

MPhil Thesis
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To determine the feasibility of serious
videogames for enhancing self-efficacy in
self-management in people with psychosis

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Declaration

‘I, Oleksandra Danilina, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.’

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Abstract

Serious videogames are games that aim to teach, train and/or inform, as well as provide a source of entertainment. These games are designed to engage players in a playful, stimulating manner to achieve a particular goal. Over the past decade, there has been a steady increase in the use of serious videogames for beneficial health reasons, in both physical and mental health domains, due to games' potential to engage the populations that are typically hard to motivate; one such population being those with a diagnosis of psychosis.

However, due to the lack of the research specifically into the serious videogame's domain for people with psychosis, we will report existing evidence for serious videogames effectiveness in promoting mental health-related outcomes, and their potential to engage and motivate the service user. In addition, we will summarise what factors should be targeted in such a game to promote engagement with self-management, as well as what is potentially the best method to design a serious videogame for psychosis using existing game design frameworks.

Inspiration for the serious videogame design and development will be drawn from existing research into serious videogames for physical and other mental health conditions.

In addition to the above, this thesis will report views and opinion of key stakeholders and how a game can potentially be tested and researched further. The views and opinions are collected to inform of the best methods to design the serious videogame.

We will present the final game design idea at the end of the thesis, along with the future implications and recommendations for practice and the research.

Impact Statement

The outcome of this thesis will indicate whether there is a potential to use a serious videogame to promote self-efficacy in the self-management of psychosis and what game elements/mechanics this serious videogames should have in order to promote engagement with the treatment based on the previous research.

In the thesis, we will identify what is already known about similar digital self-management interventions in mental health and physical health domains, and the methods that have been used to evaluate and develop these digital tools for self-management. Although the focus will be on serious videogames, due to the lack of strong evidence in the use of serious videogame's domain for self-management in mental health conditions, other digital tools (e.g., apps) will also be examined. We have conducted a series of literature reviews and one systematic review to assess the effectiveness of the serious videogames in promoting mental health-related outcomes.

In addition to the above, we have summarised relevant conclusions from existing theories on health behaviour changes, serious videogame designs, models of self-management for chronic conditions and existing serious videogames/apps for self-management. We have also conducted an interview study with mental health professionals and service users to determine views (acceptability) on the use of a serious videogame as a self-management tool, and to derive first design ideas for a videogame. These conclusions and an interview study should form the base for a future psychosis self-management serious videogame. A key task was to develop a theoretical understanding of the likely process of change by drawing on existing evidence and theory.

At the end of the thesis, we have proposed a design solution of a serious videogame to promote self-efficacy and engagement in people with psychosis, as well as how this tool can be implemented in practice and researched further.

Publications

The following publications are based on work presented in this thesis:

Danilina O, Cox A, Fonseca A, Johnson S. (2017). Serious Video Games as Psychosocial Interventions for Psychosis. In Proceedings of the 2nd Symposium Computing and Mental Health at CHI 2017, Denver, Colorado, US.

Danilina O, Cox A, Fonseca A, Johnson S. (2018). The Effectiveness of Serious Video Games on Mental Health Related Outcomes: Systematic Review. In Proceedings of the CHI Play workshop “Games for the Assessment and Treatment of Mental Health” at CHI Play 2018, Amsterdam, Netherlands.

Danilina O, Cox A, Fonseca A, Johnson S. (2019). Deriving design implications for serious videogame for people with psychosis. In Proceedings of the 4th Symposium Computing and Mental Health at CHI 2019, Glasgow, UK. (Poster)

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List of Abbreviations	
SVG(s)	Serious Videogame(s)
HBC	Health Behaviour Change
CBT	Cognitive Behaviour Therapy
MRC	Medical Research Council
WRAP	Wellness Recovery Action Plan
IMR	Illness Management Recovery
RCT	Randomised Control Trial
TPB	Theory of Planned Behaviour
NPC	Nonplayable Character
SDT	Self-determination Theory
CET	Cognitive Evaluation Theory
SCT	Social Cognitive Theory
ASD	Autism Spectrum Disorder(s)
RPG	Role-playing Game
UX	User Experience/Research
MHP(s)	Mental Health Professionals
HCI	Human Computer Interaction
TAU	Treatment as Usual
WL	Waiting List

Chapter 1: Motivation and Research Question

➤ This chapter contributes:

- A review of the research problem, which is in order to deliver more effective self-management interventions for psychosis, research is needed to identify factors that enhance and promote recovery through these interventions;
- A clear articulation of the research question;
- An overview of the method used to answer the research question;
- A summary of the main findings;
- An overview of the structure of this report.

1.1 Introduction

Psychotic disorders are among the most severe and disabling mental disorders, characterised by deviations in cognitive functioning and the perception of reality (Rössler, Salize, van Os, & Riecher-Rössler, 2005). They often lead to significant social and occupational dysfunctions, and are frequently accompanied by victimisation, self-stigmatisation, and feelings of shame and demoralisation (Peraala et al., 2007; van Os, Hanssen, Bijl, & Vollebergh, 2001).

According to the “Adult Psychiatric Morbidity Survey 2014”, published in September 2016 (Mcmanus, Bebbington, Jenkins, & Brugha et al, 2016), an estimated prevalence of psychotic disorder in the 2015 in England is 0.7%; this includes adults aged 16 and over.

It is worth noting that psychotic experiences are relatively common, with recent estimates suggesting that between 3-5% of the population have psychotic experiences at some point in their life (Dixon, Holoshitz, & Nossel, 2016). The average age of onset ranges from 15 to 35 years old (Kessler et al., 2007). However, it is worth pointing out that the majority of these experiences falls well short of being a full-scale psychotic disorder resulting in severe decline in function.

Nevertheless, the burden of psychotic disorders is large and multifaceted. There are the direct costs of providing care for individuals with psychotic disorders. The indirect costs encompass the loss of productivity through impairments, disability, and premature death, the burden on caregivers and the burden of individual distress (Rössler et al., 2005).

To stay well after the acute medical treatment, self-management of the condition (psychosis) is required. Self-management can be defined as “the individual's ability to manage the symptoms, treatment, physical and psychological consequences and life style changes inherent in living with a chronic illness” (Barlow et al., 2002). Objectives for self-management include instilling hope; improving illness management skills; providing information about the nature of the illness and treatment options; developing strategies for self-monitoring of the illness; improving coping strategies; and developing skills to manage life changes.

Self-management interventions have been used across various health conditions, especially in the domain of mental health (Taylor et al., 2014). The application of self-management interventions to severe mental illnesses like psychosis has been growing rapidly in recent years (Scott, Webb, & Rowse, 2015; Lean et al 2019). Most self-management interventions are based on standardised psychological treatments, with the most common principles being similar to those used in cognitive behavioural therapy (CBT) (Cuijpers & Schuurmans, 2007). A recent meta-analysis by Lean et al. (2019) suggests that self-management interventions for psychosis have a small-to-medium-sized beneficial effect on overall symptoms, and a moderate-sized effect on recovery and self-efficacy. Evidence from more than 40 randomised controlled studies suggests that illness management strategies can effectively enhance people’s knowledge of their illness, help them take their medications, mitigate the severity and distress associated with persistent symptoms, and reduce symptomatic relapse and hospitalisations (Lobban et al., 2013; Mueser et al., 2002).

However, despite the given effectiveness, other evidence suggests that engagement with self-management interventions is relatively poor (Donkin et al., 2011). In fact, the problem with engagement concerns all domains of psychosis treatment. Research suggests that 32% of patients drop out of services over 18 months after the first episode of psychosis (Dixon et al., 2016). In addition, research further suggests that effects from self-management interventions can be enhanced by targeting certain factors like a person’s self-efficacy (Scott et al., 2015; Lean et al 2019). To deliver more effective self-management interventions for psychosis, research is needed to identify factors that promote recovery through these interventions and enhance engagement with them.

Self-efficacy is believed to be one of the factors that can positively influence engagement with the self-management interventions and improve patient’s health outcomes. Self-efficacy

is a person's belief in their ability to exercise control over the condition(s) that affects their lives (Bandura, 1986); it is predictive of future behaviour. When confidence in one's ability to perform a particular health behaviour is high, the individual's health knowledge is more likely to translate into positive health behaviours (Bandura, 1994, 2004; Maibach, Flora, & Nass, 1991). Data from early studies suggest that the development of self-efficacy may represent a significant and important contributory factor in helping people with psychiatric disabilities to recover (Clarke et al., 2014; Mancini, 2007; Watson & Larson, 2006).

The concept of self-efficacy in psychosis self-management is an understudied area. However, preliminary results suggest that people with psychosis view self-efficacy as crucial to their recovery, quality of life, and being in control of their illness and life (Grealish, Tai, Hunter, & Morrison, 2013).

One way to target promotion of self-efficacy and engagement with the self-management routine in people with psychosis is through the use of technologies like SVGs.

SVGs are a special class of videogames created for purposes other than entertainment; they are designed to foster the learning of targeted skills that are particularly difficult and not rewarding for participants (e.g., encouraging a child to take medicine that makes him feel nauseous in the short term, but will likely cure his illness in the long run). A central goal of SVG is that the learning in the game generalises to improve real-life outcomes. They are different from games designed for the purpose of entertainment, which are not designed for the purpose of skill acquisition and are not expected to lead to generalised skills or knowledge beyond the game (De Freitas, 2006; Whyte, Smyth, & Scherf, 2015).

Studies on chronic physical conditions like diabetes (Baranowski et al., 2008; Debb Thompson, 2012) suggest that SVGs are a promising medium for health behaviour changes, building up perceived self-efficacy and engaging the patient with the treatment. As people become more successful within the game, they are likely to perceive themselves as being more efficacious in the tasks and skills they are rehearsing (Clements et al., 1987; Niemiec & Walberg, 1992).

