confirmation message will pop up, alerting the user that if he/she clicks on this button, the saved games will be lost and therefore will restart the game *(See Fig. 19)*.

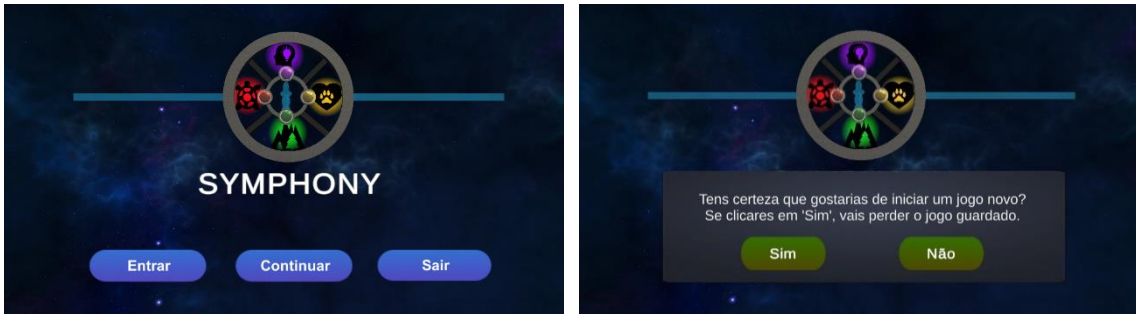


Figure 19. The main menu: with an already started game (left) and the pop-up message warning the player about saved game (right).

6.8.6.2. **The top bar**

Rather than creating a separate screen to keep all the information (or 'pouch'), we use the top bar to keep track of the player's progress, with a home button to go back to the main menu *(See Fig 20)*: From left to write, we have the home button, the number of stars collected, the number of guardians that have been set free, and a visual reference to the fragments and relics that have been collected. A pop-up will always show to confirm if the player wants to leave the game, and if clicked in the middle of a mini-game, it will warn the player that the game will not be saved and will have to restart the mini-game if he/she decides to leave at that point.

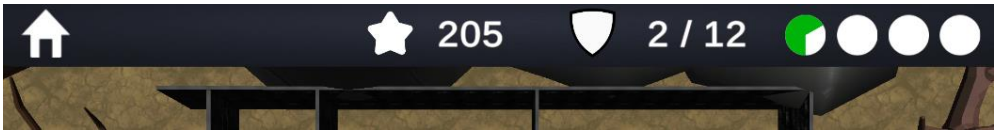


Figure 20. Standard top bar appearance

There is an empty space in the top bar that is only populated in two games: the nonogram and the emotion identification and regulation game. In the nonogram, a counter is added with the number of maximum points (the number of filled spaces) and the number of empty buttons clicked *(See Fig. 21)*.

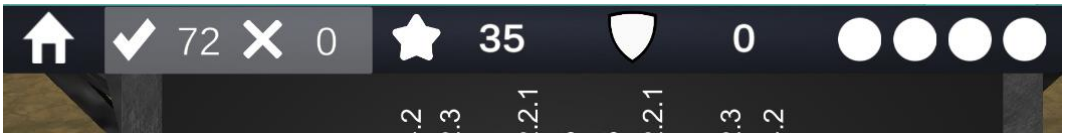


Figure 21. Top bar appearance in nonograms.

In the emotion identification and regulation game, a space with a countdown indicates the amount of time left, and stars to be given, stopping at 0 points *(See Fig. 22)*.

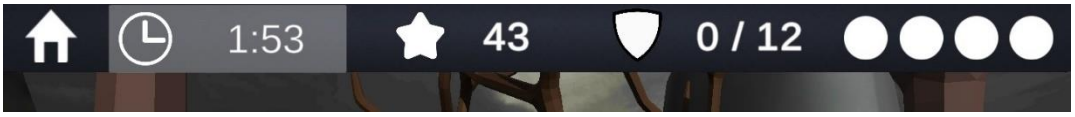


Figure 22. Top bar appearance in Emotion Identification and Regulation mini-game.

6.8.6.3. **The dialogue and Instruction box**

The dialogue box appears automatically at the bottom whenever Lumina needs to give important information, reminds the player what needs to be done or encourages/prizes the player, it has an arrow to go back to the previous line, and a forward arrow to continue the dialogue *(See Fig. 23)*. It closes automatically when there are no more lines. The instructions box appears in the middle only when the player clicks on the corresponding button, and can be closed at any point using the 'x' on the top right corner *(See Fig. 23).*

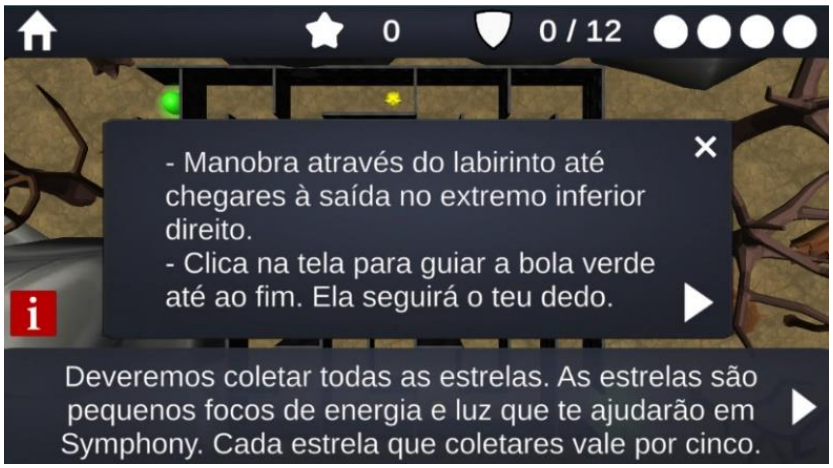


Figure 23. Instructions and Dialogue box in the maze mini-game**.**

6.8.6.4. **The battery and difficulty selection**

This screen is composed of a battery-like bar, the text underneath it with the number of steps given and the target steps. At the top of the screen, a text and a scroll bar where the player will select the level of exercise he/she is willing to do during the game *(See Fig. 24)***.**

Figure 24. Battery charging while walking between scenes

7. Usability Experiment

7.1. Study Design

To study the high-fidelity prototype's usability before taking up an experiment with a sample of our target population, we seeked for volunteers from the general population to test it and give us their feedback. This represents the first test of the mini-games, step-counter, the amount of walking and GUI in general. Since face-to-face interaction was relatively prohibited at this stage and avoided due to Covid-19, with universities closed and all contact between therapists, students, and university done online, all of this process involved using web contact and tools. Participants played the game and were also asked to complete questionnaires that would give us some insight into their mood before and after play, and their considerations of the high-fidelity prototype, feedback that we analyzed and considered for immediate, or future, changes and improvements.

7.1.1. Protocol

Before testing started, the volunteers were asked to fill in an Informed Consent form that was sent to them via Google Forms, were they were instructed about the objective of the project, what would be asked from them, and they were assured that all data collected from them would be kept anonymous and only used for academic reasons. They would then agree on participating and to the use of the data collected. They were given a code and were asked to indicate their age *(See Annex 10).* Once the informed consent was filled, volunteers were contacted via email and requested to fill in the PANAS (The Positive and Negative Affect Schedule) via Google Forms before playing the game. Because the players were able to answer the original PANAS, they completed the English version of this questionnaire *(See Annex 11)*. They were instructed on how to download the game. After this, they were given instructions regarding the game-play:

- The game is to be played in 7 days.
- It has five chapters, and it is recommended that you play only one chapter per day.
- The game is still in the optimization process, so some scenes might take some time to load.
- The data shown in the top bar regarding your progress during the game could still have a bug and not show real progress. If this happens, let us know as part of your final feedback.
- Choose wisely the exercise level you are willing to do since you only choose once and cannot change it throughout the game. Any opinion regarding this, let us know as part of your final feedback.
- If you find any problem that impedes you from playing the game (ex. a UI malfunction within the game), please contact us as soon as possible through this email address: (email of the researcher)

Once the participants finished playing the game, they were asked to complete the PANAS questionnaire again in order to compare their mood before and after gameplay, and they were finally asked to complete a Game Experience Questionnaire adapted to this

particular game *(See Annex 12)*, using some items from the Game Experience Questionnaire created by IJsselsteijn, W.A. et al (IJsselsteijn et al., 2013)**.** We highlight that we want to evaluate very specific items, therefore, we will not use the total score used in the original questionnaire.

7.1.2. Sample

Our sample initially consisted of 12 participants from different backgrounds; from 25 to 44 years old. 4 of these participants quit the game before completing one level due to difficulties to adapt the game demands to their routine, 1 of them did not speak Portuguese and could not play, 1 never started playing, and 1 failed to follow the protocol. Our final sample consisted of 5 participants (3 females and 2 males) between 25-27 years old, Master or PhD students at the University of Madeira.

7.2. Results

7.2.1. PANAS

Although all participants successfully finished the study, only 2 participants were able to complete the test within the established time (7 days). Regarding the PANAS scores before and after playing the high-fidelity prototype *(See Table 4)*, they were generally positive: the positive score increased 3.4 points on average, and the negative score decreased by 0.2 points. In terms of the individual items of this questionnaire, some of them showed minimal improvements on average: the positive item 'interested' increased by 0.4, 'proud' by 1.4, 'alert' by 0.4, 'inspired' by 0.2, 'determined' by 0.6, 'attentive by 0.2, and 'active' by 0.6 values. Some negative scores showed small reductions such as 'guilty' by 0.2, 'scared' by 0.4, 'ashamed' by 0.2, 'jittery' by 0.4, and 'afraid' by 0.2 values on average.

However, 'excited' decreased by 0.4; and 'distressed' increased by 0.8, and 'irritable' had an increase of 0.4 values. The questionnaire's remaining items ('upset', 'strong', 'hostile', 'enthusiastic' and 'nervous') remained the same both before and after playing the game.

Individually speaking, the differences (increase or decrease) were of only one point in most cases. However, more substantial changes happened in participants 2 and 4. Participant 2 had 2 values of increase in 'active', 'determined' and 'proud' items, but there was also a 2-value increase in the negative item 'distressed'. Also, participant 4 had a 2-value increase in the positive item 'alert', and an increase of 4 in 'proud', and decreased negative item 'scared' by 2. However, the positive item 'excited' decreased by 2, and 'distressed' increased by 3. Despite the latter, they had the highest level of improvements in the positive score (by 7 and 9 values respectively). Only one participant, participant 5, showed a decrease in his/her positive score of 5 values after playing the game.

Table 4. Table of Results: PANAS from Usability Experiment Sample.

It shows all 20 items, and the Positive Affect Score and Negative Affect Score. In all cases, two columns show the results Pre-intervention (Pr) and Post-intervention (Po). The average of all columns (Av) and their median value (Me) are also presented.

Part.	Item 1		Item 2		Itme3		Item 4		Item 5		Item6		Item7		Item8		Item9		Item10		Item 11		Item 12		Item13		Item 14		Item 15		Item 16		Item 17		Item 18		Item 19		Item 20		Positive Score		Negative Score	
	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po
P1	4	4	1	1	5	4	2	1	4	4	1	1	1	1	1	1	4	4	3	4	1	1	1	1	1	1	4	3	3	1	4	4	4	4	2	1	3	4	1	1	36	36	14	10
P2	4	4	1	3	3	4	1	2	3	3	1	1	1	1	1	1	3	3	2	4	2	3	3	3	1	1	2	3	1	1	2	4	3	4	2	2	3	5	1	1	28	37	12	16
P3	3	4	3	3	2	3	1	1	3	4	2	1	1	1	1	1	3	3	3	3	2	2	1	2	1	1	3	4	1	2	3	4	3	3	1	1	3	3	1	1	27	33	14	14
P4	4	5	1	4	5	3	1	1	1	1	1	1	3	1	1	1	2	2	1	5	1	2	1	3	2	1	3	4	3	3	4	4	2	3	2	1	3	3	2	1	26	33	17	16
P5	4	4	2	1	4	3	1	1	4	3	1	1	1	1	1	1	4	4	4	4	2	2	2	1	1	1	3	2	1	2	3	3	3	2	1	1	3	3	1	1	34	29	12	12
Av	3.8	4.2	1.6	2.4	3.8	3.4	1.2	1.2	3	3	1.2	1	1.4	1	1	1	3.2	3.2	2.6	4	1.6	2	1.6	2	1.2	1	3	3.2	1.8	1.8	3.2	3.8	3	3.2	1.6	1.2	3	3.6	1.2	1	30.2	33.6	13.8	13.6
Me	4	4	1	3	4	3	1	1	3	3	1	1	1	1	1	1	3	3	3	4	2	2	1	2	1	1	3	3	1	2	3	4	3	3	2	1	3	3	1	1	28	33	14	14

List of items:

1. Interested
2. Distressed
3. Excited
4. Upset
5. Strong
6. Guilty
7. Scared
8. Hostile
9. Enthusiastic
10. Proud
11. Irritable
12. Alert
13. Ashamed
14. Inspired
15. Nervous
16. Determined
17. Attentive
18. Jittery
19. Active
20. Afraid

7.2.2. Symphony - Game Experience Questionnaire

As for the Game Experience Questionnaire, scores go from 0 (not at all) to 4 (extremely), 2 considered a medium-term (moderately).

I. **Regarding the game experience as a whole:** some positive aspects had a quite positive result in average: 'I was interested in the game's story' got an average of 3.4, and 'It was aesthetically pleasing got a 3. 'It felt like a rich experience' got a medium score of 2.8. Some negative aspects had a medium or low score on average: 'It gave me a bad mood' got 1.4, 'I thought it was hard' received a 1.8. Also, 'I had to put a lot of effort' got a 2.6.

II. **Regarding the mazes:** most values were relatively medium or low, both positive and negative: positive item 'I felt skilful' received the average value of 1.8, 'I felt challenged' 2.8, and 'I felt good' 2.8; while the negative item 'I felt bored' got 0.6, 'I felt frustrated' 2.2, and 'I found it tiresome' 1.2.

III. **Regarding the nonograms:** the average values were generally medium or low, both in the positive and negative aspects, similarly to mazes: positive item 'I felt skilful' received the average value of 1.8, 'I felt challenged' 1.8, and 'I felt good' 2.4; while negative item 'I felt bored' got 0.8, 'I felt frustrated' 1, and 'I found it tiresome' 1.

IV. **Regarding the Emotion Identification and Regulation Game:** the average values were mostly low, with some medium, both in the positive and negative aspects: positive item 'I felt skilful' received the average value of 1.2, 'I felt challenged' 1.2, and 'I felt good' 2.4; while negative item 'I felt bored' got 1.4, 'I felt frustrated' 0.6, and 'I found it tiresome' 0.8. The items related to their interaction with the characters, 'I influenced the mood of others' was 1.2 on average, 'the other actions were dependent on my actions' got 1.8, 'When the other(s) was(were) happy, I was happy' a 2, and 'What I did affected what the other(s) did' a 2.2.