Videogames provide an environment where people can experiment and learn over time. Users may fail sometimes but, ultimately, they can try again and succeed. The widespread appeal of digital game playing among all ages creates a unique opportunity to deliver health education during leisure time, outside of the practice, and in a manner that is cost-effective and easily scalable (Baranowski et al., 2008). Lastly, games can attract and maintain attention, which is

a key component for effective health behaviour change (Thompson et al., 2010). In fact, videogames are widely popular among all ages and groups of people. According to ESA's reported findings (Entertainment Software Association, 2017), the average age of a female gamer is 37 and the average age for males is 33. Furthermore, gaming is popular among the United Kingdom's young generation. 71% of UK adults (approx. 40m) own a smartphone and 59% of UK households (approx. 15.9m) own a tablet (Ofcom, 2016). Furthermore, 47% of UK smartphone owners use apps on their phones to play games – more that use apps for online banking (40%) or reading the news (33%).

Studies on the effectiveness of SVGs suggest potential benefits for psychological and behavioural changes, including improved disease self-management in chronic disorders (Kato, 2010a; Primack et al., 2012). In addition, results of randomised controlled trials (RCTs) and systematic reviews show that serious games have the potential to be used entirely or as part of the treatment and management of mental health disorders (Beaumont & Sofronoff, 2008; Fleming et al., 2014; Lau, Smit, Fleming, & Riper, 2017).

At the moment, there are no SVGs for psychosis self-management. Therefore, we would like to address this gap in the literature by exploring the feasibility and acceptability of a SVG for psychosis self-management designing, as well as establishing the basic design principles necessary for such a SVG.

1.2 Methodology

The revisited Medical Research Council (MRC) framework for complex interventions (Craig et al., 2008) (see Fig.1) is used to develop and evaluate complex interventions. Although a definition of a “complex intervention” is complicated, we believe SVG fits the outlined criteria. These criteria were taken from a new guidance summarised by Craig et al. (2008):

1. It has a number of interactions between components within the experimental and control interventions;
2. It has a number of difficult behaviours required by those delivering or receiving the intervention (e.g., a range of measures will be needed to determine the effectiveness of the intervention);
3. It has a number of groups or organisational levels targeted by the intervention (e.g., complex interventions can be adapted for the needs of various groups – for example, CBT for psychosis and CBT for depression);

4. It has a number and variability of outcomes;
5. It has a degree of flexibility or tailoring of the intervention permitted.

The MRC framework characterises the process of development through to the implementation of a complex intervention in terms of the phases of drug development. Although it is useful to think in terms of phases, in practice these may not follow a linear or even a cyclical sequence

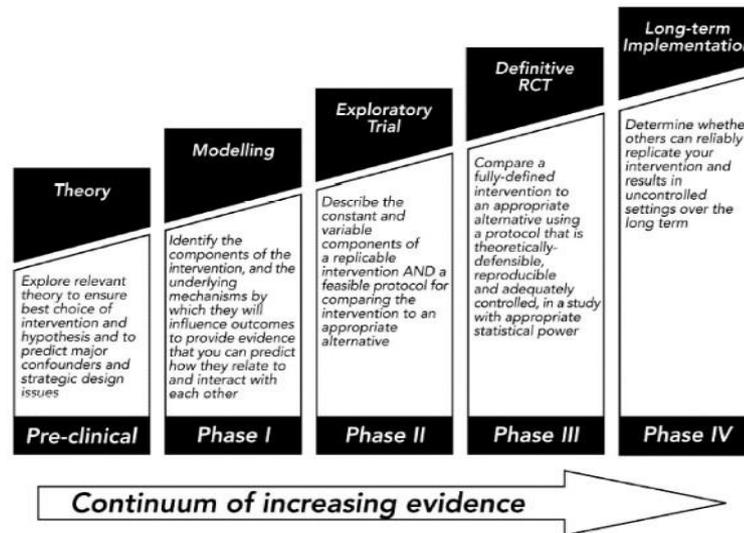


Figure 1 Key elements of the development and evaluation process (MRC framework)

The best practice is to develop interventions systematically, using the best available evidence and appropriate theory, then to test them using a carefully phased approach.

The development of any complex intervention starts with building a theory, then moving on to conducting a series of pilot studies targeted at each of the key uncertainties in the design, and moving on to an exploratory phase and then a definitive evaluation.

Usually, the development of complex interventions undertakes five phases (including pre-clinical). We aim to cover the pre-clinical phase and Phase 1 (modelling) during this MPhil.

Pre-clinical and Phase 1 will involve:

Step 1: Identifying existing evidence. The first step is to identify what is already known about similar interventions and the methods that have been used to evaluate them. If there is no recent, high-quality systematic review of the relevant evidence, one should be conducted and updated as the evaluation proceeds; this will be covered in Chapters 2,3 and 4.

Step 2: Identifying and developing a theory. The second step aims to develop a theoretical understanding of the likely process of change by drawing on existing evidence and theory, supplemented if necessary, by new primary research. This should be done whether the researcher is developing the intervention or evaluating one that has already been developed, and will be covered in Chapter 5.

Step 3: Begin to model process and outcomes. The third step involves conducting a qualitative study that is required to progressively refine the design of an intervention before embarking on a full-scale evaluation or a subsequent series of iterations; and providing future research with more details/information regarding future exploratory phase for the intervention (Phase 2) ; this will be covered in Chapters 6-8. This can be seen as part of the Phase 1.

Subsequent Phases 2, 3 and 4 require more time and resources than this MPhil can afford; therefore, they are not included in the detailed description.

The MRC framework is applicable for the design of complex interventions, yet it does not consider the specific nature of the intervention. We believe that combining the MRC framework approach, existing recommendations and guidelines for the design of mental health technologies (Doherty, Coyle, & Matthews, 2010) will allow us to produce an effective SVG for self-management in people with psychosis.

1.3 Research Question

The title of this thesis is “To determine the feasibility of an SVG for enhancing self-efficacy in self-management in people with psychosis”.

By “feasibility” we mean determining whether a SVG is appropriate for further testing and if there is a need, scope and place for it within the existing healthcare system (Bowen et al., 2009).

Feasibility as a concept can have many outcomes, however we focused on acceptability (or the likelihood of the end users [patients and mental health professionals] to use future SVGs in the existing clinical setting) and potential implementations (how can SVGs be used within existing practice; e.g., use as part of the treatment, play before/after therapy sessions/for how long?).

Bearing in mind the above definition of “feasibility” and the outcomes that we used to assess it, this MPhil explored the feasibility of using SVGs as a tool for enhancing self-efficacy in self-management in people with psychosis by exploring the following research questions:

1. *What evidence is there to suggest that SVGs have the potential to be an effective tool to promote engagement and self-efficacy in self-management interventions in people with psychosis?*
2. *Which game elements and game mechanics are likely to be effective in promoting engagement and self-efficacy in self-management interventions for people with psychosis, and how can these be used within a SVG for self-management of psychosis?*

Main contribution: The outcomes explored the feasibility of using an SVG to promote self-efficacy and engagement in self-management of psychosis following the revisited MRC framework for complex interventions. Also, this MPhil explored clinicians' and service users' attitudes towards SVGs as a delivery mechanism of interventions for self-management of psychosis, and possible methods of integrating such games in the existing care system.

In addition, this thesis synthesised the existing literature on SVGs for psychosis and digital mental/physical health self-management. We also examined whether SVGs are effective in promoting engagement and self-efficacy in self-management interventions, what game elements and mechanics were utilised for this purpose, and how we could use these findings to design our own SVG for people with psychosis.

Addressing these research questions required a good understanding of the existing literature on the acceptability, use and effectiveness of serious therapeutic games in the mental health field, as well as their development and subsequent implementation.

In order to follow the MRC framework for complex interventions, the following steps were undertaken to answer two research questions posted above:

1. Identifying existing evidence (pre-clinical). The first step was to identify what is already known about similar self-management interventions, and the methods that have been used to evaluate and develop them. We have conducted a series of literature reviews and one systematic review (see Chapters 2-4). We found that digital tools such as videogames have a potential to be an effective and feasible medium for the delivery of self-management interventions in people with psychosis because they have the power to promote self-efficacy, engage the player and are an accessible option.
2. Identifying and developing a theory (pre-clinical/Phase 1). The second step involved drawing relevant conclusions from existing theories on health behaviour changes, SVG design, models of self-management for chronic conditions and existing SVG/apps for self-

management. We found that in order to build an effective and engaging SVG, researchers should consider these conclusions from our research:

- (1) take inspiration from existing successful SVGs (such as those in cancer and diabetes research),
- (2) build upon existing theories of HBC and SVG design,
- (3) utilize inherent videogame's abilities that are believed to promote self-efficacy - such as providing choice, connecting goals to personal values, providing immediate performance-related feedback, and structuring the game in levels with challenges that gradually increase in difficulty (Thompson et al., 2010).
- (4) collaborate with stakeholders such as MHPs, service users, HCI researchers and game designers.

In addition to the above, step 2 further developed an understanding of a potential SVG for people with psychosis via a qualitative interview study. We have interviewed MHPs and service users on whether SVGs can be used within NHS, and what the potential game will look like.

These conclusions formed a base for a future SVG. A key task was to develop a theoretical understanding of the likely process of change by drawing upon existing evidence and theories (see Chapters 5-8).

1.4 Overview of the Thesis:

Chapter 1 introduces the research problem, research questions, an overview of the methods used to answer the research question and an overview of this report's structure.

Chapter 2 covers a review of the literature on digital and non-digital self-management tools, and interventions for psychosis. This chapter also highlights existing problems with engagement in the self-management of psychosis, as well as the importance of promoting self-efficacy in self-management interventions.

Chapter 3 is an overview of the existing literature on how people with psychosis use technologies, whether this population is interested in videogames and whether they see them (videogames) as an acceptable medium for therapeutic interventions.

Chapter 4 is systematic review of the effectiveness of SVGs in mental health, which further explores the acceptability of videogames as an intervention.

Chapter 5 is a literature review on existing apps and videogames that promote self-efficacy in chronic physical and mental health conditions. The aim of the chapter is to summarise the existing technologies that are successful in promoting self-efficacy in patients with chronic conditions. Furthermore, Chapter 5 combines conclusions from the previous chapters and aims to determine initial design implications for a self-management videogame for people with psychosis.

Chapter 6 describes the interviews held with end users (patients and clinicians) on whether SVGs can be used within the NHS and what the potential game will look like.

Chapter 7 describes the SVG's gameplay that we would like to propose, based on the outcome of Chapter 6 (interview study), and a plan to test the proposed SVG idea in terms of effectiveness and promoting self-efficacy.

Chapter 8 is a synthesis of the conclusions from other chapters. It outlines contribution of this thesis with the reference to research questions. It also provides limitations of our research. In addition to the above, this chapter provides recommendations for future research, namely how future research can take our findings further into the development of our SVG.

Chapter 2: Self-management of Psychosis

- This chapter contributes:
 - An overview of what we know about self-management for psychosis;
 - An overview of existing examples of non-computerised interventions for self-management of psychosis;
 - An overview of existing examples of using digital means to deliver interventions for psychosis;
 - A summary of the factors that influence the effectiveness of self-management interventions for psychosis;
 - Highlights the problem of engagement in self-management of psychosis;
 - Highlights the importance of promoting self-efficacy in order to address the problems with self-management of psychosis.

2.1 Introduction to Self-management for Psychosis

Self-management interventions are defined as those that are “designed to be conducted predominantly independently of professional contact” (Bower, Richards, & Lovell, 2001). They can be administered through a variety of mediums, such as face-to-face or group meetings, through computers, mobiles and online platforms. Self-management typically involves working independently through a guide that describes the steps to be taken to apply a psychological treatment. One of the variations of traditional self-management interventions is guided self-management (or supported self-management), which is distinguished “by the support that is given by a professional therapist or coach to the patient when working through the standardized treatment” (Cuijpers, Smit, Bohlmeijer, Hollon, & Andersson, 2010). The support offered can range from assisting the person to work through the self-management programme to emotional support, and can be provided in a range of ways (e.g., face-to-face, telephone or email).

Self-management interventions have been used across various health conditions, especially in the mental health domain (Taylor et al., 2014). Applications of self-management interventions to severe mental illnesses, such as psychosis, has been growing rapidly in recent years (Scott et al., 2015; Lean et al 2019).

As with other mental health difficulties, self-management approaches may reduce the experiences and symptoms of psychosis. For instance, self-management interventions could be used to address the frequency of symptoms, the extent to which they can be controlled and/or the distress associated with symptoms like hallucinations and delusions.

Alternatively, or in addition, self-management interventions can target difficulties associated with the experience of psychosis, such as anxiety, self-esteem, low mood and poor social functioning, as well as setting and monitoring recovery goals (including social recovery).

Psychoeducation is one of the more common approaches used to promote self-management. For example, Smith et al (2011) developed an internet-based intervention for those diagnosed with bipolar disorder. The intervention involved participants being given information about the causes of bipolar disorder, medication, lifestyle changes, the role of early intervention and information regarding the various psychological approaches to bipolar disorder.

Other interventions augment psychoeducation with approaches like peer support and CBT. For instance, Alvarez-Jimenez et al. (2013) supplemented internet-based psychoeducation with online peer-to-peer social networking and elements of computerised CBT. Peer-to-peer social networking typically involved those with shared experiences interacting via an online platform, providing each other with mutual support, whereas computerised CBT delivered online cognitive strategies to help identify unhelpful thinking patterns (e.g., ruminative thoughts).

CBT seems to be less frequently used as a basis for developing self-management for psychosis when compared to its use in self-help for depression and anxiety (Scott et al., 2015).

Peer-support groups can be used in conjunction with other self-management techniques and involves those with shared experiences of a particular set of symptoms and/or diagnoses interacting with one another to provide mutual support. Peer-support groups are not only delivered face-to-face, since online peer support for psychosis have also been developed.

A meta-analysis and systematic review by Lean et al. (2019) compared all available forms of self-management interventions for psychosis and found a small-to-medium-sized beneficial effect on overall symptoms and a moderate-sized effect on recovery, self-efficacy, empowerment and hope. The evidence reported in the meta-analysis additionally suggested that self-help interventions can have comparable effects on psychosis as having been

described for depression and anxiety in other reviews (Bower, Richards, & Lovell, 2001; Gellatly et al., 2007; Haug, Nordgreen, Öst, & Havik, 2012; Hirai & Clum, 2006; Marrs, 1995; Spek et al., 2007).

As described above, there are different forms of self-management interventions that will be discussed further in Paragraphs 2.2 and 2.3. The majority of the existing evidence-based self-management programmes combine psychoeducation, behavioural training and peer-support techniques. Therefore, separate programmes and tools will be reviewed.

2.2 Examples of Non-computerised Interventions for Self-management of Psychosis

Currently, there are many self-management programmes that focus exclusively on mental health; however, only a few were designed to potentially manage psychotic disorders. The full list of existing self-management programmes can be accessed via the review by Lean et al. (2019). Some of the examples include the Wellness Recovery Action Plan (WRAP) (Copeland, 2008), the Illness Management and Recovery (IMR) programme (Gingerich & Mueser, 2005), the Mindfulness-Based Psychoeducation Program (Chien et al., 2016), and Building Recovery of Individual Dreams and Goals through Education and Support (Cook et al., 2012). For convenience, we have opted to focus on IMR and WRAP, since they are widely disseminated and accepted examples of self-management programmes. Below, each programme will be briefly described and the evidence of effectiveness will be discussed.

2.2.1 Wellness Recovery Action Plan (WRAP)

WRAP is programme that relies on an individual to identify internal and external factors that can help patients to facilitate recovery; these factors form the basis of a future individualised plan. The creation of a WRAP plan generally begins with the development of a personal Wellness Toolbox (akin to a diary), consisting of simple, safe and free or low-cost self-management strategies (e.g., healthy diet, exercise, sleep patterns and pursuit of adult life roles) (Copeland, 2008). The person then uses this toolbox to create an individualised plan that uses each strategy to obtain and maintain their recovery. The plan includes the identification of “early warning signs” concerning symptom exacerbation or crisis, and how the toolbox can help people to manage their symptoms and feel better. WRAP also encourages the development of a crisis plan, which states how the person would like to be treated in times of crisis (similar to an advance directive for inpatient psychiatric care), as well as a post-crisis plan for getting back on the road to recovery.

WRAP is typically taught in a group of 5-12 patients, educators are individuals (peers) in stable recovery from mental illness and it is offered in 8–12 weekly sessions with homework assignments. Sessions usually include lectures, group discussions, personal examples from the lives of the educators and participants, individual and group exercises, and voluntary homework assignments. According to developers, one of the most important components of WRAP is a social support provided by peers.

Research findings suggest that WRAP can improve psychiatric symptoms, physical health, and personal recovery, and increase hopefulness and self-advocacy in a number of psychotic conditions including schizophrenia and schizoaffective disorder (Cook et al., 2012; Fukui et al., 2011; Starnino et al., 2010). WRAP has also been shown to improve attitudes about recovery and increase recovery knowledge in service users, their family members/carers, and mental health practitioners (Doughty, Tse, Duncan, & McIntyre, 2008; Higgins et al., 2010). These studies, however, did not randomly allocate participants to groups. The strongest evidence to date comes from the two RCTs in the US. The first trial demonstrated that participating in WRAP can improve personal recovery and quality of life, reduce depression and anxiety, enhance hopefulness and increase levels of self-advocacy (Cook et al., 2010, 2012). The second trial confirmed that WRAP can reduce the self-reported need for and use of formal mental health services over time (Cook et al., 2013).

However, an RCT by Cook and colleagues (Cook et al., 2012) also reported that WRAP did not have any impact on participants' acquisition of knowledge about their illness, nor on their willingness to be assertive in treatment settings. In addition, an RCT by O'Keeffe et al (2016) failed to replicate the findings of (Cook et al., 2012); the authors believe there are multiple reasons for this, including that their analysis was underpowered to detect significant effects, and that WRAP was delivered by mental health professionals and not by service users (although in the manual WRAP should be delivered by peers).

2.2.2 The Illness Management and Recovery (IMR) programme

Unlike WRAP that focuses on all mental health disorders, the IMR programme was developed in order to help primarily clients with schizophrenia and major mood disorders. A clinician or other mental health professional deliver it. The objective of IMR is to teach individuals how to manage their illnesses more effectively in the context of pursuing their personal goals. IMR incorporates five self-management strategies that have been identified by the author during the initial literature review. These five strategies are psychoeducation

materials about mental illness and its treatment, cognitive-behavioural approaches to medication adherence (e.g., incorporating cues for taking medication into daily routines), developing a relapse prevention plan, strengthening social support by social skills training and coping-skills training for the management of persistent symptoms. To motivate clients to better learn how to manage their illness and to help them move forward in their lives, IMR begins with an exploration of the meaning of recovery to the client and setting personal recovery goals to work towards in the programme.

The five strategies outlined above are further incorporated into nine curriculum topic areas. These topics are taught using a combination of educational, motivational and cognitive-behavioural teaching strategies, with weekly individual or group sessions requiring approximately nine months to complete. Homework assignments are developed collaboratively with the client. In addition, and with the clients' consent, significant others (e.g., family, friends) are encouraged to help clients learn self-management strategies and pursue their personal goals.

The IMR programme often comes with the patient and clinician versions of the Illness Management and Recovery Scale (IMRS). This was done to provide a practical measure of a patient's progress during his or her participation in IMR. Parallel versions of the scales have been developed for patients and their key clinician, with questions reflecting specific IMR programme targets.

A review of the literature by McGuire et al. (2014)¹ reported three RCT trials that found an overall significant improvement in IMRS scores among patients assigned to IMR versus treatment as usual. However, other tools were used to measure the improvement and, in this case, results were different. In one RCT (Färdig, Lewander, Melin, Folke, & Fredriksson, 2011), participation in IMR was associated with an increased use of social support and problem solving, and a decreased use of avoidance and self-control using the Ways of Coping Scale. Another RCT (Hasson-Ohayon, Roe, & Kravetz, 2008) measured coping with the Coping Efficacy Scale and found no differences in improvement between the patients assigned to IMR or treatment as usual. Patients assigned to IMR versus treatment as usual did

¹ It is important to note that out of three RCTs, only one RCT (Färdig et al., 2011) looked exclusively at patients with psychosis while other two RCTs (Levitt et al., 2009; Hasson-Ohayon et al., 2008) looked at various psychiatric patients including those with psychosis.

not report greater improvement on measures of symptoms (Levitt et al., 2009), recovery and quality of life (Färdig et al., 2011), or social support (Hasson-Ohayon et al., 2008).