V. **Regarding their feelings after playing the game:** positive items had the highest values on average, being 'I felt proud' an average of 3, and 'I felt satisfied' of 2.8; Negative items had low values, 'I felt bad' and 'I found it a waste of time' had an average of 0, and 'I felt exhausted' a 0.6, and 'I felt I could have done more useful things' a 0.8.

VI. Other questions:

a. **What they believe the game was about:** 2 participants thought the game was about emotional regulation and controlling your emotions, while the others saw the game as a journey toward wellbeing by gaining coping

strategies, or improving our emotional state through the accomplishment of smaller goals.

b. **What they believe was the role of music in the game:** The participants recognized its relation with emotions, and saw it as “a tool to understand and regulate the expressed emotions”, and to change or give a boost to your mood. P1 described the music’s role as “to change the mood of the player”, while P3 expressed that “The music had the main role of changing the emotional state of the main character”. P5, in particular, saw it as a metaphor: "for example, when we feel sad, we can surround ourselves with positive things (happy songs) to help us feel better. However, feeling sad is as valid as feeling any other way, so sometimes it is ok to keep that feeling for a while (sad songs)".

c. **To what extent this game could influence their future behavior:** For this question, the values used were from 1 (Not at all) to 5 (Extremely), and on average, the level of influence the participants reported was 2.6, being P2, P3 and P4 the ones who reported most influence (3, 3 and 4 points respectively), and P5 reported the least influence (1).

d. **The most useful strategies they used:** 2 participants mentioned walking/stretching to change or improve their mood. 2 times was mentioned the use of the right music to help improve mood. While P4 referred to the “the entertaining part to not think on my problems”. P3 mentioned “waiting patiently during the most advanced levels of the mazes” as a useful strategy. Only P5 mentioned that he/she did not use any strategies.

e. **What was most appreciated about the game:** 2 participants appreciated the walking, how “the game encourages us to be physically active”, and the fact of the game “making you go outside”. The music and soundtrack were also mentioned three times, one expressing that “the music is a big plus, making it more engaging”, and one with a particular like for the “Soundtrack of the menu and steps section”; P5 in particular expressed that “sometimes, it was a sad song and we had to choose a song with the same emotion, it subtly alerts to the importance of experiencing sadness, as well as any other emotion”. P4 mentioned that he/she liked ‘the maze and the picross’ (nonogram), and P2 mentioned that “the cognitive games are fun and challenging”. P3 highlighted ‘the moral of the story’ as his/her favorite feature.

f. **What was least appreciated about the game:** First, the number of steps to be walked, mentioning P2 that “walking 3 times per day seems too much”, and the fact that the game would not save the steps or run in the

background. The second least appreciated aspect of the game was the repetitiveness of the mini-games and how there could be more variety of tasks, with one participant stating "Probably if when trying to obtain the gems we had different games, it would feel more challenging and keep our interest in the game". More specific comments were the fact of the voids in the mazes being particularly challenging; P2 mentioned that "the labyrinths, because of how the voids act, can become a bit unfair to the player". Despite the nonograms being considered as 'a great component of the game" for P4, he/she also mentions that they have images that sometimes are not clear; also mentioned that changes in the environment should be more contrasting and that some ideas should be explained to the player in a psychoeducational way.

7.3. Conclusions and Discussion

First of all, it is important to note that, in general, this sample consists of 5 individuals who, according to self-report in the PANAS, can be considered emotionally healthy. This could influence the impact of any positive or negative aspect of the game, as emotionally stable individuals are believed to be better able to deal with negative emotions, such as frustration. We must also consider the possibility of 'complacency' as a factor when choosing their answers for any of the questionnaires; however, since we cannot tell if this was a factor or not, we see these results as honest selections of their feelings.

Even though there are no notable differences between the before-play and after-play scores in the PANAS, we consider that an increase of 3,4 points and the fact that the average negative score did not increase are quite positive factors. The individual variations between pre and post-play results, as it can be the lack of notable differences such as P1, or big improvements (or not) like P2, P4 and P5, could be related to the game experience itself or the participants' preferences in games. Nevertheless, there is always the possibility that external factors (e.g., good/bad family/academic experiences) influenced these results.

Now focusing on the game itself, it is very relevant that the game's story and aesthetics and the feeling of pride after finishing the game had very good scores on average. Also, it is also satisfactory that they somewhat felt it was an enriching experience and felt satisfied after playing. However, the fact that the item 'I had to put a lot of effort' got a moderate score, brings questions as to whether this is a positive or negative sign. Should a player finish a game with no effort at all? or making a greater effort is an essential part of game play? Only through the analysis of the tasks themselves we might get an answer to where Symphony stands in this matter.

Starting with the puzzles, the only two participants who mentioned the puzzles as what they liked the most about the game, were also the participants whose PANAS positive scores increased from 7 to 9 values after play. It is possible that these participants are fond of playing puzzle games in general and therefore had a more positive emotional outcome. P4 also mentioned "entertaining to not think about problems" as a strategy

he/she used during the game, which seems to go hand-in-hand with the theory that game-play is useful for interrupting cognitive rehearsal of negative situations. However, this is to be seen with care, since simple 'distraction' can become 'avoidance', hence the importance of controlling play-time giving external, real-world, tasks (e.g., walking).

Puzzles had, individually, different levels of acceptance and challenge. Mazes, for instance, were considered moderate to very challenging, which we could consider favorable, mainly because they felt moderately good; when it comes to the level of frustration, it was not very high on average, which makes us believe that this game could be closer to an 'ideal' balance between challenge and frustration. It is also very important to remember that P3 mentioned waiting patiently as part of his/her strategies used, which we consider being quite positive since this was one of the aims of creating the voids and it is an aspect that is reflected in the game as one of the elements of resilience. Nevertheless, it was stated by P2 that because of how the voids act, the maze could become a bit unfair to the player. Further informal contact with this participant suggested that voids are sometimes instantiated either too close to the entrance, giving them less chance to think about their strategy or move. P1 also stated in informal contact that when the player did not have enough stars, the maze became too challenging and frustrating.

Even though the nonogram was considered by P5 as a "great component of the game" and had a very low score in 'boredom', it only brought low to moderate feelings of skilfulness and challenge, and the player felt moderately good. In other words, we have to consider how to increase these values to make the game much more satisfying in the future. It was also suggested that sometimes the images were not clear. Informal contact with another participant also suggested that the buttons' size was small and sometimes made them accidentally click on the wrong buttons, causing a bit of frustration. However, this is the standard size for nonograms in mobile games, and those that have zooming-in/out have the problem of losing the general perspective of the image and could be equally uncomfortable. Overall, this was an isolated case.

The last game, the Emotion Identification and Regulation one, had a relatively low score in general, being its only moderate value 'feeling good'. Even though this game had the highest 'feel good' value among the minigames, and it is a good sign that negative values were low, the levels of challenge and skills required are considerably low, which means that it will possibly need much more work to become an actual game, with the proper balance challenge/frustration, and boredom/excitement. The music factor was one of the most frequently appreciated; especial mentions were the background music selection and the use of sad songs to accept negative feelings as part of healing. This last point is related to the game's main purpose, which was apparently achieved, as participants mentioned the importance of 'emotion regulation' and using the right music to improve mood.

It was quite positive that at least one participant recognized and supported the idea of using music mirroring feelings as a way of coping and that negative feelings are a normal part of life. However, only one participant expressed directly that he/she recognized they were using music to regulate the emotions of the guardian, while one associated this game to "regulating the player's mood". For a player thinking of these songs for his/her own regulatory purposes, the game can be seen as inappropriate and the

dynamics between songs hard to understand as, first, his/her connection to one song might be different from the standard gotten from our tests, and they may not satisfy their personal/emotional needs.

A second most appreciated aspect of the game was that it forced them to go outside and walk, and was seen as a strategy to improve mood, consistent with our overall objectives. Nevertheless, its adaptation to the game may need some work, as walking 3 times a day was considered too frequent and challenging to adapt to daily routines; and it was also informally stated by a couple of participants that the number of steps seemed too much for an app that is not aimed at fitness. Another issue was that the game would not save the steps when the game was closed or the phone went on standby, and it would not keep the step counter working in the background. Hence, the player had to either leave the phone always on or start walking from the beginning again.

Finally, another least appreciated aspect of the game, but one we already expected, was the repetitiveness of mini-games. The way the game was initially designed (with other games that would show less but break with the routine, like match-3 and word puzzles), might have helped to feel more dynamic. The participants' advice to vary the games or not always complete the same tasks for the same objectives is good to be considered in the future.

Despite technical limitations and time constraints of the project, we successfully implemented the following improvements:

- We changed the pedometer used in the game. Instead, we used and adapted a step-counter programmed by Yusuf Olokoba (https://github.com/olokobayusuf/Pedometer-API), which works in the background. Also, we created a 'skip' option, always hoping the player will stick to the rules. We also changed the way the walking scene is presented. Instead of having one scene with everything, there is one first scene with Lumina asking the player to select the effort level *(See Fig. 25)*. After this selection has been made, the scene with the battery and the step counter working shows. The steps given are no longer shown, only the target steps *(See Fig. 25)*. We also made changes in the saving system, saving the game every time a step is counted. Therefore, making sure that even if the phone goes off in the middle of a walk, these data have already been saved.

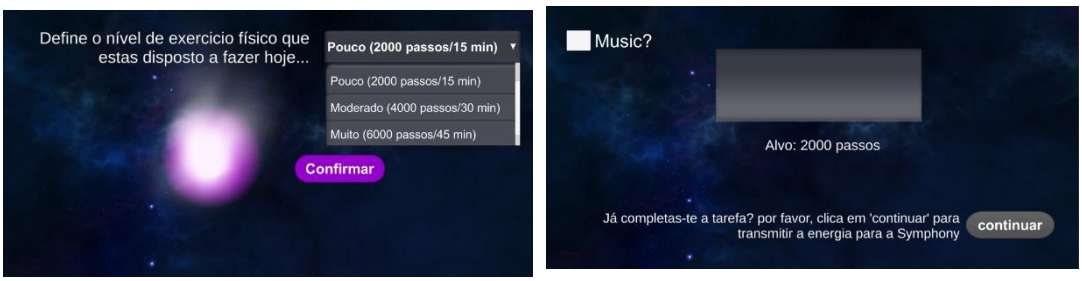


Figure 25. Modified exercise selection (left) and battery charge (right)

- The frequency of walking and the number of steps were also rethought. First, we reduced the daily number of steps by half and added the walking time it takes in

case the pedometer fails: low (2000 steps/15 minutes per day), medium (4000 steps/30 minutes per day), and high (6000 steps/45 minutes per day). Moreover, instead of having to walk three times a day, the player only needs to walk once a day, ideally before starting a new level.

- We added a 'resting' area at the maze entrance, where the player is spawned, and the voids cannot either access or detect the player *(See Fig. 26)*. We also increased the number of stars added in the star-count for every star-item collected in the maze, for two reasons: first, because the number of stars to be spawned are limited to the size of the maze (never bigger than 15x15), which means that this is the mini-game where the players get fewer stars despite being the one that requires the greatest effort. Therefore, every star-item collected in the maze is worth 3-5 stars in the star-count. Second, the more stars the player has in the last level, the easier it is to complete the maze, which will reduce frustration and the level of challenge. We also reduced the number of voids to be spawned in the maze for this purpose.

Figure 26. Modified maze with resting at the entrance.

- We made changes in the 'score display' from the nonogram and the Emotion Identification and Regulation game. In the nonogram, while in the past the display always showed the total of possible points with a tick, and the total of errors with an 'x', now the x shows the number of errors, and as errors happen, the number in the tick is reduced by one. This way, the player is aware of the points it is losing as errors happen and learns how the final score is calculated.
- In the Emotion Identification and Regulation game, we changed the 'clock' icon for a 'stars' icon since the 'clock' made the players think that they had a time limit to do the task before 'game over' and was not clear that they could continue even after reaching 0, or that the number of stars won depended on this number *(See Fig. 27)*. We also increased the countdown start number, so the player had more possibilities to win an appropriate number of stars.

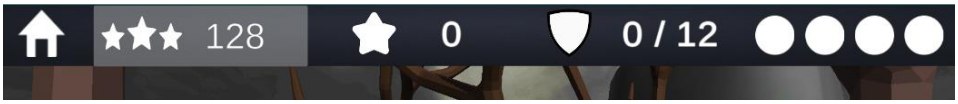


Figure 27. Modified top bar for the Emotion Identification and Regulation mini-game

- Other changes were made in the Emotion Identification and Regulation game, such as giving more transparent tips on the dynamics between the songs work in the instruction, and Lumina instructing the player to find this information by reading the instructions of the game. We also set that whatever song is played as the Enemy (the negative song that represents the initial negative effect of the guardian) does not show in the options of the Allies (songs facilitated to fight the initial negative affect), as it did not seem to make sense to have the same song to fight itself.
- Improvements were done in the UI, more specifically, the forward/backward buttons of the dialogue box, whose responsiveness was sometimes low. We also added visual aid the first time each of the mini-games appear as part of the instructions (e.g., a hand icon indicating you need to touch and guide de player)
- Unfortunately, we were unable to fix some minor bugs existent in the artificial intelligence of the voids with the time and knowledge we had available:
    - If the player touches a wall that the void is also touching on the other side, the void can still attack the player, despite the fact there is a line of code to avoid this.
    - Despite the fact that the voids are instantiated similarly to the coins and, therefore, should not spawn on the same spot, sometimes this happens.

Voids sometimes may get stuck or stop moving for some reason, which might be related to a logic error that has not been found yet

8. Field Experiment

8.1. Study Design

In the following pages we will be presenting the steps taken to test the final/high-fidelity prototype in a sample of our target population. We followed a similar protocol to the usability experiment, asking our player to fill in specific questionnaires before and after the play experience; we later put together the results and discussed these findings.

8.1.1. Protocol

All contact with the participants of this experiment took place online, in Portuguese, and with their therapist from the Psychology Service of the University of Madeira as an intermediary. We asked all participants of this study to, first, fill in an Informed Consent form in Google Forms format sent to them via email *(See Annex 13)*. In this form, they were instructed about the project's objective, what would be asked from them, and they were assured that all data collected from them would be kept anonymous and only used for academic reasons. They agreed to participate and to the use of the data collected, and were given a code. They were also asked to fill in three more Google Forms documents, before they started playing the game:

- A Demographics questionnaire to collect information such as their age and profession, and information about them as video game players *(See Annex 14)*;
- The Portuguese version of the PHQ-9 (Patient's Health Questionnaire - 9), a self-report instrument designed to evaluate the severity of depressive symptoms *(See Annex 15)*. It is constituted by 9 items, with a Likert scale of four items: 0 (Never), to 3 (Almost Every Day). The total score is obtained by summing up all 0, 1, 2, and 3 along with the 9 items, and the maximum score possible is 27 points (0-4 - Minimal/5-9 - Mild/10-14 - Moderate/15-19 - Moderately Severe/20-27 - Severe). The last item includes the extent to which these 9 previous items influenced, or made more difficult, their daily life performance in terms of work, taking care of their home, or dealing with other people.
- The Portuguese version of the PANAS (Positive and Negative Affect Schedule) in order to determine the emotional state of the player before play (Costa Galinha & Pais-Ribeiro, 2005) *(See Annex 15).*

Finally, they were instructed how to download the game and provided with the following instructions:

- In general, the game should be played in 5 days.
- The game is composed of a total of 5 chapters: before each chapter starts, the game will ask you to go for a walk. You must complete a chapter per day.
- The mini-games are only saved when concluded, going to a new scene. Therefore, try not to leave a mini-game in the middle, unless you really want to restart this mini-game.
- We strongly recommend you to take notes of what you like (or not) along the experience, and anything you think could be improved in the future.