Outcomes evaluated by independent assessors were generally more encouraging. Two RCTs examined observer ratings of psychiatric symptoms among patients assigned to IMR or treatment as usual, and both reported a greater reduction of symptoms among the IMR patients (Färdig et al., 2011; Levitt et al., 2009). The effect sizes were small (Levitt et al., 2009) and small-to-medium (Färdig et al., 2011).

Finally, all three RCTs found that there were no significant differences in hospitalisation among patients assigned to IMR or treatment as usual. No differences were found between patients assigned to IMR versus treatment as usual in the improvement of employment rate or in changes in medication compliance.

Non-RCT trials were generally more positive about the IMR programme, reporting a significant reduction in psychiatric symptoms (Fujita et al., 2010; Mueser et al., 2006). In addition, these trials indicate that self-ratings of recovery improved more among IMR patients than a control group, but the one RCT that evaluated whether IMR was associated with improved consumer ratings of recovery did not confirm this hypothesis.

2.2.3. Conclusion

Both programmes help to empower patients with the severe mental health problems. WRAP and IMR programmes have a similar pattern of action, and both combine psychoeducation, early symptom recognition and coping-skills learning. However, WRAP focuses more on peer support, while IMR focuses on the reduction of symptoms. Furthermore, WRAP was designed to suit all the existing mental health illnesses, while IMR was mainly (though not exclusively) developed for the self-management of schizophrenia.

Evidence from RCTs are mixed for both programmes, but the most researched one is WRAP.

2.3 Examples of Using Digital Means to Deliver Interventions for Psychosis

There are a number of pressing issues on the current healthcare providers to improve the outcomes for people with psychosis. These include (Torous, Woodyatt, Keshavan, & Tully, 2019):

(1) The improvement of access to care for people with psychosis;

- (2) Accounting for variability among clinical population (experience of psychosis is not the same for everyone);
- (3) A need for better modelling of illness outcomes;
- (4) Improved access and availability of early intervention treatments;
- (5) A need for new pathways to enhance the use of existing treatments.

In addition to the impairments negatively affecting the seeking of help, long waiting times and limited financial resources are strong arguments to develop innovative treatment concepts.

One novel opportunity to address the above challenges may be to provide mental health services via the technology-based tools. The use of such “eMental health” technology to care delivery has developed rapidly.

As suggested by Torous et al (2019), eMental health interventions are not a panacea to the challenges faced by mental health services, but rather a potential cost-effective and scalable solution that has a number of advantages. These interventions are easily accessible, provide anonymity to the user and are less expensive than personal patient-provider contacts. The elimination of social cues and distinctions, such as race, disability and facial expressions, through technology can help people to communicate more freely and feel more confident.

The use of eMental health applications (“apps”) may be especially important for patients without access to traditional mental health care (Younes, Chollet, Menard, & Melchior, 2015). However, it does not mean that eMental health interventions should completely replace interactions with clinicians. On the contrary, these interventions should be incorporated carefully into the existing practice and enhance the use of existing treatments.

The types and effectiveness of existing eMental health interventions will be examined further in this chapter. There are two types: web-based interventions and mobile-based interventions. The categorisation of eMental health interventions was adopted from a systematic review by (Gaebel et al., 2016).

2.3.1 Web-based interventions

Web-based interventions are mediations that can take any form, however it is usually either a website, an online forum or an offline computer programme that can be accessed via computer (PC), laptop and mobile/tablet.

Literature reviews by Naslund et al (2015) and Gaebel et al (2016) summarised the types of remote technologies used in different eHealth interventions for severe mental illnesses, and found that most web-based interventions had been developed up until 2015/2016. However, there has been a recent trend in the development of mobile apps due to the commonplace technology of smartphones (a primary mode of delivery) (Bucci, Barrowclough, et al., 2018), and that smartphone ownership rates in psychosis are comparable to the general population (Firth et al., 2016).

Web-based interventions tend to focus on psychoeducation, provide general information about schizophrenia and psychotic disabilities, medication, other treatment options, and various community services, such as housing, employment services and rehabilitation services.

There were two studies that describe computer programmes that contain additional interactive parts to a traditional psychoeducation approach, such as online psychoeducation therapy groups and a channel for peer support (Rotondi et al., 2010; Álvarez-Jiménez et al., 2012).

Another use of web-based programmes is to encourage communication between the patient and clinician. For example, one study developed a web-based programme to empower patients with schizophrenia to discuss treatment options with their clinicians. Patients in the intervention group used an interactive web-based intervention with video clips of actors, who simulated a patient discussing treatment, concerns showing the performance of communication strategies. The control group was shown educational videos about the treatment of schizophrenia before a routine follow-up appointment. The results showed that the ensuing clinician visits in the intervention group were longer and patients had a proportionately greater contribution to the dialogue with less verbal dominance by the clinician. Moreover, patients in the intervention group asked significantly more questions, provided more lifestyle information and more often made sure that they had understood the information provided by the clinician (Steinwachs et al., 2011). A limitation of this study was the small sample size and, therefore, limited generalisability. In addition, there was a self-selection bias, since less than one-third of clinicians at the study sites participated.

Another web-based intervention that lacks investigation is online peer-support groups. Online peer-support groups serve as a platform for service users to exchange information and personal experiences with peers, either moderated (Kaplan et al., 2011) or not (Haker, Lauber, & Rössler, 2005). A study (Álvarez-Jiménez et al., 2013) reported the development

of a website that integrates therapy modules with a privately moderated social networking “café”. The e-café functions included a personal profile page, a network of friends, a group problem-solving function and a discussion forum.

However, a further reviews by Gaebel et al. (2016) and Rotondi et al. (2010) concluded that participation in unmoderated and unstructured online peer-support groups was not associated with clinical or psychological benefits Therefore, formal supervision or guidance in online peer support seemed to be pivotal (Álvarez-Jiménez et al., 2013).

Research on online peer-support groups as a mode of delivery of self-management interventions is still sparse, and a randomised controlled trial showed that unmoderated and unstructured internet-based peer support (including patients with schizophrenia spectrum disorders and affective disorders) was not efficacious to improve recovery, quality of life, empowerment, social support and distress (Naslund et al., 2015).

Table 1 details examples of web-based interventions for psychosis:

Table 1: Web-based Interventions for Psychosis

Study Name	Description of the Intervention
HORYZONS (Álvarez-Jiménez et al., 2013)	 <p>A website that integrates tailored therapy modules with a private moderated social networking “café.” The e-café functions include a personal profile page, a network of friends, a group problem-solving function and a discussion forum. Aimed to facilitate peer-to-peer interaction, while being moderated by the clinician. The aim is to prevent psychotic relapses for patients with first-episode psychosis and to further empower them.</p>
SOAR (Rotondi et al., 2010)	 <p>A website that consists of psychoeducational material for people with schizophrenia and their supporters. Includes therapist-moderated online forums.</p>

MieliNet (Anttila et al., 2012)



Offers information about schizophrenia, its symptoms and patients' rights, a chat room for peer support and a Q&A column. Designed to structure a psychoeducation intervention delivered by trained nursing staff over six sessions.

2.3.2 Mobile-based interventions

Mobile-based interventions are any mediations delivered in a form of an app or text via phone, smartphone or tablet; for example, text messaging like FOCUS (Ben-Zeev et al., 2014) and apps like Actissist (Bucci, Barrowclough, et al., 2018), which are discussed below.

Naslund et al. (2015) found several mobile-based interventions upon reviewing mHealth and eHealth interventions for serious mental illnesses. The interventions for psychotic disorders focused on disease management, medication adherence and support, relapse control, managing psychiatric instability, as well as detecting early warning signs.

Preliminary evidence showed that mobile-based interventions may lead to improved outcomes regarding positive and negative symptoms, depressive symptoms, rates of hospital admissions and numbers of inpatient days, emergency room visits, medication adherence and attendance of clinical appointments, social interactions, suicidal ideation, quality of life and somatic comorbidity. Although it is worth noting that the majority of the evidence of effects comes from studies with small power, any conclusions should be interpreted with care.

As an example, in one study, mobile text-messaging intervention FOCUS assessed medication adherence and clinical status, and provided feedback and support to the participants. It suggested various coping strategies in response to participants' replies to the text messages (Ben-Zeev et al., 2014).

Most of the research on mobile-based interventions are focused on feasibility and acceptability, rather than determining treatment efficacy.

Table 2 details a summary of some mobile-based interventions that focus on various aspects of self-management. The right side offers an outline of how each intervention is being delivered and its key characteristics.

Table 2: Mobile-based Interventions for Psychosis

Study Name	Description of the Intervention
FOCUS (Ben-Zeev et al., 2014)	 <p>An app. Prompts user to answer daily self-assessment questions (related to medication, voices, mood, social interaction and sleep), and encourages users to engage in illness self-management strategies structured as Q&A exchanges, advice and visual aids, drawing on CBT principles, social skills training and illness management.</p>
MATS (Granholt, Ben-Zeev, Link, Bradshaw, & Holden, 2012)	<p>Mobile phone text message intervention. Targets: medication adherence, socialisation, and symptom management. The MATS intervention prompted health-promoting behaviours and used CBT techniques. (No picture available)</p>
ITAREPS (Španiel et al., 2012)	<p>Text messaging. Weekly mobile telemonitoring identifying prodromal symptoms of relapse to enable intervention and prevent unnecessary hospitalisations. (No picture available).</p>
My Journey 3 (Stear et al., 2019)	 <p>An app available through Google Play. My Journey 3 adapted existing paper-and-pen self-management intervention components—in routine use in NHS services, which includes monitoring of psychotic experiences, mood, sleep, stress, alcohol and cannabis use, medication trackers and advice for each area, and information about psychosis. Reminder function for activities and coping strategies. Currently is in testing (feasibility RCT).</p>
WellWave (Macias et al., 2015)	 <p>An pp. Delivers daily menu of suggested activities, including exercise prompts, regular self-assessments of physical health quality, health control and stage of exercise, and passive recording of physical activity.</p>
PRISM (Depp et al., 2012)	<p>This mobile intervention builds upon established psychoeducational approaches for bipolar disorder focused on self-monitoring of mood states and on planning action steps to address both symptoms and early warning signs of illness. (No picture available).</p>
FIMM (Miklowitz et al., 2012)	<p>Text-messaging intervention targeting early warning sign identification, sleep-wake cycle regularisation, and medication adherence. (No picture available).</p>

Actissist (Bucci, Barrowclough, et al., 2018) An app. Provides a series of self-assessment questions structured as question-answer exchanges that focus on cognitive appraisals, belief conviction, emotions and associated behaviours. Depending on the appraisal selected, the exchange is followed by normalising messages and cognitive or behavioural strategies aimed at suggesting ways of coping with distressing experiences. Multiple messages and images associated with each exchange minimise boredom and repetition within the app. Allows tracking over time.