They were also reminded to contact the researcher through email and not to hesitate to contact the Psychology Services of the University of Madeira if they needed support or wanted to share anything important about their well-being during the experiment. Finally, they were asked to contact the researcher or the Psychology Services once they had finished the game to receive some questionnaires to be filled in after-play and call the experiment to an end. The post-game assessment included completing the PHQ-9 and the PANAS once more. Also, they were finally asked to complete a Game Experience Questionnaire *(See Annex 16)* adapted to this particular game, using some items from the Game Experience Questionnaire created by IJsselsteijn, W.A. et al (IJsselsteijn et al., 2013)**.** We highlight that we want to evaluate very specific items, therefore, we will not use the total score used in the original questionnaire.

8.1.2. Sample

The sample for this study was composed of volunteers who were receiving therapeutic support at the University of Madeira's Psychology Service. They were a total of 8 participants, all of them students: 5 females, 2 males and 1 undisclosed gender; between 20 and 28 years old, and with different backgrounds, from Technology and Programming of Information Systems, to Visual Arts. All of the participants were selected for being under observation for depressive symptoms.

8.2. Results

8.2.1. Demographic Questionnaire

As for their playing tendencies, 7 out of 8 participants expressed to have played video games, while one reported that 'Maybe'. Out of 8 participants, 4 play up until one hour a day, 1 plays between 1-2 hours a day, 3 play over two hours a day. Regarding their reasons to play video games, 4 reported doing it to spend their free time, 2 described playing to 'enjoy time differently, in a different reality', while 2 other players do it for relaxing, and socializing with other players respectively. All of the participants play video games at home in their free time. 4 of them reported preferences for playing alone, while other 2 prefer to play with other players online, and the last 2 participants prefer to play with others face-to-face. When it comes to types of games, 3 expressed preferences for online games to play with others, 2 others have no preference and play any game, while the other 3 participants varied, preferring puzzles, car racing, and platform games respectively. Finally, 3 participants reported enjoying the music in video games but preferring to listen to their own music, while 2 reportedly like music in some game menus, 2 typically deactivate the game's music, and 1 always listens to game's music.

8.2.2. PHQ-9

Regarding the PHQ-9 scores, since this was a very short intervention, no significant changes to the clinical diagnosis were expected. Tests were done in SPSS software, more specifically a Wilcoxon test, to evaluate these differences, all items retaining the null hypothesis. The value obtained from the difference in the total score between the two

conditions (before and after play) was ,497 of p. On average, depression scores decreased 1 point post-intervention. Most items in the questionnaire showed small improvements on average, being the most significant 'I had difficulties to fall asleep or to sleep without interruptions', and ' I felt that I do not like myself - or that I am a failure, or have disappointed myself or my family', both of which had a decrease of 0.375. However, some other items increased in smaller values, being these 'I had lack or excess of appetite' which increased by 0.25 on average, and 'I moved or talked so slow that other people might have noticed, or the opposite: I was agitated to the point of walking around more than usual' by 0.125.

The most relevant changes can be seen when analysing participants individually *(See Table 5)*. For instance, P4's score of depressive symptoms decreased 7 points, and P5's decreased 6 points. In other words, from 'Moderately severe' and 'Moderate' before play respectively, evolved to 'Mild'. P3 and P6 showed a smaller decrease of 1 ('Mild' before play/'Mild' after play) and 2 values respectively ('Moderately Severe' before play/'Moderate' after play). Nevertheless, P8 increased 5 points ('Moderate' before play/ 'Moderately Severe' after play), P1 increased 2 points ('Moderate' before play/'Moderately Severe' after play), and P2 increased by 1 ('Moderate' before play/'Moderate' after play). P7 showed no differences pre to post-play ('Mild' both before and after play).

8.2.3. PANAS

For the PANAS scale, in the positive affect score, higher scores represent higher levels of positive affect, while in the negative affect lower scores represent lower levels of negative affect. The same as with the PHQ-9 questionnaire, tests were done in SPSS software, more specifically a Wilcoxon test, to evaluate these differences, all items retaining the null hypothesis. The value obtained from the difference in the Positive Affect score between the two conditions (before and after play) was ,0.62 of p; while that obtained from the difference in the Negative Affect score was ,497 of p. In other words, no statistically significant changes were observed. However, the average results showed mood improvements. The positive affect score showed an average increase of 2 points, while the negative affect score decreased on average 3.625 points after play. The positive item in this questionnaire that had the highest increase was 'Active', with an increase of 0.625; and the highest decrease in negative affect items can be seen in 'Guilty' with a decrease of 0.875, followed by 'Disturbed' by 0.75 points, and 'Tormented' by 0.625. Only two negative items showed an average increase: 'Nervous' by 0.125 points, and 'Jittery' by 0.375.

Individually speaking, the participants with the most remarkable differences were P3, P4, P5 and P6 *(See Table 6)*. P6 showed the highest increase in the positive affect score of 7 points, and the highest decrease of negative affect score of 17 points; P4 increased his/her positive affect score by 3, and showed a substantial decrease of 11 points in the negative affect score. P3's positive affect score increased by 4, and a decrease of negative affect score of 6. P5 showed an improvement of 2 points in his/her positive affect score, and a decrease of 5 in the negative affect score. P8 showed an increase in

both measures (2 points in the positive affect score, and 1 in the negative affect score). P7 showed a decrease in the positive affect score and an increase in the negative affect score of 1 point for both. Only P1 and P2 showed important increases in the negative affect score of 4 points, while their positive affect score changes were null and minus 1, respectively.

Individual items in the PANAS mostly increased or decreased by 1 point, with a few exceptions. P6 showed a considerable decrease in several negative items: 'Tormented' by 5 values, 'Guilty' by 3, and 'Disturbed', 'Scared', Remorseful' and 'Disgusted' by 2; and he/she showed an increase of 2 values in both positive items 'Determined' and 'Active'. P4 also showed a notable decrease in negative items: 'Guilty' and 'Remorseful' decreased by 3 values, while 'Disturbed' decreased by 2. Other participants showed changes greater than 2 in isolated items: P5's 'Disturbed' item increased by 2; P3 showed a reduction of 2 points in 'Guilty', and P2 showed a 3-value increase in 'Active'.

Table 5. Table of Results: PHQ-9 from the Field Experiment Sample.
It shows all 10 items, and the final Score. In all cases, two columns show the results Pre-intervention (Pre) and Post-intervention (Pos). The average of all columns (Av.) and the median value (Me.) are also presented.

	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8		Item 9		Item 10		Score	
	Pr	Pos	Pre	Pos	Pre	Pos	Pre	Pos	Pre	Pos	Pre	Pos	Pre	Pos	Pre	Pos	Pre	Pos	Pre	Pos	Pre	Pos
P1	2	2	2	2	1	0	1	1	2	3	1	2	1	1	1	1	2	3	1	1	13	15
P2	1	1	1	1	3	3	1	1	3	3	1	1	0	0	0	1	1	1	3	0	11	12
P3	1	1	1	0	2	3	1	1	1	1	0	0	2	1	0	0	0	0	1	1	8	7
P4	2	1	1	1	2	0	3	2	0	0	3	2	3	1	0	0	1	1	2	0	15	8
P5	2	1	1	0	1	1	1	1	2	1	2	1	2	2	1	0	1	0	2	1	13	7
P6	2	1	2	2	1	1	2	1	1	3	3	2	1	1	1	1	3	2	2	2	16	14
P7	1	1	1	1	0	0	1	1	0	0	1	1	1	1	0	0	0	0	1	1	5	5
P8	1	2	1	2	3	2	3	3	2	2	2	1	2	3	0	1	1	1	2	2	12	17
Av.	1.5	1.25	1.25	1.125	1.625	1.25	1.625	1.375	1.375	1.625	1.625	1.25	1.5	1.25	0.375	0.5	1.125	1	1.75	1	11.625	10.625
Me.	1.5	1	1	1	1.5	1	1	1	1.5	1.5	1.5	1	1.5	1	0	0.5	1	1	2	1	12.5	10

List of items:

1. Little interest or pleasure in doing things
2. Feeling down, depressed, or hopeless.
3. Trouble falling/staying asleep, sleeping too much.
4. Feeling tired or having little energy.
5. Poor appetite or overeating.
6. Feeling bad about yourself, or that you are a failure, or have let yourself or your family down.
7. Trouble concentrating on things, such as reading the newspaper or watching TV.
8. Moving or speaking so slowly that other people could have noticed. Or the opposite; being so fidgety or restless that you have been moving around more than usual.
9. Thoughts that you would be better off dead or of hurting yourself in some way.
10. If you checked off any problem on this questionnaire so far, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Table 6. Table of Results: PANAS from Field Experiment Sample.

It shows all 20 items, and the Positive Affect Score and Negative Affect Score. In all cases, two columns show the results Pre-intervention (Pr) and Post-intervention (Po). The average of all columns (Av.) and the median value (Me.) are also presented. Items were originally in Portuguese, translated into English below:

Part.	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8		Item 9		Item10		Item 11		Item 12		Item13		Item 14		Item 15		Item 16		Item 17		Item 18		Item 19		Item 20		Positive Score		Negative Score	
	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po	Pr	Po
P1	3	2	2	3	3	3	2	2	1	2	3	3	2	2	1	1	1	1	3	2	1	2	3	2	2	2	1	1	2	3	2	4	3	2	1	3	2	2	2	2	21	21	19	23
P2	3	2	3	3	2	1	2	3	1	1	3	3	4	3	1	1	1	1	2	2	2	2	3	3	1	1	3	2	3	2	2	4	3	2	1	3	1	4	1	2	19	18	23	27
P3	3	3	3	2	4	4	2	1	4	3	4	2	3	2	2	2	1	1	2	3	1	2	1	2	1	1	3	2	1	3	3	2	1	2	2	1	2	2	1	2	21	25	23	17
P4	1	2	3	1	1	2	2	1	1	2	4	1	1	1	1	1	1	1	1	1	1	1	3	2	1	1	4	1	1	1	1	1	1	1	2	1	1	1	1	1	10	13	22	11
P5	2	2	3	1	2	2	2	3	1	2	3	2	2	3	3	3	1	1	2	2	1	2	3	2	1	1	3	2	2	3	3	2	2	2	1	1	1	2	3	2	18	20	24	19
P6	3	3	4	2	1	2	5	2	2	3	4	1	3	1	2	3	4	2	2	3	4	3	5	4	1	1	3	1	3	3	2	1	2	4	1	1	2	4	3	2	22	29	34	17
P7	3	3	2	2	2	2	2	1	3	2	1	2	1	1	1	2	1	1	3	2	3	3	2	2	2	2	1	2	3	3	3	3	2	3	1	1	3	2	1	1	25	24	15	16
P8	2	3	2	2	1	2	3	2	2	2	2	3	2	3	2	1	3	2	2	2	3	3	2	3	2	2	3	2	2	2	3	3	1	2	2	3	2	2	3	3	19	21	25	26
Av.	2.5	2.5	2.8	2	2	2.3	2.5	1.9	1.9	2.1	3	2.1	2.3	2	1.6	1.8	1.6	1.3	2.1	2.1	2	2.3	2.8	2.5	1.4	1.4	2.6	1.6	2.1	2.5	2.4	2.5	1.9	2.3	1.4	1.8	1.8	2.4	1.9	1.9	19.4	21.4	23.1	19.5
Me.	3	2.5	3	2	2	2	2	2	1.5	2	3	2	2	2	1.5	1.5	1	1	2	2	1.5	2	3	2	1	1	3	2	2	3	2.5	2.5	2	2	1	1	2	2	1.5	2	20	21	23	18

List of items:

1. Interested
2. Disturbed
3. Excited
4. Tormented
5. Nicely Surprised
6. Guilty
7. Scared
8. Warm
9. Disgusted
10. Enthusiastic
11. Proud
12. Irritated
13. Enchanted
14. Remorseful
15. Inspired
16. Nervous
17. Determined
18. Jittery
19. Active
20. Frightened

8.2.4. Symphony - Game Experience Questionnaire

Regarding the Game Experience questionnaire, let us remember that the items that follow are marked from 0 (Not at all), through 2 (moderately), to 4 (Extremely).

I. **Regarding the game experience as a whole:** 'I was interested in the story' and 'I thought it was aesthetically pleasing' received moderate scores of 2.25 and 2, respectively. The other items had low scores, being the first of importance 'I got in a really bad mood' with an average score of 1.625; 'I thought it was hard' and 'It seemed a rich experience' got scores of 1.5, and 'I had to make a great effort' had the lowest score of 1.25. However, answers to the latter were unequal, and P1, P4, P5 and P7 scored between 3 and 4.

II. **Regarding the mazes**: values were low in the positive items: 'I felt skillful' and 'I felt challenged' with an average of 1.75, and 'I felt good' of 1.5. However, negative items received a moderate score: 'I felt frustrated' and 'It was tiring' scored 2.625, and 'I felt bored' a 2.375. Individually speaking, the positive items 'I felt skillful' was given a high score of 3 by P3 and P5; 'I felt challenged' was given a very high score of 4 by P1, and 3 by P3 and P5 as well, being the lowest score (0) from P8. Only P3 gave a very high score to the item 'I felt good' for this game. The negative items of this game received high or very high scores from most participants, being the exceptions P3, P5 and P6, who gave low scores (0-1) to the item 'I felt bored'; and P3 giving a score of 1 and 0 to the items 'I felt frustrated' and 'I thought the game was tiring'.

III. **Regarding the nonograms:** it had positive feedback, with moderate to high values in positive items. More specifically, 'I felt challenged' received an average score of 3.125, 'I felt good' of 2.75, and 'I felt skillful' of 2.625. Negative items got lower scores, being 'I felt bored' and 'I felt frustrated' with a score of 1.25, and 'I thought it was tiring' of 0.875. However, P1, P4 and P6 reportedly felt extremely challenged, and P3, P5 and P7 felt very challenged. P6 was the participant who felt the most skillful, while participants P3, P4, P5, P7, and P8 felt very skillful; P1 and P2 felt not very skillful at this game.

IV. **Regarding the Emotion Identification and Regulation game:** the average values were mostly low for the positive items: 'I felt skillful' with a score of 1.125 on average, 'I felt challenged' with 0.625, and 'I felt good' with a score of 1.625. On average, negative items had low to moderate scores, being 'I felt bored' given a 2.375, 'I thought it was tiring' a 2.875, and 'I felt frustrated' a 1.75. Among players, only P5 gave a high score of 3 to the items 'I felt challenged' and 'I felt good', and only P8 thought he was very skillful, giving a score of 3. P2, P6 and P8 gave scores of 4 and 3 to the item 'I felt bored'; P2, P3 and P5 gave a score of 3 and 4 to 'I felt frustrated', and most participants (P1, P2, P3, P5, and P6) gave a score of 3 or 4 to 'I thought it was tiring'.