App also provides a series of multi-media options that act in a stand-alone fashion designed to complement and support the feedback from the intervention domains. This supplementary content contains information and activities including relaxation and mindfulness exercises, recovery stories (videos), a range of fact sheets (e.g., low mood, anxiety, self-esteem), external links to web-related content (e.g., TED talks), daily diary, and emergency contacts resources. (No Picture available).

RealLife Exp (Kumar et al., 2018) An app that can be downloaded via the App Store (iPhone) or Google Play store (Android). Contains a series of standard survey questions which comprised of questions pertaining to mood, medication use, socialisation, and conflict.

The RealLife Exp EP clients chose a time to receive their survey and had up to 90 min to complete it. Responses to survey questions were displayed for treatment providers on the dashboard as a graph/chart. Treatment providers could individualise the display of dashboards for each client. For example, if sleep was a symptom of interest for a particular client, a provider could move survey questions relating to amount of sleep to the top of the dashboard for quick viewing (Picture available via publication).

Heal Your Mind (HYM) (Kim et al., 2018) There are two types of HYM app; one was designed for use by clients, and the other was designed for use by case managers. Both the iPhone and Android apps are available for download.

The app is largely based on CBT. The HYM app for clients includes six main modules including thought record, symptom record, daily life record, official notices, communication and scales. When the client writes and sends the self-CBT sheet to the case manager, the latter receives a notification and can provide feedback in real time (Picture available via publication).

2.4 What Factors Influence the Effectiveness and Compliance of Self-management Interventions for Psychosis?

a) Effectiveness

Certain factors can either promote or hinder the effectiveness of computerised and non-computerised self-management interventions for psychosis. For instance, guided self-management interventions tend to be more effective than unguided self-management interventions. Furthermore, levels of contact with mental health professionals significantly influences the efficacy of self-management interventions on positive symptoms (Scott et al.,

2015). However, the benefits of guided interventions need to be balanced against higher costs and limited availability (Berger et al., 2011). Given that unguided self-help interventions can offer a small improvement in symptoms, research might further explore the efficacy of unguided self-help interventions for psychosis and focus more on possible alternatives to lessen the burden on the healthcare services in the form of digital interventions (Torous et al., 2019).

The complexity of the intervention also influenced effect sizes. Specifically, interventions using a variety of self-management techniques in conjunction (such as interventions that combined elements of CBT, psychoeducation and relaxation) are associated with larger effect sizes than interventions using a single self-help technique (e.g., relaxation only). This is perhaps not surprising given that previous research has advocated the use of multiple techniques (Buccheri, Trygstad, & Dowling, 2007; Carter, Mackinnon, & Copolov, 1996; Trygstad et al., 2002). However, more complex and multifaceted interventions bring the potential for reduced adherence and engagement; this is a serious concern for self-help interventions (Christensen et al., 2009; Titov et al., 2010).

The mode of delivery does not moderate the effect of self-help interventions on overall symptoms or associated outcomes, meaning that remotely delivered, technology-assisted online interventions for those experiencing psychosis can be an effective treatment option. Technology-assisted therapies have many benefits that include increased access to services by reducing logistic barriers, increased portability (such as technologies using hand-held devices) and improved self-monitoring (Newman et al., 2003; Torous et al., 2019).

(b) Adherence

A review of the literature suggests that non-adherence to the treatment of schizophrenia is far better documented than it is understood (Velligan et al., 2010). Although certain demographic factors like age, gender and ethnicity play a certain role in the compliance to treatment and self-management, none has been shown to correlate consistently with adherence, especially with regard to medication (Fenton, Blyler, & Heinssen, 1997). Two studies by Kopelowicz et al. (2015) and Mausbach et al. (2013) proposed the examination of motivation in this population through the Theory of Planned Behaviour (TPB) (Ajzen, 1991). The TPB proposes that people engage in a behaviour based on their intention to perform the behaviour, which is a function of a person's attitude towards the behaviour, subjective norms and perceived behavioural control. "Perceived behavioural control" encompassed both self-

efficacy and environmental control, and Ajzen conceptualised this as directly predicting behavioural intention, as well as the individual's actual engagement in the behaviour.

The idea to use TPB came from the discovery that interventions that individually assess patients with schizophrenia and specifically target the identified cause of non-adherence are more likely to be successful than broad-based programmes covering a wide range of problem areas (Barkhof et al., 2012; Zygmunt, Olfson, Boyer, & Mechanic, 2002).

Both studies (Kopelowicz et al., 2015; Mausbach et al., 2013) concluded that TPB and, specifically, perceived behaviour control (self-efficacy) are good predictors of compliance and potentially should be targeted by future interventions. However, it is worth noting that both studies were conducted in Mexico and South America, and both had a small number of participants.

2.5 The Problem of Engagement in Self-management of Psychosis

In the existing literature, “engagement” is defined as attending sessions, following advices by healthcare provider and is usually measured via attendance, adherence, retention, dropout and attrition rates.

Research suggests that eliciting and maintaining engagement with the treatment and self-management routines in people with psychosis is the ongoing challenge faced by healthcare providers to date (Chien et al., 2016; Dixon et al., 2016; Schlosser et al., 2018). It is a significant obstacle to the efficacy of treatments and effective service delivery. Therefore, clients are less likely to improve if they do not engage fully (Kim et al., 2012).

Approximately one-third of adults experiencing a first psychotic episode delay treatment for one-to-three years. Furthermore, an 80% dropout rate was recorded within the first year of care (Kane et al., 2016). Multiple causes for early dropout from treatment or disengagement have been offered, including poor therapeutic alliance (relationships and level of trust between service user and their psychotherapist and/or care coordinator), mistrust of the system, and poor insight into the need for treatment and availability of services (Dixon et al., 2016). Research also suggests it is possible that existing interventions and self-management programmes have inadequately focused on facilitating patients' engagement and eliciting intrinsic motivation to comply with the treatment (Chien et al., 2016). Poorer engagement, as rated by clinicians, has also been found to be associated with greater positive and negative

symptoms, greater general psychopathology and poorer premorbid social adjustment (Macbeth, Gumley, Schwannauer, & Fisher, 2013).

Some research has been done to investigate what factors may promote or diminish engagement. A qualitative analysis of adults who were successfully engaged in treatment highlighted shared themes that seem to promote engagement (Kane et al., 2016). For example, in the acute hospitalisation phase, two factors were crucial in enhancing engagement: the timely introduction of the early psychosis programme staff and the development of positive relationships with peers on the unit. Other themes that emerged as enhancing engagement were those of collaboration, rational understanding of problems and a commitment to finding solutions. Multiple participants also commented on the negative experience of acute adult hospitalisation that subsequently influenced their engagement (Dixon et al., 2016).

In an analysis of patients who had participated in the RAISE Connection early intervention programme, four domains seemed to influence engagement: individualised care, programme attributes, family member engagement and personal attributes (Lucksted et al., 2015, 2016). For many participants, one key factor of the programme was the focus on their own goals and building self-efficacy.

Other factors that might influence engagement in rehabilitation have been outlined by Ben-Zeev et al. (2014) and Bucci et al. (2018): the lack of clinicians who are trained in these interventions, timely delivery of the interventions and access to services. Even if demand for the necessary amount of interventions will be met, they often do not meet evidence-based guidelines and standards (Mojtabai, 2005).

Provision of eMental health interventions seemed like a viable solution to the problems stated above, especially because research claims that it is a feasible, acceptable and potentially effective option (Álvarez-Jiménez et al., 2014; Musiat & Tarrier, 2014).

Technology-based interventions could drive improvements in quality, cost and access to treatment, while enhancing patient experience and facilitating engagement with self-management interventions.

However, as with other populations, engagement over time can be difficult to sustain (Álvarez-Jiménez et al., 2013; Villani & Kovess-Masfety, 2017) and the cost of continuing constant real-life (online) support can be challenging (Naslund et al., 2015). Current research

acknowledges that eMental health interventions offer the potential to deliver scalable lower-cost services, yet implementation still requires an investment to provide constant technical support, data storage and analysis, and technological upgrades to these interventions (Torous et al., 2019).

Nevertheless, many researchers see digital health technology as a highly feasible and acceptable tool for self-management. Even more evidence for this is emerging in the field of psychosis self-management. However, important questions like efficacy, usability, sustainability and long-term engagement remain open (Naslund et al., 2016; Torous et al., 2019).

2.6 The Importance of Self-efficacy in Self-management of Psychosis and Other Chronic Conditions.

Successful self-management relies on learning about the nature of chronic disease and illness, establishing an effective relationship between the service user and health professional, and learning self-management techniques.

Of specific relevance to self-management is the impact of people's beliefs in their efficacy to exercise some control over conditions that affect their lives (Bandura, 1986; 2004).

A growing body of research has identified various processes – cognitive, motivational, affective and physiological – through which self-beliefs of efficacy exert their effects. Perceived self-efficacy influences what people choose to do, their motivation, their resilience in the face of difficulty and their vulnerability to stress. Indeed, people's beliefs in their personal efficacy have been found to influence outcomes in several acute and chronic illnesses, including the level of benefit they receive from therapeutic interventions.

Beliefs in personal efficacy can be strengthened in four principal ways (Bandura, 1986):

- 1) Guided mastery experiences. This involves learning and practising the appropriate behaviours, which is best done by breaking the desired behaviour into small, graded tasks that can be accomplished in a relatively short time. Feedback is important so that patients can progress. Once a component task is accomplished, another is added until the entire behaviour is achieved.
- 2) Social modelling. This is the experience of observing others exercise the skills and then gain the benefits. It is important that the models be as much like patients as possible; for example, a young person will be more willing to learn from a young person.