V. **Regarding their feelings after playing the game:** positive items received moderate to low scores on average: "I felt proud' got a 2, and 'I felt satisfied' got a 1.75. The same happened to negative items: 'I felt bad' had a 1.125, 'I felt it was a waste of time' a 1.7, 'I felt exhausted' a 1.875, and 'I felt I could have done more useful things' a 1.875. As for the participants, P8 gave a score of 3 to 'I felt bad', but also a score of 3 to the item 'I felt proud'. P1 gave low scores (1-2) to the items 'I felt proud' and 'I felt satisfied', and high scores (3-4) to the items 'I felt exhausted' and 'I felt it was a waste of time'. P2 gave a high score (3) to the items 'I felt satisfied' and 'I felt proud'. P6 did not feel exhausted, and gave a high score (3) to item 'I felt proud'. Only P4 gave a high score of 4 to the item 'I feel I could have done more useful things', while the other participants gave either moderate or low scores to this item (2-1).

VI. Other questions:

a. **What they believe the game was about:** 5 out of 8 participants referred to music and emotion regulation as the main topic of the game. More specifically, P1, P2 and P5 referred to emotions and emotion regulation, and P8 related emotion regulation directly with music, saying that the game was about "how the type of music we consume daily can influence our mood". P6 broadened the scope of emotional influence in the game, stating that it was about "how the activities and stimuli around us can influence our mood and consequently our behavior". 3 out of 8 participants also stated the game was about the symptoms of depression: P4 perceived the aim of the game as to "give tips to help deal with and overcome depression" and P3 expressed that it was about what is important for our well-being: "I felt it was about understanding certain important points of our well-being and accept them. With a small story to try to send the message". P5 stated that the game was also about 'cognitive stimulation'

b. **What they believe was the role of music in the game:** all 8 participants mentioned music and either emotion classification or regulation as the main objective of music in the game. P8 refers to music as "the main element of the game. The whole story revolves in this topic", while other participants referred to its most specific role of "making the player know how to regulate their emotions by choosing different songs" (P1), "improve the character's mood" (P6), and "provoque the most diverse emotional reactions, since music has an effect on our behavior, emotions, and mental health" (P7). However, some mentioned not only the emotional regulation game but the background music. P4 expressing that "music helps give mood, and get to continue the game because it is nice", and P3 going into more details saying that "it seemed that music was supposed to influence the state of spirit. In all mini-games (except the one involving identifying the song/emotion), I felt that music was relaxing. It was simple, melodic and it helped to stay focused instead of distracting".

c. **To what extent this game could influence their future behavior:** participants were given a scale from 1 (not at all) to 4 (Extremely) for this item. On average, the reported influence the game might have in the participant was 2.125, that is, to have little or a small influence in the future. P3 and P6 gave a score of 3 to this item, and P4 a score of 1, while the rest of the participants gave it a 2.

d. **The most useful strategies they used:** most strategies mentioned were related to moving around the maze, completing the nonograms, and stress management. P1 mentioned "give a deep breath" as his/her most useful strategy, while P7 mentioned "managing the stress caused by some parts of the game", and P5 mentioned "Tolerating the frustration of the mazes". 3 participants mentioned the mazes as the games where they applied more strategy. This was mentioned by P6, who expressed "before starting, see the best paths and do it as fast as possible", and P3, who said about this mini-game that it was "more challenging than the previous one, but it was interesting - especially in the last two chapters was when I started to feel better in that mini-game". "Understanding the bugs of the game" was another strategy mentioned by P4. The nonograms were also mentioned by P6 and P3 who used the similar strategy of "trying to find a pattern or the image that would come out and solve it accordingly", P3 stating that this "brought an 'I did it' sensation after confirming". Walking as an important factor for committing to the task was also mentioned by P5. On the other hand, P2 and P8 reported not using, or not knowingly using, any particular strategy.

e. **What was most appreciated about the game:** 3 out of 8 participants, specifically P5, P6 and P7, reportedly enjoyed the nonograms the most. P1 and P5 expressed that their favorite part of the game was the part of "influencing the mood states with music", in other words, the Emotion Identification and Regulation game. P3 and P5 also mentioned their liking for the walking tasks and "starting each chapter with an objective of steps". P3 and P8 liked the background music. Specifically for P8 "the songs used during the labyrinths and during the nonograms". P4 mentioned the puzzles in general, while only P2 mentioned the story as what he/she liked the most. P3 mentioned having enjoyed the changes in the environment and the tones of the game, "unlike many games that end up having gaudy colors, yellow/pink, fluorescent - that become tiring".

f. **What was least appreciated about the game:** 5 out of 8 participants mentioned the Emotion Identification and Regulation game as their least favorite, and the most common reasons were that the instructions seemed not to be very clear, as P3 stated that "When there was not an option with

a smiling face I could not understand which one I had to choose, which one was the opposite option", and P5 said that "the instructions sometimes did not separate the strategies between the emotions". It was also mentioned that "most emotions were always the same type, which made the game boring and predictable". Others considered that a different type of music should be used for this particular game, as, in the words of P3 "the fact that the songs had lyrics was also a distraction, even more when it was a song that I liked and notice that the time was still running and I had to finish"; and it was even advised by P8 that "using instrumental music (like the ones used in the labyrinth and nonogram) in the mini-game to improve the guardian's mood would be more appropriate for the fantasy world where the story takes place". The other two participants mentioned the mazes as what they liked the least because they were "full of bugs" (P4), the voids (P1), and how hard it was to guide the sphere and its low speed (P8). The mini-games' little diversity and dynamism were also mentioned as the least favorite characteristic by P2 and P7. Other minor references were about more technical issues related to the AI, such as the little responsiveness of some buttons sometimes, the fact that the cell phone got too hot, or the visual style, considering that the graphics should have been more attractive.

8.3. Conclusions and Discussion

Average scores, both in the PHQ-9 and the PANAS, reflected improvements, even if small, which supports the viability of our approach. The fact that out of 8 participants 4 showed post-intervention improvements in both questionnaires, one showed minimal negative impact, and 3 showed negative results, is quite positive. It is also worth mentioning that, after an informal conversation with the therapist, it was clarified that the 3 participants who showed detrimental results, namely P1, P2 and P8, were receiving external psychiatric support due to other comorbidities; P1, in particular, was going through a complicated situation during the experiment and had recently started taking medication, which might have affected his/her sleep and energy levels, as well as responses to the game tasks. Also, one of the participants who showed improvements, P4, happened to had finished his/her university evaluations when the experiment started.

Similarly to what happened in the usability test, the story and the aesthetics of the game were the most appreciated factors, but in a much lower grade than the usability group, given moderate scores; while negative items, even though they did not surpass the positive ones, had higher scores than what was desired. This shows that, despite the positive impact found, the game needs important improvements, and an analysis of each of the mini-games might help us define where to focus our attention in the future.

The mazes, opposite to what happened in the usability test, were mentioned as the least liked features, and the reasons are mostly related to the existent bugs in the game and the responsiveness of some items.

The nonograms, also opposite to what happened in the usability tests, had moderate to high scores in the positive items of the questionnaire, with many participants expressing how they felt challenged and skilful, negative items receiving low scores. They were regarded as the most appreciated mini-game by P5, P6, and P7 and they were not mentioned amongst the least appreciated features. Another positive feature of nonograms was the fact that P3 and P6 both reported using the strategy of trying to guess or find the pattern of the image that might be hidden to help them complete the task. The positive regard of this particular puzzle and the feeling of accomplishment that it gave to some participants might have collaborated to improve depression levels and affect/emotional balance of some individuals, as these feelings of achievement and success activate the rewarding systems.

Despite the puzzles being aimed at cognitive stimulation and training problem-solving skills and strategic thinking, P2 and P8 (two participants that did not show improvements in mood) reportedly did not use any strategies, which might have influenced the lack of enjoyment of playing puzzles. This could be related to the fact that they had Moderate and Moderately Severe depression and felt unable to apply such strategies because of associated symptoms of low concentration and cognitive retardation. However, we can also not exclude that maybe players were not particularly fond of this type of game.

The Emotion Identification and Regulation game was regarded as mostly tedious and tiring, and some of the criticisms to this game are worthy of discussing. Feedback reveals that players would enjoy a broader spectrum of emotions (e.g. 'calm', 'hopeful', 'relaxed' instead of only 'joyful') or even mixed emotions as part of the game dynamics. Even though our aim is to show that the 'common' music we listen to in our daily life affects our mood and behaviors, against the common use of classical, jazz or instrumental music for these purposes, this was seen as distracting or non-appropriate for a fantasy world. Would another type of fantasy game (e.g., science fiction) separate from the player's reality, be suitable for the use of daily-life music types? It is also important to note that players do not enjoy it if they cannot listen to a song they like because of game mechanics.

It is also important to note the importance of clear instructions, since the strategies set to define the dynamics between the songs were not clear for all players; we believe that these strategies might have been better understood and applied if the players were using their own selection. Making more detailed rules, or giving very specific values to the different emotions and intensity categories against other specific items, and making these known to the player, might have made this stage, if not more suitable to regulate the player's emotion regulation, feel more like a game. Based on these findings, the game dynamics and emotion range need to be considered and improved.

Regarding the walking, it was one of the aspects two participants liked the most, and it was even mentioned as a strategy used by a player to commit to the tasks he was being asked to perform. Giving the player the choice of different levels of effort was important, and walking only once a day and reducing the number of steps to be walked seems to have been an improvement. However, we cannot discard the possibility of some players not walking these steps and cheating, whether by shaking their hand to fool the

step-counter or using the emergency ‘skip’. We do know from the therapist’s feedback that P2, for instance, had no problems with the walking task because he/she adapted this to his/her daily routine.

The most significant for us is that participants seem to have understood the most important objective of the game: the importance of emotion regulation and how music influences our mood, emotions, and therefore, behaviors and mental well-being. The story also seems to have achieved its purpose by providing tips to the players on important aspects of our wellbeing. Despite not being our main intention, it seems that we managed to provide or provoke feelings of calm and relaxation to some players. A short relief that might be meaningful for depressed individuals. However, we cannot tell whether these teachings will translate into real-world actions, but participants reported that this game would influence their future behavior to some extent.

Finally, it is important to highlight that there is a clear difference between the usability group and the field group. Despite not having done any PHQ-9 to the usability group, the PANAS test reflected two entirely different groups in terms of emotional balance. Before interventions, while the usability group had average PANAS above 30 points in the positive affect score, the field group suffering from depressive symptoms had an average smaller than 20. Also, in the negative affect score, while the usability group had scores below 20, the field group had average scores superior to 20 values. This will, most likely, show us very different perspectives on the game. We also need to consider that this project was aimed at minimal to moderate cases of depression, and the field group consisted of 4 Moderate Depression cases, 2 Moderately Severe cases, and 2 Mild cases. Therefore, we have participants for whom this game was not particularly prepared for.

9. Conclusions

Depression is a mental illness that is amongst the most common worldwide and one of the greatest economic burdens of Europe. It is also an illness that gets more and more detrimental the lengthy the remission process is, which means that an immediate action to diminish its symptoms is required, but the capability and extent to which the health system can act and help these individuals is limited. Unfortunately, health practitioners are unable to give a 100% effective treatment for many reasons: many patients assigned to one single practitioner, lack of compliance from the patients, difficulties to meet face-to-face. Therefore, computer-assisted therapy and technology-based tools, together with alternative therapies like music therapy, have been proposed as solutions for this dilemma, and some studies have shown they can bring some benefits for individuals with depression.

In this project, we proposed developing a casual serious game (CSG) revolving around basic concepts of Cognitive-Behavioral Therapy, and emotion regulation through puzzle-playing and daily-life music listening. This CSG called Symphony takes advantage of video games' capacity to improve mood and its task-based nature to train essential skills necessary for improving mental and physical well-being and raising awareness of the effect of music on emotional and mood states.

We conducted an iterative design and development with several tests and studies, including healthy and with a sample of our target population, to understand which games, type of interaction would be appropriate and the preferred types of game for this population and feedback from the different prototypes. Based on these results, a mobile casual game named Symphony about a world that was shut down due to the destruction of its energy core and its protectors' physical and emotional imprisonment was developed for Android using the Unity game engine.

A first usability study with the final prototype involved 5 members of NeuroRehab Lab in the Madeira Interactive Technologies Institute, and the results showed that the game's story was attractive, the graphics were appealing, the puzzles were well received, and they liked the idea of walking. Some improvements were made based on their feedback. The final version of the high-fidelity prototype was tested by 8 volunteers who were students at the University of Madeira and were receiving therapeutic aid from the University of Madeira's Psychology Service due to having depressive symptomatology.

With this study, we aimed at addressing the following research questions:

RQ1: Does Symphony improve the mood of young adults with depressive symptomatology?

The results of our field study showed that, on average, Symphony improved the mood of participants, with an average improvement in the PHQ test 1, and in the PANAS test of -3.625 in the negative affect score, and +2 in the positive affect score. However, group differences between pre-and-post play results were not statistically significant. Improvements in 5 out of 8 participants can be considered positive on this matter. Nevertheless, there are many variables to consider: the characteristics of this game might

be more suitable for some players than for others, as well as the effectiveness of any treatment is impacted by the emotional state of the player when performing it. We must also keep in mind that, as their therapist expressed, "some started enthusiastic (with the sense of being able to contribute at something…), but later felt the game as an obligation since they had to commit with it in the established period of time", which would not be the case if it had been delivered as an actual casual game to be played whenever wanted and for the amount of time wanted. We believe that impact could be higher if all mini-games had an optimal level of challenge for all participants, which would have increased motivation due to a stronger feeling of competence and self-efficacy, as our participants reported some games did not adjust to their needs, being too difficult or easy. As the therapist expressed, "some participants, told me that it became boring/tiring and some that at the end the game was too complex, leading them to abandon the task".

RQ2: Does Symphony raise awareness of the positive or negative impact of music on our mood?

Based on the questionnaire results, most of our participants understood the impact music-listening habits can have on our mood and mental health, being mentioned by most of them its importance as an emotion regulation tool. However, when it comes to the strategies that can be used with music for emotional regulation purposes, the game was reportedly not able to communicate this effectively, being reported that the instructions were not very clear.

RQ3: Does Symphony promote using music to manage mood and regulate emotions?

PHQ-9 and PANAS data indicate that Symphony has a positive impact on people with depressive symptomatology. However, we cannot ascertain if this is due to music use to manage mood and regulate emotions, as there were many additional components in the game. According to self-reports, participants thought that the video game's impact on future behavior is low. Therefore, we assume that this might include the use of music to manage the participants' mood. However, only a long-term observation would tell if the participants have effectively gained more awareness about the impact of music, and ever use what they have learned about regulating emotions and use it in a real situation.

RQ4: Which elements are more valued by the participants and why?