3) Social persuasion provides a third type of efficacy-enhancing influence. Successful efficacy builders do more than convey positive approaches; they also design and explain activities for others in ways that bring success. Effective persuasion usually involves urging learners to do just a little more than they are presently doing. It is essential to set up realistic goals that can be achieved by patients, because self-efficacy is about the gradual building of one's self-belief through a string of small tasks and challenges.

4) Reducing aversive physiological reactions or interpreting them in less pathological ways. Self-efficacy may be increased by the interpretation of an individual's physical and emotional feelings as positive, rather than negative; for example, the ability to cope with anxiety through breathing exercises.

The self-efficacy literature already provides support for the notion that a person's perceived self-efficacy facilitates behaviour change in a variety of situations. However, the majority of self-efficacy research has utilised adult subjects with common mental health problems, with few studies examining the relationship between self-efficacy, and mental health and psychosis self-management (Lean et al., 2019).

Limited research reports that people with psychosis (especially young people) view empowerment and self-efficacy as crucial to their recovery, quality of life, and being in control of their illness and life (Grealish et al., 2013). However, they also report that adolescents felt disempowered by clinicians who did not communicate effectively, listen to their needs or effectively help them control and manage symptoms. These findings are supported by previous studies into young people's experiences with mental health services, in particular the work of Fraser & Blishen (2007), and Worrall-Davies & Marino-Francis (2008).

Barker & Whitehill (1996) maintain that empowerment depends on a number of key values that improve the person's situation and show that a better lifestyle is possible. In their model, collaboration and participation are vital, with self-determination being the ultimate goal, resulting in the enhancement of the person's capacities. Focusing on a greater sense of empowerment may enable change by causing the individual to experience a sense of hope, excitement and direction. During the process of empowerment, adolescents with psychosis may discover the cause of their problems, which may help them to cope and take action (Zimmerman, 2000).

However, despite the growing focus on empowerment in mental health, few studies have examined the subject as an outcome, and it is a virtually unexplored area in research on psychosis. Nevertheless, the preliminary results of a study involving adolescents with psychosis show that empowerment can enable people with psychosis to develop an awareness behind the cause of their problems, and to take action to control their lives and manage symptoms, which in turn can give them a sense of hope, achievement, confidence and direction (Grealish et al., 2013).

In addition to the above, a recent meta-analysis and systematic review by Lean et al. (2019) did report a moderate-to-large effect on self-efficacy in people with severe mental health illness (including psychotic spectrum disorders) both at the end of treatment and during the follow-up. It is worth noting, however, that only four studies (Hasson-Ohayon et al., 2008; Shon & Park, 2002; Todd et al., 2012; van Gestel-Timmermans et al., 2012) examined self-efficacy scores after self-management intervention (total number of participants from four studies was 601). Out of four studies, two measured self-efficacy through a specifically derived questionnaire (Shon & Park, 2002; van Gestel-Timmermans et al., 2012), while the other two used bigger batteries of questionnaires where self-efficacy was assessed as a part of the entire package (e.g., IMRS was used, which contains scores for self-efficacy). Another limitation to consider is that fact that two studies looked exclusively at people with psychosis (Shon & Park, 2002; Todd et al., 2012), while the other two studies examined a variety of conditions, including depression and anxiety disorders.

Nevertheless, the emerging findings seem to indicate a positive correlation between the success of self-management interventions and self-efficacy scores in people with psychosis and other serious mental health conditions.

2.6.1 Applications for behaviour change and self-management

In general, high self-efficacy has been shown to predict success for change in a wide range of health-related behaviours (Strecher, Devellis, Becker, & Rosenstock, 1986). Persons with higher self-efficacy are more likely to initiate new behaviours, maintain behaviour that has already changed, put forth greater effort towards changing, and persist longer in their efforts (Bandura, 1977; Boone et al., 1977). For instance, studies of recovering alcoholics have found that those who had higher ratings of self-efficacy regarding their ability to resist temptations to drink in high-risk situations with lower rates of relapse (Annis & David, 1988; Donovan, Chaney, & O'Leary, 1978)

Self-management strategies inspired by efficacy theory include teaching general and specific coping skills to deal with high-risk situations; building self-efficacy by rehearsing coping responses, starting with the simple coping response; focusing on positive aspects of an incomplete coping response; providing reinforcement; and changing outcome expectations about the effects of the behaviour.

A new area of research concentrates on the use of peers and their effect on self-efficacy and the behaviour change associated with successful self-management (Lean et al., 2019).

2.7 Conclusion

Existing research suggests that there are many delivery of self-management interventions for psychosis, starting from face-to-face sessions, and ending with websites for peer support and apps. Most of the existing interventions seem to focus on building personal skills and self-efficacy, promoting recovery-related goals and generally gaining more knowledge about the condition.

Digitalised self-management interventions seem to be acceptable and potentially feasible among people with psychosis, although certain challenges like compliance, adherence and a lack of engagement still do exist. One way to tackle some of these issues is to consider the use of SVG as a potential medium for self-management interventions, which will be discussed in the next chapters.

Chapter 3: Psychosis and the Use of Technology

- This chapter contributes:
 - An understanding of digital technology use by those with psychosis;
 - An understanding of the ways in which videogames increase engagement and promote self-efficacy;
 - An overview of the prevalence of videogame usage among people with psychosis;
 - A justification for using SVGs for self-management of psychosis.

3.1 Introduction

In Chapter 2, we discussed that self-management interventions for psychosis are effective, however there is a noticeable lack of engagement with existing interventions (Chien et al., 2016; Dixon et al., 2016; Kreyenbuhl, Nossel, & Dixon, 2009; Lucksted et al., 2015; Schlosser et al., 2018). On the top of that, the research also suggests that more attention should be directed to the studying of motivation in people with psychosis, namely the promotion of self-efficacy.

One possible solution to tackle these problems is the use of game-based approaches like serious games and gamified interventions. Games and game elements (badges, leader boards, avatars etc.) are seen as suitable mediums that can support and increase engagement (Deterding et al., 2011). In addition, research suggests that both approaches are potentially effective in improving psychological wellbeing, alleviating disorder-related symptoms and affecting psychological mediators of change, such as self- efficacy (Baranowski et al., 2008; Fleming et al., 2017; Thompson et al., 2010).

Research on the use of game-based approaches and digital interventions in self-management have more evidence based within physical health than mental health. Therefore, less information is known about attitude, acceptability and perspectives on the use of videogames within mental health field – especially psychosis.

Chapter 3 will attempt to summarise existing research on the technology usage among people with psychosis and build further on the argument as to why videogames are a good method to increase engagement and promote self-efficacy in self-management interventions.

3.2 Perspectives on the Use of Technology in the Self-management of Patients With Psychosis.

Evidence suggests that people with psychosis use technology in a similar way to the wider population (Aref-Adib et al., 2016; Firth & Torous, 2015). In fact, there is a significant desire among service users to increase their use of computers and technology for healthcare purposes, even among older populations (Ennis et al., 2012). A meta-analysis of mobile phone ownership among those with symptoms of psychosis revealed that the rate of phone ownership was rapidly increasing, with 81.4% ownership among those surveyed in 2014 and 2015 (Firth et al., 2015). Individuals with schizophrenia not only own connected devices, but are also able to use them for their mental healthcare. A systematic review of mobile phone studies and schizophrenia found no evidence of any adverse events related to technology use, and rather overall strong support, interest and adherence among those with schizophrenia (Firth & Torous, 2015).

It is worth noting that the acceptability of mobile interventions is high among people with schizophrenia (Ben-Zeev et al., 2014). In particular, this trend seems to be stronger in the younger population (18-35 years old), who would prefer to receive specialised mental health services using technology (Lai, 2017). A systematic review of past studies by Naslund et al. (2015) confirms there is a consistent and strong finding that emerging technologies are both highly feasible and acceptable for use among people with serious mental health illnesses, including psychosis. Usually, measures of feasibility and acceptability included frequency of intervention use over time, response rates, study retention, the proportion of devices that were returned undamaged and participant-reported usability. The conclusion of that systematic review was:

An important implication of our findings is that researchers should move beyond simply investigating whether emerging devices are feasible for use among people with SMI. It is clear that people with SMI can use and are interested in using smartphones or services delivered online, while evidence highlights that people with SMI use mobile devices, the internet, and social media websites. (p. 14)

Recent systematic review by (Gaebel et al., 2016) confirmed the above conclusion.

Aggregated indicators of acceptability and feasibility ratings offer positive support for mobile interventions, but the results are less conclusive for engagement ratings due to variability in reporting them (e.g., rate of daily response, dropout, satisfaction) (Depp et al., 2016). The rates of adherence and attrition are similar to those reported in mobile health trials for other conditions and compare favourably (Free et al., 2013) to the dropout rates in the short-term trials of in-person interventions for SMI. However, long-term results on sustained engagement seem to be mixed and less conclusive, suggesting that research should focus on other mediums of self-management interventions delivery (Álvarez-Jiménez et al., 2013; Villani & Kovess-Masfety, 2017).

3.3 Videogames as a Way to Increase Engagement and Self-efficacy

One way to increase engagement and promote self-efficacy with self-management interventions is through the use of SVG. Below we summarise existing evidence for using SVGs as a medium to promote engagement and factors related to engagement, namely self-efficacy. We will also outline how SVGs elicit engagement and motivation.

(a) Engagement

SVGs are games developed for ‘serious’ purposes: to educate, motivate and/or persuade users, in educational, health and other settings through the medium of game (Michael & Chen, 2005). Studies suggest potential benefits for psychological and behavioural changes, including improved disease self-management in chronic disorders (Kato, 2010b; Primack et al., 2012). In addition, results of RCTs and systematic reviews show that serious games have the potential to be used as an entire or part treatment for the management of mental health disorders, in particular the adolescent population (Beaumont & Sofronoff, 2008; Fleming et al., 2014; Lau et al., 2016).