The results revealed that participants highly regarded the nonograms, and a majority seemed to have gotten the best out of this game, as most participants felt challenged, but not excessively, and quite skilful. This is an interesting finding as nonograms are not in the literature of puzzle games tested to determine their impact on depression, and the level of challenge chosen for this mini-game turned out to be the ideal level of challenge for this sample of the target population.

The walking had a second-place in the most valued elements by the participants. This is particularly relevant as the therapist reported that "they had to make that reorganization in their day, establishing objectives, something important. For this reason, I think this requisite is something important for our purpose". The addition of the step-

counter taught us that, even though not all individuals will be willing to break a lethargic routine, they might do it with the proper motivation and inspiration.

Finally, we have the background music, the story, and the changes in the environment as characteristics that the participants enjoyed a lot. They tell us that choosing background music that helps the players concentrate and relax is important, and even more, if the player has depression symptoms; the same way, the choice of colors and tones of the environment might need to be chosen with care, as aberrant happy tones, for instance, might not be well received or seen as an exaggeration of a 'joyful environment'.

To conclude, the fact that the participants welcomed the idea of playing a video game to aid depression with lots of motivation already suggests that a video game to aid depression treatment is promising and would be well received as a complementary tool. Overall, the game itself showed that some principles of psychotherapeutic lessons can be delivered through a story not directly related to depression and that a video game can raise awareness of the impact of music-listening behaviors on our mood. However, this approach cannot substitute the typical psychoeducational approach and face-to-face contact in the real-life.

Another important lesson to learn from our findings is that a balanced level of challenge is important for this population, further tests with the target population are needed. Also, despite Symphony having a reportedly good story and achieving some of its goals, some game design aspects need further development. This includes using the music they listen to every day. A video game that teaches emotion regulation strategies and obliges the player to apply this knowledge both in the game and the real world could have much more impact because they are learning through doing. Concerning walking, instead of just walking to open the next chapter, why not request the player to visit a park or a square, and take a picture of a tree to access the game? A casual game without the time constraints that were imposed would allow the player to do this whenever possible in order to continue playing, without the pressure of 'having to do it before tomorrow'.

Of course, our work presents some limitations. Despite not fully achieving our goals, mostly due to the lack of time and technical difficulties, we performed different user studies for this project, from initial tests of mini-games, a low-fidelity prototype, rating of emotional stimuli to a field study with participants with depressive symptomatology. Overall, the project involved 28 participants. All tests were done, including the high-fidelity one, counted with modest sample sizes, and the experiment lasted only one week. Also, our before-game-development research of the target population was done in a sample of only 9 participants, whose results in terms of taste could differ from the sample that played the final prototype. For instance, while an average of the population we based this game on expressed a like for puzzles, the final sample of the target population had a majority of individuals who preferred playing games with other players online. Truth is, it is impossible to make one game that can satisfy the needs of all players suffering depressive symptoms since they are all individuals with different interests. Instead, the goal should be making the universal game but identifying the characteristics of those individuals with depressive symptomatology that will make them benefit the most from symphony.

For the future, it would be a good idea to work on including more mini-games in Symphony as it had been projected at the beginning of this journey, and try to give different uses to the different games along the story to avoid boredom and predictability. The connection between players and characters could also be improved, making them visually and personality-wise more representative of their name and what they protect in their world. Furthermore, since we are talking about depressed individuals whose daily mood can be easily negatively affected, it might be desirable to give them the choice of choosing their difficulty level every time they start a new chapter or enter the game, so the player can choose according to the way he/she feels at the moment of play.

It is also important to make further experiments to find a way to use the player's own selection of music in the Emotion Identification and Regulation game. We learned from the usability and field experiments that people have a strong connection with music, especially the music they like and may be associated with a particular memory, and it is challenging to see music objectively. In fact, during the tests to select the expressed emotion and intensity of emotions in songs, answers were so varied that Symphony is likely to be an overgeneralization of what some individuals may feel. Despite the risks of allowing the players to use their own selection of music that we mentioned during our research, our results show that it might be necessary. Finally, the game needs improvements in UI and responsiveness, and it would also be recommended to include more rewards inside the game, such as earning skills as they complete tasks, or ranks/medals they can look forward to as a token of their efforts. The reason is that, even though players get stars at the end of each game in Symphony, these are mostly to be used ahead as 'weapons', and players can potentially end up with no reminder of their achievements.

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Annex 1. PHQ-9- Portuguese version given to the iterative design sample

QUESTIONÁRIO SOBRE A SAÚDE DO PACIENTE-9 (PHQ-9)

Durante os <u>últimos 14 dias</u>, em quantos foi afectado/a por algum dos seguintes problemas? *(Utilize"✔" para indicar a sua resposta)*	**Nunca**	**Em vários dias**	**Em mais de metade do número de dias**	**Em quase todos os dias**
1. Tive pouco interesse ou prazer em fazer coisas	0	1	2	3
2. Senti desânimo, desalento ou falta de esperança	0	1	2	3
3. Tive dificuldade em adormecer ou em dormir sem interrupções, ou dormi demais	0	1	2	3
4. Senti cansaço ou falta de energia	0	1	2	3
5. Tive falta ou excesso de apetite	0	1	2	3
6. Senti que não gosto de mim próprio/a — ou que sou um(a) falhado/a ou me desiludi a mim próprio/a ou à minha família	0	1	2	3
7. Tive dificuldade em concentrar-me nas coisas, como ao ler o jornal ou ver televisão	0	1	2	3
8. Movimentei-me ou falei tão lentamente que outras pessoas poderão ter notado. Ou o oposto: estive agitado/a a ponto de andar de um lado para o outro muito mais do que é habitual	0	1	2	3
9. Pensei que seria melhor estar morto/a, ou em magoar-me a mim próprio/a de alguma forma	0	1	2	3

FOR OFFICE CODING *0* **+** _____ **+** _____ **+** _____

=Total Score: _____

Se indicou <u>alguns</u> problemas, até que ponto é que eles <u>dificultaram</u> o seu trabalho, o cuidar da casa ou o lidar com outras pessoas?

Não dificultaram	Dificultaram um pouco	Dificultaram muito	Dificultaram extremamente
⑤	⑤	⑤	⑤

Annex 2. Questionnaire *The Use of Video Games by Young Adults* given to the iterative design sample

Questionário - O uso de vídeo jogos por jovens adultos

Este questionário tem como objetivo recolher dados sobre o seu relacionamento com os vídeo jogos, tipos de vídeo jogos preferidos, a maneira como você se sente e reage a situações relacionadas com vídeo jogos e o papel que estes desempenham no seu dia a dia.

1. **Masculino ou feminino?**
    a. Masculino
    b. Feminino

2. **Quantos anos você tem?**

    a. _____

3. **Selecione sua atividade (selecione aquela ou aquelas que mais se aplicam a si)**
    a. Estou desempregado
    b. Sou estudante
    c. Trabalho em tempo integral
    d. Trabalho a tempo parcial
    e. Faço trabalho voluntário
    f. Sou trabalhador independente

4. **Você joga video jogos?**
    a. Sim
    b. Não
    c. Raramente

5. **Se não, você estaria disposto a jogar um vídeo jogo?**
    a. Sim
    b. Não

6. **Com que frequência você joga video jogos?**
    a. Todos os dias
    b. Quase todos os dias
    c. Sempre que tenho vontade
    d. Apenas quando os meus amigos estão a jogar
    e. Raramente
    f. Nunca jogo

7. **Quanto tempo, em média, você costuma jogar vídeo jogos?**
    a. Até 1 hora por dia
    b. 1 ou 2 horas por dia
    c. Mais de 2 horas por dia

8. **Costumo jogar videogames para ...**
    a. ... relaxar
    b. ... passar o meu tempo livre
    c. ... sentir o desafio
    d. ... socializar com outros jogadores
    e. ... ouvir a música dos vídeo jogos
    f. ... desfrutar dos gráficos do jogo
    g. ... desfrutar o tempo de forma diferente, numa realidade diferente

9. **Normalmente jogo vídeo jogos...**
    a. Em casa, no meu tempo livre
    b. No trabalho durante a hora do almoço
    c. Na cama, antes de ir dormir
    d. Num salão de jogos
    e. Num cyber café

10.Eu prefiro jogar video jogos ...

a. ... sozinho
b. ... com outros jogadores presencialmente
c. ... com outros jogadores online

11.Que tipo de videogame você gosta de jogar? (selecione os seus 3 preferidos)

a. De ritmo acelerado
b. Com uma história profunda e complexa
c. Qualquer tipo de jogo
d. jogos que estejam online e que possam ser jogados com outras pessoas
e. Não sabia que existiam vários tipos de jogos
f. Qualquer jogo que permita atirar em um alvo
g. Puzzles
h. Corrida de carros
i. Outro: _____

12.Onde é que você obtém a maioria dos seus jogos? (selecione as opções que se apliquem ao seu caso)

a. Em lojas de jogos online
b. Em qualquer loja antiga
c. Em lojas de jogos locais, negociando o valor e assim poupo dinheiro
d. Faço o download
e. Quando vou a casa de um amigo a jogar
f. Em plataformas online gratuitas
g. Na PlayStore ou motores similares

13.Quando um grupo de amigos deseja jogar, eu costumo ...

a. ... configurar tudo e pedir para ser o primeiro jogador
b. ... perguntar o que eles querem jogar e ir na onda
c. ... pedir-lhes ajuda para passar um nível que esteja a ser mais difícil para mim
d. ... sentir-me perdido e peço ajuda para saber quais os botões para jogar e por vezes carrego nos botões errados.

14.Quando estou a jogar, simpatizo com os restantes jogadores

Nunca 1 2 3 4 5 Sempre

15.Sou influenciado pelo humor dos outros enquanto estou a jogar

Nunca 1 2 3 4 5 Sempre

16.Influencio o humor dos outros enquanto estou a jogar

Nunca 1 2 3 4 5 Sempre

17.Quando estou a jogar desfruto sempre da companhia dos outros jogadores

Nunca 1 2 3 4 5 Sempre

18.Quando estou a jogar com os outros sinto-me com vontade de me vingar

Nunca 1 2 3 4 5 Sempre

19.Quando estou a jogar vídeo jogos, sinto-me frustrado

Nunca 1 2 3 4 5 Sempre

20.Quando estou a jogar vídeo jogos, sinto-me desafiado

Nunca 1 2 3 4 5 Sempre

21.Quando estou a jogar vídeo jogos, sinto-me feliz

Nunca 1 2 3 4 5 Sempre

22.Quando estou a jogar vídeo jogos, sinto nostalgia

Nunca 1 2 3 4 5 Sempre

23.Quando estou a jogar vídeo jogos, sinto raiva

Nunca 1 2 3 4 5 Sempre

24.Quando estou a jogar vídeo jogos, sinto-me competente

Nunca 1 2 3 4 5 Sempre

25.Quando estou a jogar vídeo jogos, sinto-me confiante

Nunca 1 2 3 4 5 Sempre

26.Quando estou a jogar vídeo jogos, sinto-me calmo

Nunca 1 2 3 4 5 Sempre

27. Quando estou a jogar a um bom vídeo jogo, fico preocupado com a forma como me apresento

Nunca 1 2 3 4 5 Sempre

28.Quando estou a jogar um bom jogo, eu sei bem o que quero fazer

Nunca 1 2 3 4 5 Sempre

29. Quando estou a jogar um bom jogo, perco a noção do tempo

Nunca 1 2 3 4 5 Sempre

30.Quando estou a jogar um bom jogo, eu bato ou jogo para o chão o joypad para libertar a frustração

Nunca 1 2 3 4 5 Sempre

31.Quando eu jogo um bom jogo, eu aprecio mais o design do jogo do que a experiência de jogar o jogo propriamente dita

Nunca 1 2 3 4 5 Sempre

32.Você gosta de ouvir as músicas dos vídeo jogos? (selecione as opções que se apliquem ao seu caso)

a. Eu ouço sempre
b. Sim, mas prefiro ouvir as músicas que eu gosto
c. Eu volto sempre ao meu nível favorito do jogo para ouvir a música desse nível
d. Eu gosto da música de alguns dos menus dos jogos.
e. Quando estou a jogar, ás vezes ponho a tocar as minhas músicas favoritas.
f. Normalmente desativo a música do vídeo jogo para não me distrair

33.Qual tipo de música você gosta mais de ouvir num vídeo jogo? (por favor, indique um máximo de 3)

a. _____

b. _____

c. _____

Por favor confirme se respondeu a todas perguntas.

Obrigada pela sua colaboração.

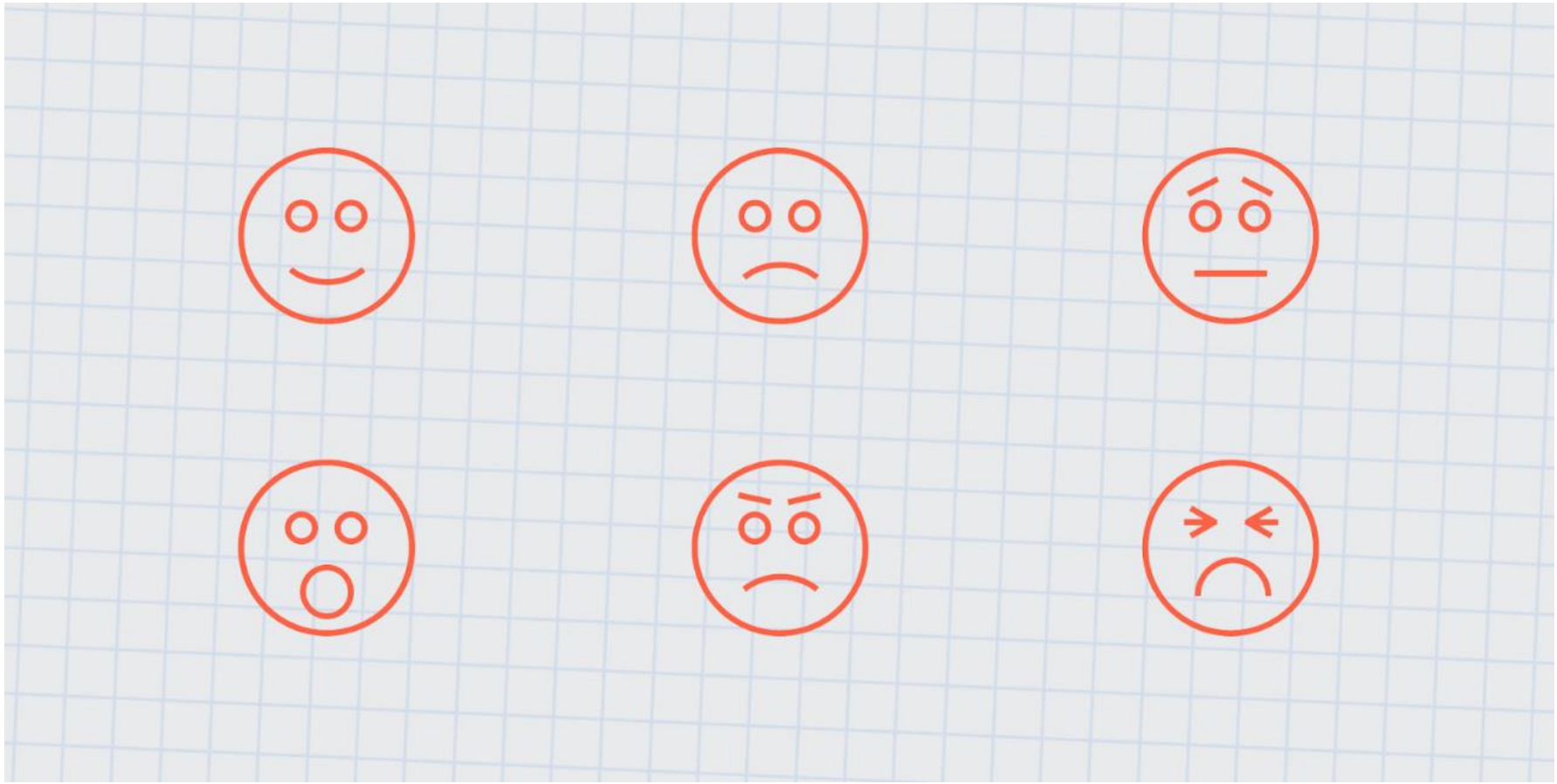
Annex 3. Table of results: PHQ-9- from the Iterative Design Process Sample.
It shows all 10 items, and the final Score. Items were originally in Portuguese, translated into English below:

Part.	Item. 1	Item. 2	Item. 3	Item. 4	Item. 5	Item. 6	Item. 7	Item. 8	Item. 9	Item. 10	Score
P1	1	2	3	2	1	1	0	0	0	2	10
P2	0	1	1	1	0	0	1	1	0	1	5
P3	1	0	1	1	1	1	0	1	0	1	6
P4	1	0	2	1	0	0	1	1	0	1	6
P5	2	2	2	2	1	1	2	1	1	2	14
P6	0	0	0	1	0	0	1	1	0	1	3
P7	1	0	0	1	2	1	2	2	1	0	10
P8	1	1	2	2	0	0	2	0	0	2	8
P9	1	1	1	2	0	1	2	2	1	1	11

List of items:

1. Little interest or pleasure in doing things
2. Feeling down, depressed, or hopeless.
3. Trouble falling/staying asleep, sleeping too much.
4. Feeling tired or having little energy.
5. Poor appetite or overeating.
6. Feeling bad about yourself, or that you are a failure, or have let yourself or your family down.
7. Trouble concentrating on things, such as reading the newspaper or watching TV.
8. Moving or speaking so slowly that other people could have noticed. Or the opposite; being so fidgety or restless that you have been moving around more than usual.
9. Thoughts that you would be better off dead or of hurting yourself in some way.
10. If you checked off any problem on this questionnaire so far, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Annex 4. Six Basic Emotions Image used for the emotion categories test during the iterative design.
Extracted from URL: https://www.kairos.com/blog/the-universally-recognized-facial-expressions-of-emotion)



Annex 5. Resulting list from our test to catalog emotions.
Songs are divided into 4 basic emotions: sadness, happiness, anger, and fear.

	SADNESS	
	Author	Title
1	Passenger	*Let her go*
2	Coldplay	*The scientist*
3	Evanescence	*My immortal*
4	Gary Jules	*Mad world*
5	Samuel Barber	*Adagio for strings*
6	The Rolling Stones	*Wild horses*
7	Queen	*Who wants to live forever*
8	Snow Patrol	*Run*
9	Eric Clapton	*Tears in heaven*
10	Sinead O'Connor	*Nothing compares to you*
11	Pink Floyd	*Comfortably numb*
12	Coldplay	*Fix you*
13	Depeche Mode	*The things you said*
14	Radiohead	*High and dry*
15	Jeff Buckley	*Hallelujah*
16	Annie Lennox	*No more I love yous*
17	Uriah Heep	*Rain*
18	The Mavericks	*Blue moon*
19	Blink 182	*Stay together for the kids*
20	James C. Frank	*I want to be alone*
	HAPPINESS	
21	ABBA	*Dancing queen*

22	R.E.M.	*Shiny happy people*
23	Mark Ronson Ft. Bruno Mars	*Uptown funk*
24	The Beach Boys	*Wouldn't it be nice*
25	Dexy's Midnight Runners	*Come on Eileen*
26	The Archies	*Sugar sugar*
27	New Radicals	*You get what you give*
28	E.L.O	*Rock and Roll is king*
29	Toploader	*Dancing in the moonlight*
30	Manfred Mann	*Do wah diddy*
31	Queen	*Don't stop me now*
32	Chumbawamba	*Tubthumping*
33	Scissor Sisters	*I don't feel like dancing*
34	The Monkees	*I'm a believer*
35	Grand Funk Railroad	*Locomotion*
36	Capital Cities	*Safe and sound*
37	The Offspring	*Pretty fly (for a white guy)*
38	Ramones	*Blitzkrieg bop*
39	**Jason Mraz**	***I'm yours***
40	Spin Doctors	*Two princes*
41	Pharrell Williams	*Happy*
42	The Jackson Five	*I want you back*
43	The Rembrandts	*I'll be there for you*
44	U2	*Beautiful day*
45	Wham	*Wake me up before you go go*
46	American Authors	*The best day of my life*
47	Justin Timberlake	*Can't stop the feeling*
48	Imagine Dragons	*On top of the world*

49	Rusted Root	*Send me on my way*
50	The Black Eyed Peas	*I gotta feeling*
51	Inner Circle	*Games people play*
52	Kool & The Gang	*Celebration*
53	Katrina & The Waves	*I'm walking on sunshine*
54	Junior Senior	*Move your feet*
55	Owl City & Carly Rae Jepsen	*Good time*
56	One Direction	*Live while we're young*
57	Michael Bublé	*It's a beautiful day*
58	Culture Club	*Karma Chameleon*
59	Smash Mouth	*All star*
60	Little Richard	*Tutti Frutti*
61	Opus	*Live is life*
62	Swedish House Mafia	*Don't you worry child*
63	**A-Ha**	***Take on me***
64	Green Day	*Platypus (I hate you)*
	ANGER	
65	Nirvana	*Smells like teen spirit*
66	System of a Down	*Toxicity*
67	Limp Bizkit	*Break stuff*
68	Three Days Grace	*Riot*
69	Nickelback	*Burn it to the ground*
70	The Offspring	*The kids aren't alright*
71	Beastie Boys	*Sabotage*
72	Papa Roach	*She loves me not*
73	The Prodigy	*Firestarter*

74	Metallica	*Enter Sandman*
75	Papa Roach	*Last resort*
	FEAR	
76	Pink Floyd	*Goodbye blue sky*
77	Zack Hemsey	*Vengeance*
78	Johann Sebastian Bach	*Toccata and fugue in D minor*
79	Wolfgang Amadeus Mozart	*Requiem Dies Irae*
80	Mike Oldfield	*Tubular bells*
81	Pink Floyd	*High hopes*
82	Nox Arcana	*Night of the wolf*

Annex 6. List given to volunteers during iterative design process to catalog of previously selected songs into intensities light, medium and strong.

TEST OF AROUSAL - Part 1
Testee # _____

- The songs below have been previously classified as expressing the four basic feelings (Joy, Sadness, Anger, and Fear).
- For this test, we would like you to select the strength of the feelings the song represent. (ex. If it expresses joy, is it light, medium or strong?)
- Listen to a 35-45 second excerpt of the song. Then mark with an 'x' the cell that corresponds in your opinion.

	Title	Author	Emotion	Light	Medium	Strong
1	*Dancing Queen*	ABBA	Joy			
2	*My Immortal*	Evanescence	Sadness			
3	*Shiny Happy People*	R.E.M.	Joy			
4	*Goodbye blue sky*	Pink Floyd	Fear			
5	*Uptown Funk*	Mar Ronson Ft. Bruno Mars	Joy			
6	*The things you said*	Depeche Mode	Sadness/Fear			
7	*Come on Eileen*	Dexy's Midnight Runners	Joy			
8	*Let her go*	Passenger	Sadness			
9	*Wouldn't it be nice*	The Beach Boys	Joy			
10	*The scientist*	Coldplay	Sadness			
11	*Sugar sugar*	The Archies	Joy			
12	*Smells like teen spirit*	Nirvana	Anger			
13	*Rock and Roll is king*	Electric Light Orchestra	Joy			
14	*Toxicity*	System of a Down	Anger/Sadness			
15	*Don't stop me now*	Queen	Joy			
16	*Break stuff*	Limp Bizkit	Anger			
17	*You get what you give*	New Radicals	Joy			
18	*The kids aren't alright*	The Offspring	Anger/Joy			
19	*Dancing in the moonlight*	Toploader	Joy			

20	*Enter sandman*	Metallica	Fear/Anger			
21	*Tubthumping*	Chumbawamba	Joy			
22	*Tocatta and Fugue in D Minor*	Johan S. Bach	Fear			
23	*Locomotion*	Grand Funk Railroad	Joy			
24	*Mad World*	Gary Jules	Sadness			
25	*Do wah diddy*	Manfred Mann	Joy			
26	*Vengeance*	Zack Hemsey	Fear/Sadness			
27	*Don't feel like dancing*	Scissor Sisters	Joy			
28	*High Hopes*	Pink Floyd	Sadness/Fear			
29	*Safe and sound*	Capital Cities	Joy			
30	*Run*	Snow Patrol	Sadness			
31	*Pretty fly (for a white guy)*	The Offspring	Joy			
32	*Wild horses*	The Rolling Stones	Sadness/Joy			
33	*I'm a believer*	The Monkees	Joy			
34	*Stay together for the kids*	Blink 182	Sadness/Anger			
35	*I'm yours*	Jason Mraz	Joy			
36	*Sabotage*	Beastie Boys	Anger			
37	*Blitzkrieg Bop*	The Ramones	Joy			
38	*Riot*	Three Days Grace	Anger			
39	*Two princes*	Spin Doctors	Joy			
40	*Burn it to the ground*	Nickelback	Anger/Joy			
41	*Night of the wolf*	Nox Arcana	Fear			
42	*The best day of my life*	American Authors	Joy			

TEST OF AROUSAL - Part 2
Testee # _____

- The songs below have been previously classified as expressing the four basic feelings (Joy, Sadness, Anger, and Fear).

- For this test, we would like you to select the strength of the feelings the song represent. (ex. If it expresses happiness, is it light, medium or strong happiness?)

- Listen to a 35-45.minute excerpt of the song. Then mark with an 'x' the cell that corresponds in your opinion.

	Title	Author	Emotion	Light	Medium	Strong
43	*Happy*	Pharrell William	Joy			
44	*Adagio for Strings*	Samuel Barber	Sadness			
45	*Wake me up before you go go*	Wham	Joy			
46	*Tubular bells*	Mike Oldfield	Fear/Sadness			
47	*Life is life*	Opus	Joy			
48	*Nothing compares to you*	Sinead O'Connor	Sadness			
49	*I want you back*	The Jackson Five	Joy			
50	*Who wants to live forever*	Queen	Sadness			
51	*I'll be there for you*	The Rembrandts	Joy			
52	*Firestarter*	The Prodigy	Anger			
53	*Can't stop the feeling*	Justin Timberlake	Joy			
54	*She loves me not*	Papa Roach	Anger			
55	*On top of the world*	Imagine Dragons	Joy			
56	*Platypus (I hate you)*	Green Day	Anger/Joy			
57	*Beautiful day*	U2	Joy			
58	*Requiem Dies Irae*	Mozart	Fear			
59	*I want to be alone*	James C. Frank	Sadness			
60	*I gotta feeling*	The Black Eyed Peas	Joy			
61	*Comfortably numb*	Pink Floyd	Sadness			
62	*Games people play*	Inner Circle	Joy			
63	*Tears in heaven*	Eric Clapton	Sadness/Joy			
64	*Send me on my way*	Rusted Root	Joy			
65	*Celebration*	Kool and The Gang	Joy			

66	*High and Dry*	Radiohead	Sadness			
67	*I'm walking on sunshine*	Katrina and The Waves	Joy			
68	*Hallelujah*	Jeff Buckley	Sadness/Joy			
69	*Move your feet*	Junior Senior	Joy			
70	*Good time*	Owl City and Carly Rae Jepsen	Joy			
71	*Last resort*	Papa Roach	Anger			
72	*Live while we're young*	One Direction	Joy			
73	*Rain*	Uriah Heep	Sadness/Joy			
74	*Tutti Frutti*	Little Richard	Joy			
75	*No more I love yous*	Annie Lennox	Sadness/Joy			
76	*Don't you worry child*	Swedish House Mafia	Joy			
77	*It's a beautiful day*	Michael Bublé	Joy			
78	*Fix You*	Coldplay	Sadness			
79	*Karma Chameleon*	Culture Club	Joy			
80	*Take on me*	A-Ha	Joy			
81	*Blue moon*	The Mavericks	Sadness/Joy			
82	*All-star*	Smash Mouth	Joy			

Annex 7. Final music selection catalogued in the emotion expressed and intensity. Songs are divided into 4 basic emotions: sadness, happiness, anger, and fear; and intensities strong, medium, and light.