Research suggests that one of the main reasons for incorporating videogames into healthcare services is their ability to increase motivation and engagement (Kato, 2010a; Kelley, Wilcox, Ng, Schiffer, & Hammer, 2017; Przybylski, Rigby, & Ryan, 2010); since both are existing problems in the provision of self-management interventions, it seems logical to use mechanisms of motivational “pull” provided by videogames. Engaging a patient’s motivation is necessary in any area of healthcare, especially if the condition is chronic and requires constant management. Usually, such management procedures are aversive (e.g., side-effects of antipsychotics like weight gain or sexual dysfunction), or boring and mundane (e.g., take

pills for a prolonged period, engage in lengthy psychotherapies). However, these procedures are necessary in order to improve a patient's health.

Games for health can provide people with flexible learning environments in which they can learn about their medical condition in a dynamic and personalised setting that allows for accessible and appealing exploration, information seeking and practice (Cannon-Bowers, Bowers, & Procci, 2011; Charlier et al., 2016). Games can adapt content and challenges to the age, educational level, personal interest and specific diseases of the gamers, thereby allowing them to design a self-management plan with their own personal educational goals, which is likely to result in a more effective educational approach (Barlow et al., 2002; Fogg, 2003). In contrast with other electronic media, contemporary games typically combine both intrinsic and extrinsic motivational elements (Ryan, Rigby, & Przybylski, 2006), active learning processes (Smith & Foley, 2006), the provision of immediate feedback (Garris, Ahlers, & Driskell, 2002) and opportunities for socialisation with others (Hawn, 2009; Maloney-Krichmar & Preece, 2005). Based on these powerful and persuasive game mechanisms, it is hypothesised that playing health games increases the gamers' learning, which results in increased knowledge and a better adoption of healthier lifestyles and self-management behaviours (Thompson et al., 2010).

(b) Self-efficacy

Videogames can be designed to enhance psychological mediators of change, such as self-efficacy, which refers to beliefs in one's own ability to carry out a task or successfully take a course of action needed to meet the demands of a situation (Bandura, 1986; Maibach & Cotton, 1995). Self-efficacy is predictive of future behaviour. If confidence in one's ability to perform a particular health behaviour is high, the individual's health knowledge is more likely to translate into positive health behaviour (Bandura, 1982; Maibach et al., 1991). Improvement in health self-efficacy perceptions is an important goal for health-promotion interventions like videogames, which provide an environment where people can experiment, perhaps fail, but ultimately succeed. As people become more successful, they are likely to perceive themselves as being more efficacious in the tasks and skills they are rehearsing (Brown et al., 2013; Lewis et al., 2002; Lubans et al., 2008; Marshedi et al., 2017)

In a game, players can observe personal success (through mission completion etc.), as well as observe others (either players or NPCs) engage in a sequence of actions. Character modelling and dialogue can convey knowledge, demonstrate skills and enhance self-efficacy. Modelling

a coping style in which characters model imperfect performance initially, but persevere and gradually improve through personal effort and skill refinement, thus emphasising the importance of using strategies, verbalising and/or demonstrating how the strategies can be used, would enhance knowledge, refine skills, and enhance both self-efficacy and competence. An example of how to achieve this in a videogame would be to have an ‘expert’ character (i.e., one who self-manages and is in control) guide other characters in the game who are attempting to self-manage. Providing encouragement, feedback, and demonstrating how to use skills and strategies to self-manage would serve as a model for the player.

Providing choice, connecting goals to personal values, providing immediate performance-related feedback and structuring the game in levels with challenges that gradually increase in difficulty would enhance competence in self-efficacy (Thompson, Baranowski, & Buday, 2010).

In addition to the above, videogames can encourage social interaction with peers and family members, as many children and adolescents enjoy playing with others in competitive and collaborative games (Baranowski et al., 2008). A health-oriented videogame can help young people talk with others about their own concerns and can increase the likelihood that they will seek support and advice (Brown et al., 1997; Lieberman, 2012).

The next subsection will look at the underlying theory of motivation in videogames, and how these games can engage and elicit motivation with the treatment/health behaviour change in patients.

3.3.1. Theory of motivation in videogames

According to the Self-determination Theory (SDT), intrinsic motivation is what underlies motivation in games and sports; this is also relevant for videogames. A videogame is not played to gain an external benefit. On the contrary, gamers must often pay to play and are even reprimanded for playing. It is possible to conceive that videogames are intrinsically satisfactory or, in other words, people play games because they are entertaining (Ryan et al., 2006). The tenets of SDT are autonomy (people have a need to feel that they are in control of their own behaviour), competency (mastery over self-management skills) and connectedness (social support from relevant others).

As a mini theory of SDT, the Cognitive Evaluation Theory (CET) proposes that events and conditions that favour the feeling of autonomy and competence support intrinsic motivation,

while factors that decrease perceived autonomy or the feeling of competence hurt intrinsic motivation (Ryan et al., 2006). CET ignores connectedness and focuses only on competency and autonomy as key factors for intrinsic motivation.

Autonomy implies a sense of agency or wish when a task is being done, meaning that person feels in control of their actions and behaviour. When activities are done with interest or personal value, perceived autonomy is high. The provision of alternatives, the use of reinforcements with information feedback and non-controlling instructions have been shown to increase autonomy. The second element of CET proposes that factors that increase the experience of competence – such as opportunities to acquire new skills and abilities, optimal challenge or positive feedback – contribute to intrinsic motivation.

Clearly, an adequate articulation of these elements in the design of a videogame contributes to a positive game experience. In addition to the feeling of autonomy and competence, Ryan et al. (2006) proposes that the intrinsic motivation is related to the sense of presence or the feeling of being inside the game world. The concept of presence is important for videogame designers who try to create an experience of virtual worlds that feel real and authentic in terms of the creation of a story and an attractive narrative in the graphic environment, and who must also make the controls as user-friendly as possible. Other similar constructs are immersion, flow, psychological absorption and dissociation. It has been proposed that these formulations incorporate different levels of the subjective experience of involvement in the game (Fox & Brockmyer, 2013).

Other theory that has been used to promote motivation and positive health behaviour change, including self-management skills, is Social Cognitive Theory (SCT) (Bandura, 2006). It builds on existing principles of promoting self-efficacy, which were outlined in section 2.6. SCT postulates optimal mechanisms through which health knowledge (psychoeducation) can be translated into an actual health behaviour change. It emphasises the importance of learning through modelling (e.g., observing others, rehearsing acquired theoretical knowledge in a safe environment) and enhancing perceived self-efficacy. The key message of SCT is the belief that personal efficacy plays a central role in personal change and is the foundation of human motivation and action.

3.4 Videogame Usage Among People With Psychosis

Unfortunately, research is limited on the use of videogames among people with psychosis and mental health in general. In addition, opinions of clinicians and service users on acceptance and feasibility of SVGs within healthcare domains remains poorly explored.

One brief report suggests usage of devices for gaming activities is common among people with the first episode of psychosis. In fact, gaming activity is even higher when compared to general population (Abdel-Baki et al., 2017).

There are sparse accounts of acceptability rating among service users and clinicians. One exploratory focus-group study examined the potential patient's acceptance of the game-based therapy SPARX ('Smart, Positive, Active, Realistic, X-factor thoughts') for depression, finding general support for the intervention among children and adolescents. In particular, respondents reported the benefits of increasing access to mental health services, as well as the protection of identity afforded by computer-based therapy (Fleming et al., 2014).

In addition, solitary existing studies of specifically tailored serious games for anxiety (Scholten et al., 2016), depression (Carrasco, 2016; Poppelaars et al., 2016), autism spectrum disorders (ASD) (Alves, Marques, Queirós, & Orvalho, 2013; Wijnhoven, Creemers, Engels, & Granic, 2015), and eating and addiction disorders (Fernández-Aranda et al., 2012; Tárrega et al., 2015) suggest that videogames are seen as an acceptable and feasible option for patients. However, these studies look only at children and adolescent populations of patients; only one study (Fernández-Aranda et al., 2012) reported acceptability ratings by clinicians.

A recent study by Eichenberg, Grabmayer and Green (2016) conducted a review on acceptance of serious games as eMental health applications in clinicians (n=234) and patients (n=260). Patients had various diagnosis and clinicians had different professional backgrounds. They found that patients and therapists had a general openness towards the use of serious games in psychotherapeutic settings. However, therapists expressed concern regarding the use of SVG for severely ill patients. The majority of the participants in both groups could imagine using a serious game as a complementary tool during psychotherapy. From a therapists' point of view, particular psychological disorders were selected as appropriate for serious game utilisation: anxiety disorders (73.9%), affective disorders (69.6%), disorders regarding impulse control (59.9%) and adjustment disorders (54.6%). The application of serious games was perceived the least suitable for factitious disorders, schizophrenia and dissociative disorders. Regarding the severity of a particular psychological

disorder, most therapists could imagine using a serious game with a mild form of a disorder (89.2%)

This study also showed that individual factors, such as one's personal experience of gaming, can affect whether individuals would even contemplate the utilisation of serious games within therapy. This particular finding is in line with the previous report from review by Fleming et al. (2017), who suggested that SVG as a medium of intervention is most attractive to people who play videogames.

Another factor that appears to affect the readiness and potential uptake of serious games is the therapeutic approach, with the most support coming from behavioural and cognitive therapists.

One of the perceived benefits of SVGs by patients was unrestricted availability and easier access to serious games compared to conventional face-to-face therapy. The additional use of serious games as an assistive element to psychotherapy was beneficial by a quarter (24.3%) of the responding patients, specifically due to the additional training for certain exercises. The third-most commonly stated positive aspect was the simplified opportunity to contemplate therapeutic content (22.1%). Both the options to complete exercises without time or therapeutic pressure, and to be able to repeat specific exercises as often as desired were regarded as widely beneficial. Another important benefit stated by 18.6% of the respondents was the additional engagement with the therapeutic content outside of therapy.

One of the major concerns from both groups surrounded the possible distraction from or substitution of therapy through serious games. According to participants, this could lead to a neglect of relationship and communication components of therapy.

Another finding showed that knowledge of the existence of SVGs among both clinicians and patients is very limited. The current knowledge about the existence and application of serious games is still only 10.4% of patients and 11.5% of therapists reporting knowledge of serious games. The current use is even more infrequent, with only 1.7% of therapists presently using serious games as an intervention.

To date, the study by Eichenberg et al. (2016) was the only study that looked at the acceptability of SVGs by clinicians and patients.