SADNESS			
	Strong		
	Author	Title	
1	Evanescence	*My immortal*	
2	Gary Jules	*Mad world*	
3	Snow Patrol	*Run*	
4	Samuel Barber	*Adagio for strings*	
5	James C. Frank	*I want to be alone*	
6	Eric Clapton	*Tears in heaven*	
7	Jeff Buckley	*Hallelujah*	
8	Uriah Heep	*Rain*	
9	Coldplay	*Fix you*	
	Medium		
10	Depeche Mode	*The things she said*	
11	Passenger	*Let her go*	
12	Coldplay	*The Scientist*	
13	Pink Floyd	*High Hopes*	
14	The Rolling Stones	*Wild Horses*	
15	Blink 182	*Stay together for the kids*	
16	Sinead O'Connor	*Nothing compares to you*	
17	Queen	*Who wants to live forever*	
18	Radiohead	*High and dry*	
19	The Mavericks	*Blue moon*	

	Light		
HAPPINESS			
	Strong		
20	ABBA	*Dancing Queen*	
21	Mark Ronson Ft. Bruno Mars	*Uptown funk*	
22	The Beach Boys	*Wouldn't it be nice*	
23	The Archies	*Sugar sugar*	
24	E.L.O	*Rock and roll is king*	
25	Queen	*Don't stop me now*	
26	Toploader	*Dancing in the moonlight*	
27	Dexy's Midnight Runners	Come on Eileen	
28	Manfred Mann	*Do wah diddy*	
29	Scissor Sisters	*I don't feel like dancing*	
30	Capital Cities	*Safe and sound*	
31	The Offspring	*Pretty fly (for a white guy)*	
32	The Ramones	*Blitzkrieg bop*	
33	American Authors	*The best day of my life*	
34	Pharrell Williams	*Happy*	
35	Wham	*Wake me up before you go go*	
36	Opus	*Live is life*	
37	The Jackson Five	*I want you back*	
38	The Rembrandts	*I'll be there for you*	
39	Justin Timberlake	*Can't stop the feeling*	
40	Imagine Dragons	*On top of the world*	
41	Green Day	*Platypus (I hate you)*	

42	Inner Circle	*Games people play*	
43	The Black Eyed Peas	*I gotta feeling*	
44	Kool & The Gang	*Celebration*	
45	Katrina & The Waves	*I'm walking on sunshine*	
46	Junior Senior	*Move your feet*	
47	Owl city & Carly Rae Jepsen	*Good time*	
48	One Direction	*Live while we're young*	
49	Little Richard	*Tutti Frutti*	
50	Swedish House Mafia	*Don't you worry child*	
51	Culture Club	*Karma chameleon*	
52	Smash Mouth	*All star*	
	Medium		
53	R.E.M	*Shiny happy people*	
54	New Radicals	*You get what you give*	
55	Chumbawamba	*Tubthumping*	
56	Grand Funk Railroad	*Locomotion*	
58	The Monkees	*I'm a believer*	
59	Spin Doctors	*Two princes*	
60	Michael Bublé	*It's a beautiful day*	
	Light		
61	U2	*Light joy*	
62	Rusted Root	*Send me on my way*	
ANGER			
	Strong		
63	Nirvana	*Smells like teen spirit*	
64	System of a Down	*Toxicity*	

65	The Offspring	The kids aren't alright	
66	Beastie Boys	*Sabotage*	
67	Metallica	*Enter Sandman*	
68	Three Days Grace	*Riot*	
69	Nickelback	*Burn it to the ground*	
70	Papa Roach	*Last Resort*	
	Medium		
71	Limp Bizkit	*Break stuff*	
72	The Prodigy	*Firestarter*	
	Light		
FEAR			
	Strong		
73	Pink Floyd	*Goodbye blue sky*	
74	Johan Sebastian Bach	*Toccata and Fugue in D Minor*	
75	Zack Hemsey	*Vengeance*	
76	Nox Arcana	*Night of the wolf*	
77	Mike Oldfield	*Tubular bells*	
78	Wolfgang Amadeus Mozart	*Requiem Dies Irae*	
	Medium		
	Light		

Annex 8 – Questionnaire given to the general population group after testing the low-fidelity prototype.

HARMONY

This is a game that is aimed to help reduce the symptoms of depression through puzzle making and the use of music for emotional regulation. It also has the purpose to depict important aspects to consider in order to maintain a healthy life and mind.

Testee # _____

Personal Data

1. **Are you a man or a woman?**
    a. Man
    b. Woman

2. **Do you play video games?**
    a. Yes
    b. No

3. **Do you play video games on mobile phones?**
    a. Yes
    b. No

Regarding the game (keep in mind that this is a low fidelity prototype)

1. **How enjoyable do you think the game is?**
    a. Very boring
    b. Boring
    c. It's okay
    d. Enjoyable
    e. Highly enjoyable

2. **How would you rate the level of difficulty of the game?**
    a. Very difficult
    b. Difficult
    c. Normal
    d. Easy
    e. Very easy

3. **Is the game's story appealing?**

a. Not at all
b. Kind of appealing
c. Appealing
d. Very appealing

4. Is the game-play fluid?

a. Not at all
b. A little bit
c. It's normal
d. It's fluid
e. It's very fluid

5. How good is the connection between the story, mechanics, and gameplay?

a. Very bad
b. Bad
c. Average
d. Good
e. Very good

6. What aspect(s) do you like the most about the game?

_____

_____

_____

_____

_____

_____.

7. What would you change or add to make the game better?

_____

_____

_____

_____

_____

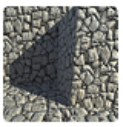
_____

_____.

Thank you!

Annex 9. Table of free Assets from Unity Store used for the development of the high-fidelity prototype:

Pack Name	Creator in the Web
 MARCELO BARRIO Stylized Female Explorer 444.0 KB **Purchased**: a year ago Version: 1.0 • Jun 13, 2019 First release Add label Hide asset	https://www.artstation.com/marcelobarrio
 ASOLIDDEV Low Poly Fantasy Warrior 611.1 KB **Purchased**: a year ago Version: 1.0 • Oct 1, 2018 First release Add label Hide asset	https://asoliddev.artstation.com/
 TEAMJOKER Fantasy Monster - Skelet... 28.5 MB **Purchased**: 10 months ago Version: Initial Version • Aug 19, 2015 First release Add label Hide asset	http://blog.naver.com/teamjoker
 LAXER Mountain Creek 20.5 MB **Purchased**: a year ago Version: 2.0 • Nov 30, 2015 Free! Add label Hide asset	http://www.illusionloop.com
 PRODIGIOUS CREATIONS Decrepit Dungeon LITE 77.2 MB **Purchased**: a year ago Version: 1.5 • Dec 8, 2017 **v1.5** ---------- more	https://www.youtube.com/channel/UC-zSLj1SzsxipOPuojqUWgg/featured
 POLYSOFT3D LowPoly Forest Pack 12.6 MB **Purchased**: a year ago Version: 1.0 • Jan 12, 2018 First release Add label Hide asset	https://alexanderzed.artstation.com/
 GREYROAD STUDIO LowPoly Trees and Rocks 1.1 MB **Purchased**: a year ago Version: 1.0 • Jan 21, 2019 First release Add label Hide asset	https://www.youtube.com/channel/UCZXhyphqQs0CUY8uaQkQPzA
 SKYTHIANCAT Glowing Forest 6.5 MB **Purchased**: a year ago Version: 1.0 • Mar 13, 2017 First release Add label Hide asset	https://skythiancat.blogspot.com/
 ALESSIO REGALBUTO High Quality Bricks & Walls 391.9 MB **Purchased**: a year ago Version: 1.1 • May 13, 2016 Fixed shaders to support Unity 5.3.4 Add label Hide asset	https://alessioregalbuto.com/

 A DOG'S LIFE SOFTWARE 18 High Resolution Wall T... 258.5 MB **Purchased**: 9 months ago Version: 1.2 • Sep 26, 2016 version 1.2 - Revamped library. more	http://telias.free.fr/
 RPGWHITELOCK AllSky Free - 10 Sky / Sk... 312.5 MB **Purchased**: 9 months ago Version: 1.0 • May 17, 2019 First release Add label Hide asset	http://www.richardwhitelock.com
 AVIONX Skybox Series Free 259.6 MB **Purchased**: 2 years ago Version: 4.2 • Aug 9, 2018 metadate update Add label Hide asset	https://avainx.wordpress.com
 UNITY TECHNOLOGIES Unity Particle Pack 5.x 97.3 MB **Purchased**: a year ago Version: 1.7 • Jun 12, 2020 Updated to 2018.3 Add label Hide asset	http://blog.sina.com.cn/u/5706673938
 CREEPY CAT 3D Games Effects Pack F... 57.5 MB **Purchased**: a year ago Version: 1.5 • Aug 13, 2019 WebGL Demo to: http://blitz Add label Hide asset	http://blitz3dfr.free.fr/
 KAKKY KY Magic Effects Free 26.3 MB **Purchased**: a year ago Version: 1.1.1 • Dec 28, 2017 1.0 Rerease 1.1 Script modification. more	http://effective1408.blog.fc2.com

Annex 10. Informed Consent used for the usability experiment in original Google Forms format.

Project “Playing Video Games to Alleviate the Symptoms of Depression”

Depression is currently among the top five disorders in the world, affecting people of all ages, walks of life, and in all countries. It causes distress and has a strong impact on people’s ability to perform even the simplest daily tasks. As such, it should be prevented and treated as early as possible to avoid severe damage to day-to-day operations. In this sense, the Project "Playing video games to alleviate the symptoms of depression" appears, under the scope of the International Master in Interactive Media Design of the University of Madeira in collaboration with the Psychology Service of Uma.

This project aims to contribute to the reduction of symptoms and possible impairments normally associated with depressive symptomatology. We aim to achieve this goal by creating an entertainment medium - a video game - that allows us to develop a set of skills in a fun and playful environment. In this sense, we intend to evaluate the real contribution of this type of intervention as a useful tool to help individuals who have depressive symptoms, in order to improve their mood and functionality in facing everyday life. * Required

Therefore, and as a participant in the project, you will be asked to:

- be available to play the proposed video game in the 7-day time frame
- play the game and fill in some questionnaires (before and after playing the game). These questions will help us to find out how this game can contribute to improving your mood.

The data collected will be confidential:

- Your identification is protected by the use of an acronym or identification code (created by you) which you will need to enter on request.
- The information collected may be used by researchers in a completely anonymous and confidential manner in public presentations, scientific congresses, and publications.

Any questions you have, don’t hesitate to contact us by email.

Researchers:
- Diana Mendes: diana.mendes@m-iti.org - Sergi Bermudez i Badia:

1. Informed consent *

Check all that apply.

☐ I declare that I agree to participate in the Project "Playing video games to alleviate the symptoms of depression" in its different moments.

☐ I hereby authorize that the information collected may be used in accordance with the parameters described above.

Identification code

The identification code is used to protect your identity. Whenever you have to fill in questionnaires we will ask you to enter it.

2. Enter the first letter of your name, the first letter of your last name, followed by the last three digits of your phone number. Follow the example: CL345 *

_____

3. Please, indicate your age: *

_____

Annex 11. PANAS Questionnaire used for the usability test – English Version, in original Google Docs format

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then select the number from the scale under each word. Indicate to what extent you have felt this way over the past week.

* Required

1. Identification code: *

_____

2. Interested *

Mark only one oval.

- ◯ 1. Very Slightly or Not at All
- ◯ 2. A Little
- ◯ 3. Moderately
- ◯ 4. Quite a Bit
- ◯ 5. Extremely

3. Distressed *

Mark only one oval.

- ◯ 1. Very Slightly or Not at All
- ◯ 2. A Little
- ◯ 3. Moderately
- ◯ 4. Quite a Bit
- ◯ 5. Extremely

4. Excited *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

5. Upset *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

6. Strong *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

7. Guilty *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

8. Scared *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

9. Hostile *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

10. Esthusiastic *

Mark only one oval.

- ( )
- ( ) 2. A Little
- ( ) 3. Moderately
- ( ) 4. Quite a Bit
- ( ) 5. Extremely

11. Proud *

Mark only one oval.

- ( ) 1. Very Slightly or Not at All
- ( ) 2. A Little
- ( ) 3. Moderately
- ( ) 4. Quite a Bit
- ( ) 5. Extremely

12. Irritable *

Mark only one oval.

- ( ) 1. Very Slightly or Not at All
- ( ) 2. A Little
- ( ) 3. Moderately
- ( ) 4. Quite a Bit
- ( ) 5. Extremely

13. Alert *

- [ ] 3. Moderately
- [ ] 4. Quite a Bit
- [ ] 5. Extremely
- [ ]
- [ ]

14. Ashamed *

Mark only one oval.

- [ ] 1. Very Slightly or Not at All
- [ ] 2. A Little
- [ ] 3. Moderately
- [ ] 4. Quite a Bit
- [ ] 5. Extremely

15. Inspired *

Mark only one oval.

- [ ] 1. Very Slightly or Not at All
- [ ] 2. A Little
- [ ] 3. Moderately
- [ ] 4. Quite a Bit
- [ ] 5. Extremely

Nervous *

Mark only one oval.

- [ ] 1. Very Slightly or Not at All
- [ ] 2. A Little
- [ ] 3. Moderately
- [ ] 4. Quite a Bit
- [ ] 5. Extremely

16. Determined *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

17. Attentive *

Mark only one oval.

- 1. Very Slightly or Not at All
- 2. A Little
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

18. Jittery *

-
-
- 3. Moderately
- 4. Quite a Bit
- 5. Extremely

19. Active *

Mark only one oval.

- [ ] 1. Very Slightly or Not at All
- [ ] 2. A Little
- [ ] 3. Moderately
- [ ] 4. Quite a Bit
- [ ] 5. Extremely

20. Afraid *

Mark only one oval.

- [ ] 1. Very Slightly or Not at All
- [ ] 2. A Little
- [ ] 3. Moderately
- [ ] 4. Quite a Bit
- [ ] 5. Extremely

Annex 12. Game Experience Questionnaire adapted for the usability group. Original in English, Google Forms format.

SYMPHONY - Game Experience Questionnaire

This questionnaire is aimed to evaluate your experience while and after playing the video game 'Symphony'. We would like to know what you think about this game, what you found more useful and valuable, and whether you feel it could bring changes to your future daily routine. All questions are mandatory, and the information you supply here is confidential and will only be used for research purposes.

* Required

1. Identification code: *

_____

Regarding your in-game experience as a whole

This section is devoted to your perception of the game as a unit. e.g. the story, the game play, the aesthetics, the characters, the timing, and so on.

2. I was interested in the game's story *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

3. It gave me a bad mood *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

4. I thought it was hard * *Mark only one oval.*

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

5. I thought it was aesthetically pleasing * *Mark only one oval.*

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

6. It felt like a rich experience * *Mark only one oval.*

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

7. I had to put a lot of effort into it * *Mark only one oval.*

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

Regarding the mazes

This section is devoted to your experience only for this specific game: Throughout your journey you had to cross labyrinths or mazes in order to find characters and collect the pieces you needed for your final tasks. In these, you found collectables, as well as enemies. Rank your feelings while you were in this particular stage of the game.

8. I felt bored *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

9. I felt frustrated *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

10. I found it tiresome *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

11. I felt skillful *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

12. I felt challenged *

Mark only one oval.

	0	1				
not at all	◯	◯	◯	◯	◯	extremely

13. I felt good *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

Regarding the nonograms

This section is devoted to your experience only for this specific game: Throughout your journey you had to solve a numerical puzzle in order to open a lock and free the characters from their cage. Rank your feelings while you were in this particular stage of the game.

14. I felt bored *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

15. I felt frustrated *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

16. I found it tiresome *

Mark only one oval.

	0	1				
not at all	◯	◯	◯	◯	◯	extremely

17. I felt skillful *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

18. I felt challenged *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

19. I felt good *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

Regarding the emotion identification and management

This section is devoted to your experience only for this specific game: After setting the character free, you had to improve his/her emotional state in order to get one of the pieces you needed for the final task. Rank your feelings while you were in this particular stage of the game.

20. I felt bored *

Mark only one oval.

	0	1			
not at all	◯	◯	◯	◯	◯ extremely

21. I felt frustrated *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

22. I found it tiresome *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

23. I felt skillful *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

24. I felt challenged *

Mark only one oval.

	0	1			
not at all	◯	◯	◯	◯	◯ extremely

25. I felt good *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

26. I influenced the mood of the other(s) *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

27. The other's actions were dependent on my actions *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

28. When the other(s) was(were) happy, I was happy *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

29. What I did affected what the other(s) did. *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

Regarding your after-play experience

It is important for us to know your feelings after this experience reached its end. Tell us how you felt after all your tasks were completed and and achieved your goal.

30. I felt bad *

Mark only one oval.

	0	1 2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

31. I found it a waste of time *

Mark only one oval.

	0	1 2	3	4	
not at all	◯	◯	◯	◯	◯	extremely

32. I felt satisfied *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯		◯	◯	extremely

33. I felt exhausted *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯		◯	◯	extremely

34. I felt that I could have done more useful things *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯		◯	◯	extremely

35. I felt proud *

Mark only one oval.

	0	1	2	3	4	
not at all	◯	◯		◯	◯	extremely

Open questions

Is is important for us to give you the opportunity to express your opinions openly, and get more insight on what worked out or can be improved in the game. All the questions need to be answered, and remember that this questionnaire is anonymous.

36. What do you think the game was about? *

37. What do you think was the role of music in this game? *

38. To what extent could this game influence your daily behavior in the future? *

Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Extremely

39. Which strategies were the most useful for you? *

40. What did you appreciate the most about the game? *

41. What did you appreciate the least about the game? *

Annex 13. Informed Consent given to the field experiment sample, in original Google Forms format

Projeto “Jogando vídeo jogos para aliviar os sintomas da depressão”

A depressão encontra-se atualmente entre as cinco maiores transtornos no mundo, afetando a pessoas de todas as idades, esferas de vida, e em todos os países. Provoca angústia e tem um forte impacto na capacidade de as pessoas realizarem até mesmo tarefas diárias mais simples. Como tal, importa que seja prevenida e tratada o mais precocemente possível para evitar prejuízos severos no funcionamento do dia a dia. Neste sentido, surge o Projeto “Jogando video jogos para aliviar os sintomas da depressão”, no âmbito do mestrado internacional em Design de Media Interativos da Universidade da Madeira em colaboração com o Serviço de Psicologia da UMa. Este projeto tem como objetivo contribuir para a redução dos sintomas e possíveis comprometimentos normalmente associados à sintomatologia depressiva. Pretendemos atingir este objetivo com a criação de um média de entretenimento - um video jogo - que permita desenvolver um conjunto de skills que se encontram comprometidas, num ambiente lúdico e divertido. Neste sentido, pretendemos avaliar o real contributo deste tipo de intervenções enquanto ferramenta útil para ajudar os indivíduos que apresentam sintomatologia depressiva, no sentido de melhorar o seu estado de humor e a sua funcionalidade no enfrentar o dia a dia. * Required

Assim sendo, e enquanto participante do projeto, ser-lhe-á pedido que:

- esteja disponível para jogar o video-jogo proposto no espaço temporal de 7 días
- jogue o jogo e preencha alguns questionários (antes e após jogar o jogo). Estes questinários ajudar-nos-ão a averiguar como este jogo pode ser um contributo ao nível da melhoria do seu estado de humor.

Os dados recolhidos são confidenciais:

- A sua identificação é protegida através do uso de uma sigla (criada por tí) e que terás que introduzir quando solicitado.
- A informação recolhida poderá ser utilizada, pelos investigadores, de forma completamente anónima e confidencial, em apresentações públicas, congressos científicos e publicações.

Qualquer questão que tenhas, não hesites em nos contatar por email.

Investigadores
- Diana Mendes: diana.mendes@m-iti.org
- Sergi Bermudez i Badia

A equipa de Serviço de Piscologia da Universidade da Madeira: servico.psicologia@mail.uma.pt
- Psicólogas: Carla Vale Lucas
- Coordenadora: Luísa Soares

1. Consentimento Informado *

Check all that apply.

☐ Declaro que aceito participar no Projeto "Jogando video jogos para aliviar os sintomas da depressão" nos seus diferentes momentos.

☐ Declaro que autorizo que a informação recolhida possa ser usada segundo os parâmetros anteriormente descritos.

Código de identificação

O código de identificação serve para proteger a tua identidade. Sempre que tiveres que preencher questionários iremos a pedir que o introduzas.

2. Coloca a primeira letra do teu nome, a primeira letra do teu último nome, seguida dos três últimos digitos do teu número de telemóvel. Segue o exemplo: CL345 *

_____

Informação demográfica

3. Indique a sua idade: *

_____

4. Indique o seu sexo: *

Mark only one oval.

- ◯ Feminino
- ◯ Masculino
- ◯ Prefiro não dizer

5. Indique curso e ano académico: *

_____

_____

_____

Annex 14. Demographics Questionnaire given to the field experiment sample in original Google Forms format.

6. Já jogou alguma vez video jogos? *

Check all that apply.

- [ ] Sim
- [ ] Não
- [ ] Talvez

7. Se respondeu 'sim', com que frequência joga video jogos? *

Check all that apply.

- [ ] Todos os dias
- [ ] Quase todos os dias
- [ ] Sempre que tenho vontade
- [ ] Apenas quando os meus amigos estão a jogar
- [ ] Raramente
- [ ] Nunca jogo

8. Quanto tempo, em média, costuma jogar vídeo jogos? *

Check all that apply.

- [ ] Até 1 hora por dia
- [ ] 1 ou 2 horas por dia
- [ ] Mais de 2 horas por dia

9. Costumo jogar vídeo jogos para... *

Mark only one oval.

- ...relaxar
- ...passar o meu tempo livre
- ...sentir o desafio
- ...socializar com outros jogadores
- ...ouvir a música dos vídeo jogos
- ...desfrutas dos gráficos do jogo
- ...desfrutar do tempo de forma diferente, numa realidade diferente

10. Normalmente jogo vídeo jogos... *

Mark only one oval.

- ...em casa, no meu tempo livre
- ...no trabalho, durante a hora do almoço
- ...na cama, antes de ir dormir
- ...num salão de jogos
- ...num cyber café

11. Eu prefiro jogar vídeo jogos... *

Mark only one oval.

- ...sozinho
- ...com outros jogadores presencialmente
- ...com outros jogadores online

12. Que tipo de vídeo jogos gosta de jogar? *

Mark only one oval.

- [ ] De ritmo acelerado
- [ ] Com uma historia profunda e complexa
- [ ] Qualquer tipo de jogo
- [ ] Jogos que estejam online e que possam ser jogados com outras pessoas
- [ ] Não sabia que existiam vários tipos de jogos
- [ ] Qualquer jogo que permita atirar em um alvo
- [ ] Puzzles
- [ ] Corrida de
- [ ] carros

Other:

13. Gosta de ouvir as músicas dos vídeo jogos? *

Mark only one oval.

- [ ] Eu ouço sempre
- [ ] Sim, mas prefiro ouvir as músicas que eu gosto
- [ ] Eu volto sempre ao meu nível favorito do jogo para ouvir a música desse nível
- [ ] Eu gosto da música de alguns dos menus dos jogos
- [ ] Quando estou a jogar, às vezes ponho a tocae as minhas músicas favoritas
- [ ] Normalmente desativo a música do vídeo jogo para não me distrair

Annex 15. PHQ – 9 and PANAS questionnaires given to the field experiment sample, in Google Forms format.

Questionário Sobre a Saúde do Paciente - 9 (PHQ - 9)

Durante os últimos 14 dias, em quantos foi afectado/a por algum dos seguintes problemas?

14. 1. Tive pouco interesse ou prazer em fazer coisas *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

15. 2. Senti desânimo, desalento ou falta de esperança *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

16. 3. Tive dificuldade em adormecer ou em dormir sem interrupções, ou dormi demais *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

17. 4. Senti cansaço ou falta de energia *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

18. 5. Tive falta ou excesso de apetite *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

19. 6. Senti que não gosto de mim próprio/a - ou que sou um(a) falhado/a ou me desiludi a mim próprio/a ou à minha familia *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

20. 7. Tive dificuldade em concentrar-me nas coisas, como ao ler o jornal ou ver televisão *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

21. 8. Movimentei-me ou falei tão lentamente que outras pessoas poderão ter notado. Ou o oposto: estive agitado/a a ponto de andar de um lado para o outro muito mais do que é habitual *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

22. 9. Pensei que seria melhor estar morto/a, ou em magoar-me a mim próprio/a de alguma forma *

Check all that apply.

- [ ] 0. Nunca
- [ ] 1. Em vários dias
- [ ] 2. Em mais da metade do número de dias
- [ ] 3. Em quase todos os dias

23. Se indicou alguns problemas, até que ponto é que eles dificultaram o seu trabalho, o cuidar da casa ou o lidar com outras pessoas? *

Check all that apply.

- [ ] Não dificultaram
- [ ] Dificultaram um pouco
- [ ] Dificultaram muito
- [ ] Dificultaram extremamente

A PANAS

Esta escala consiste num conjunto de palavras que descrevem diferentes sentimentos e emoções. Leia cada palavra e marque a resposta adequada no espaço anterior à palavra. Indique em que medida sentiu cada uma das emoções, durante a última semana:

Mark only one oval.

1. Nada ou muito Ligeiramente

2. Um Pouco

24. Interessado *

Mark only one oval.

- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

25. Perturbado *

Mark only one oval.

- 1. Nada ou muito Ligeiramente
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

26. Excitado *

Mark only one oval.

1. Nada ou muito Ligeiramente
2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

27. Atormentado *

Mark only one oval.

2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

28. Agradavelmente surpreendido * *Mark only one oval.*

1. Nada ou muito Ligeiramente
2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

29. Culpado *

Mark only one oval.

1. Nada ou muito Ligeiramente
2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

30. Assustado *

Mark only one oval.

- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

31. Caloroso *

Mark only one oval.

- 1. Nada ou muito Ligeiramente
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

32. Repulsa *

Mark only one oval.

- 1. Nada ou muito Ligeiramente
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

33. Entusiasmado *

Mark only one oval.

2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

34. Orgulhoso *

Mark only one oval.

1. Nada ou muito Ligeiramente
2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

35. Irritado *

Mark only one oval.

1. Nada ou muito Ligeiramente
2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

36. Encantado *

Mark only one oval.

2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

37. Remorsos *

Mark only one oval.

- 1. Nada ou muito Ligeiramente
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

38. Inspirado *

Mark only one oval.

- 1. Nada ou muito Ligeiramente
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

39. Nervoso *

Mark only one oval.

-
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

40. Determinado *

Mark only one oval.

- 1. Nada ou muito Ligeiramente
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

41. Trémulo *

Mark only one oval.

- 1. Nada ou muito Ligeiramente
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

42. Activo *

Mark only one oval.

-
- 2. Um Pouco
- 3. Moderadamente
- 4. Bastante
- 5. Extremamente

43. Amedrontado *

Mark only one oval.

1. Nada ou muito Ligeiramente
2. Um Pouco
3. Moderadamente
4. Bastante
5. Extremamente

Annex 16. Game Experience Questionnaire modified given to the field experiment sample in Google Forms format

SYMPHONY – Questionário de Experiência de Jogo

Este questionário destina-se aos voluntários que aceitaram participar no projeto "Jogando video jogos para aliviar os sintomas da depressão". O questionário levará cerca de 5 a 10 minutos para ser preenchido, e tem como objetivo avaliar a sua experiência durante e depois de jogar o vídeo jogo 'Symphony'. Gostaríamos de saber o que você pensa sobre este jogo, o que achou mais útil e importante, e o que acha que se podia fazer no jogo, de modo a poder contribuir mais para a sua rotina diária futura. Todas as perguntas são obrigatórias, e as informações que você fornecer aqui são confidenciais e serão usadas apenas para fins de pesquisa.

Em relação à sua experiência no jogo como um todo

Esta seção é dedicada à sua percepção do jogo como uma unidade. ex. a história, o jogo, a estética, os personagens, o timing, e assim por diante.

32. Eu estava interessado na história do jogo *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

33. Fiquei de mau humor *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

34. Pensei que era difícil *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

35. Eu pensei que era esteticamente agradável *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

36. Parecia uma experiência rica *

Mark only one oval.

	0			1	
nem um pouco	◯	◯	◯	◯	◯	extremamente

37. Tive que me esforçar muito *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

Sobre os labirintos

Ao longo da sua jornada você teve que atravessar labirintos a fim de encontrar personagens e coletar as peças que seriam necessárias para as suas tarefas finais. Nestes labirintos, você encontrou coleções, bem como inimigos. Classifique seus sentimentos enquanto estava nesta fase.

38. Eu senti-me entediado *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

39. Eu senti-me frustrado *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

40. Eu achei o jogo cansativo *

Mark only one oval.

	0	1				
nem um pouco	◯	◯	◯	◯	◯	extremamente

41. Eu senti-me habilidoso *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

42. Eu senti-me desafiado *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

43. Eu senti-me bem *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

Em relação aos nonogramas

Ao longo da sua jornada você teve que resolver um quebra-cabeça numérico, a fim de abrir uma fechadura e libertar os personagens da sua gaiola. Classifique os seus sentimentos enquanto você estava nesta fase particular do jogo.

44. Eu senti-me entediado *

Mark only one oval.

				0	1	
nem um pouco	◯	◯	◯	◯	◯	extremamente

45. Eu senti-me frustrado *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

46. Eu achei o jogo cansativo *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

47. Eu senti-me habilidoso *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

48. Eu senti-me desafiado *

Mark only one oval.

				0	1	
nem um pouco	◯	◯	◯	◯	◯	extremamente

49. Eu senti-me bem *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

Sobre a identificação e gestão de emoções

Depois de libertar o personagem, você teve que melhorar o seu estado emocional, a fim de obter uma das peças que você precisava para a tarefa final. Classifique seus sentimentos enquanto você estava nesta fase particular do jogo.

50. Eu senti-me entediado *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

51. Eu senti-me frustrado *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

52. Eu achei o jogo cansativo *

Mark only one oval.

	0	1				
nem um pouco	◯	◯	◯	◯	◯	extremamente

53. Eu senti-me habilidoso *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

54. Eu senti-me desafiado *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

55. Eu senti-me bem *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

56. Eu consegui influenciar o humor do(s) outro(s) *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

57. As ações do outro dependiam das minhas ações *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

58. Quando o(s) outro(s) ficou/ficaram felizes, eu fiquei feliz *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

59. O que eu fiz afetou o que o outro (s) fez. *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

Sobre sua experiência pós-jogo

É importante para nós conhecer os seus sentimentos depois que esta experiência chegou ao fim. Diga-nos como se sentiu depois de todas as suas tarefas terem sido concluídas e alcançado o seu objetivo.

60. Eu senti-me mal *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

61. Achei uma perda de tempo *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

62. Eu senti-me satisfeito *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

63. Eu senti-me exausto *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

64. Senti que podia ter feito coisas mais úteis *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

65. Senti-me orgulhoso *

Mark only one oval.

	0	1	2	3	4	
nem um pouco	◯	◯	◯	◯	◯	extremamente

Questões abertas

É importante para nós dar-lhe a oportunidade de expressar as suas opiniões abertamente, e obter mais insights sobre o que funcionou ou sobre o que pode ser melhorado no jogo.

66. Na sua opinião, este jogo é sobre quê? *

67. Na sua opinião, qual é o papel da música neste jogo? *

68. Até que ponto este jogo pode influenciar o seu comportamento diário no futuro? *

Mark only one oval.

	1	2	3	4	
nem um pouco	◯	◯	◯	◯	extremamente

69. Quais foram as estratégias mais úteis para si, no decurso do jogo? *

70. O que é que gostou mais no jogo? *

71. O que menos apreciou no jogo? *