Despite limited evidence of acceptability, the evidence concerning the effectiveness of SVGs is still in its infancy. Next chapter will look at the existing evidence of the effectiveness of SVGs on mental health-related outcomes, including psychotic disorders.

3.5 Conclusion

Self-management relies on healthy lifestyle adoption and maintenance; however, these are often hindered by motivational issues, lack of time to participate in health-promotion programmes and the interventions low reach into the target group. Computer-delivered and computer-tailored interventions have been successfully designed to overcome these obstacles by tailoring them to promote motivation, being accessible whenever the individual has time and ensuring high availability at lower cost. SVGs have the potential to increase motivation and engagement with self-management interventions by providing people with flexible interactive learning environments, personalised setting and accessible exploration (Cannon-Bowers et al., 2011; Charlier et al., 2016). Furthermore, SVGs can be designed to enhance psychological mediators of change like self-efficacy, which is considered to affect the health choices that individuals make and their attitudes, and the level of effort that they invest in setting and meeting health goals – even when facing barriers (Bandura, 2004).

It is important to note that there is a bidirectional relationship between self-efficacy and motivation. Patients are more likely to engage in a health-promotion programme if they are highly motivated and that motivation levels are in turn influence by self-efficacy (Hardcastle et al., 2015). Therefore, the motivational ‘pull’ from SVGs, and well-integrated game elements and mechanics that promote self-efficacy can complement and enhance each other.

In addition to the above, an exploratory study by Eichenberg et al. (2016) reported that both clinicians and participants see SVGs as a feasible and acceptable option, especially as an adjacent tool for a main psychological treatment.

However, little is known about the actual effectiveness of SVGs on alleviating psychiatric symptoms. Therefore, the next chapter will explore the existing evidence of effectiveness of SVG on various mental health-related outcomes.

Chapter 4: The Effectiveness of SVGs Games in Mental Health: A Systematic Review

- This chapter contributes evidence to examine:
 - The effectiveness of SVGs in promoting positive mental health-related outcome;
 - The user experience (including acceptability) of SVGs in promoting positive mental health-related outcome;
 - The levels of engagement (using dropout ratings) with SVGs that promote positive mental health-related outcomes;
 - A review of the current state of the art of SVGs in mental health, including mode of delivery and target population.

4.1 Introduction

In Chapter 3, technology usage and acceptability of SVGs by service users and clinicians were discussed. In Chapter 4, the effectiveness of SVGs on mental health-related outcomes will be systematically investigated. In addition, evidence of acceptability (user experience) and engagement (dropout ratings) will be provided where possible.

4.1.1 Defining serious games and gamification

Despite being similar, serious games are different from gamified interventions (Deterding et al., 2011). This confusion between the two terms leads to a certain difficulty to study them systematically.

In the current review, we looked at the SVGs – computerised games for serious purposes (Fleming et al., 2017). The definition we used can be summarised as the following: SVGs seek to employ games (or substantial game elements) to educate, motivate and/or encourage a behaviour change.

‘Gamification’, on the other hand, is the use of game elements in a non-game context (Deterding et al., 2011). In this instance, the intervention itself does not have to be a game. However, it can contain game elements, such as scoring, badges and leader boards.

This review focuses on only SVGs, since the aim of this thesis is to design an SVG for psychosis self-management. Following the MRC framework for development of complex interventions, we explore Phase 1 (pre-clinical), where we identify existing evidence for the

effectiveness of SVGs on mental health-related outcomes. Since SVGs are a relatively new phenomenon, currently there are few games for psychosis self-management, nor therapeutic games for psychosis symptom treatment. Therefore, we expanded our search to all SVGs within the mental health domain.

4.2 Research Question

This systematic review focused on therapeutic SVGs – in other words, games designed to target certain symptoms and other aspects of people’s difficulties (such as perceived quality of life) in people with a mental health disorders or subclinical symptoms, either on their own or as an adjacent tool to an existing psychosocial therapy or self-management routine.

To our knowledge, there is only one recent systematic review on the effectiveness of SVGs on mental health-related outcomes (Lau et al., 2017). However, this review and meta-analysis looked only at RCTs of SVGs and did not consider other study designs. The majority of the existing SVGs are not studied via RCTs, because research is still at the early stage of development. We have decided to expand the search by looking at all peer-reviewed studies of existing SVGs, regardless of a study design. We have also reported user experience with the SVGs (where feedback was available), since previous research has identified the importance of user-centred design and collaborative approaches when it comes to the design of digital interventions (Fleming et al., 2016; Yardley et al., 2016). User experience (UX) feedback refers to the opinion, emotions and attitudes expressed by users about the end product (SVG). In this case, ‘users’ are patients for whom the game was developed and sometimes clinicians, since some games require their support.

The principal research question was: ‘Are SVGs effective in improving mental health outcomes?’

Additional goals of this systematic review were exploratory: ‘What is the quality of the evidence for the effectiveness of SVGs?’; ‘Was user experience feedback reported?’; ‘What were the dropout rates?’

In addition, we wanted to see whether games have the potential to promote engagement by looking at dropout rates. Previous systematic reviews and meta-analysis on low-intensity digital interventions used dropout rates as a proxy for engagement; therefore, we will adopt the same strategy (Depp et al., 2016).

4.3 Method

We conducted a systematic review of peer-reviewed papers to examine the effectiveness of SVGs on mental health conditions. In addition, we assessed the quality of the examined studies to update the current status of SVGs, and provided a complete up-to-date list of the existing SVGs and their therapeutic potential.

The protocol was developed and agreed by the authors prior to commencement and registered via PROSPERO (CRD42017058074). It followed a PRISMA checklist of recommended items (Moher et al., 2009). Studies that reported the effect of an SVG on a mental health-related outcomes were included in this systematic review.

4.3.1 Data Collection

Seven electronic databases were reviewed on 30th October 2016. Subsequently, databases were reviewed once again on 20th March 2017 to gather the latest available research.

We searched the following databases: MEDLINE (Ovid interface); PsychINFO (Ovid interface); CINHAL (Ebsco interface); CMCH; EMBASE (Ovid interface); Web of Science; and ACM digital library.

In addition, we searched the references of studies identified with our primary search strategy for potentially relevant studies not identified in the database searches. We searched Google Scholar too to identify the omitted relevant literature.

The PsychINFO search strategy was adapted for other databases.

4.3.2 Search Terms

Some search terms were derived from the previous relevant systematic reviews (Connolly, Boyle, Macarthur, Hainey, & Boyle, 2012; Johnson et al., 2016; Primack et al., 2012). We used search terms related to SVGs, all mental health disorders and the effect of SVGs on the latter.

For the full list of search terms see Appendix A.

4.3.3 Inclusion/Exclusion Criteria

Inclusion criteria:

1. The intervention described is an SVG and there is a sufficient description of the game that allows establishing whether it is a truly an SVG.

Definition of SVGs: SVGs seek to employ games (or substantial game elements) to educate, motivate and/or encourage a behaviour change. They utilise gaming elements as a primary method to achieve gaming purpose (Fleming et al., 2016).

2. The study is designed to treat mental health disorders, including co-morbid conditions that include both physical conditions and mental health conditions, intellectual disabilities and substance use disorders.

Additionally, studies that look at subclinical symptoms will be included in this review.

3. The study must report the outcome of the study (effectiveness of intervention) for the treatment of mental health conditions, intellectual disability or substance use disorder.

4. Participants of any age range will be included.

Exclusion criteria:

1. Not an SVG (i.e., paper describes gamified intervention).

2. Participants do not have a psychiatric diagnosis or subclinical symptoms, or the study is designed to treat physical conditions, with no co-morbid mental health condition.

4.3.4 Quality Assessment

We used Downs and Black's (1998) modified 'Checklist for Measuring Study Quality' rating scale for quality assessment. A benefit of this validated scale is that it can be used to assess the evidence of both RCTs and non-RCTs. The modified checklist consists of 27 items with 'yes-or-no' answers, distributed between five subscales: reporting, external validity, bias, confounding and power. Items can score either 0 (no/unable to determine) or 1 (yes). The maximum score is 28. Each paper was assigned a grade of 'excellent' (24–28 points), 'good' (19–23 points), 'fair' (14–18 points) or 'poor' (<14 points).

According to O'Connor et al. (2015), in the quality assessment tool by Downs and Black (1998), if a paper scored a 'good', the study met all criteria for that study design; a 'fair' study does not meet all criteria but is judged to have no serious flaw that may compromise results; and a 'poor' study contains a potentially serious methodological flaw.

The quality assessment was carried out by OD (principal investigator – student).

4.3.5 Data extraction

Data extraction was broken down into two stages. Stage 1 covered data selection processes and importing, while Stage 2 covered the review process and initial data extraction. During Stage 1, OD carried out an initial search through the seven databases, identifying records of the studies and removing the duplicates. Additionally, a backwards citation searching was carried out to identify omitted relevant literature.

During Stage 2, OD extracted the article title and abstract of all identified articles that met the inclusion criteria from the EndNote to a spreadsheet. Each article was assigned a unique identification number. Afterwards, a TS (second reviewer) carried out the same task, but with studies identified by OD (plus 30% of the discarded studies). Both reviewers were blinded during the process.

Any uncertainties and discrepancies between the two reviewers were resolved by consulting a third independent reviewer.

4.3.6 Inter-rater reliability

TS had to review studies identified by OD, in addition to 30% of the removed studies. The main aim of the second reviewer was to apply the inclusion and exclusion criteria as defined above.

4.3.7 Categorisation of mental health-related outcomes

These includes symptoms associated with a particular mental health disorder/intellectual disability, measures of quality of life or measures of functioning; for example, improvement/deterioration of cognitive deficits in dementia, emotion recognition in children with autism, rates of recovery and relapse.

4.3.8 Patient engagement

A patient's engagement with an SVG treatment was assessed via attrition and dropout rates if they were available in the paper.

4.4 Results

Out of 6018 papers, 47 were considered and assessed as full texts. Of them, 20 did not pass the inclusion and exclusion criteria. Consequently, 27 eligible studies remained and were individually assessed for this review. The study selection process is reported as recommended by the PRISMA group (Moher et al., 2009) in Fig. 2.

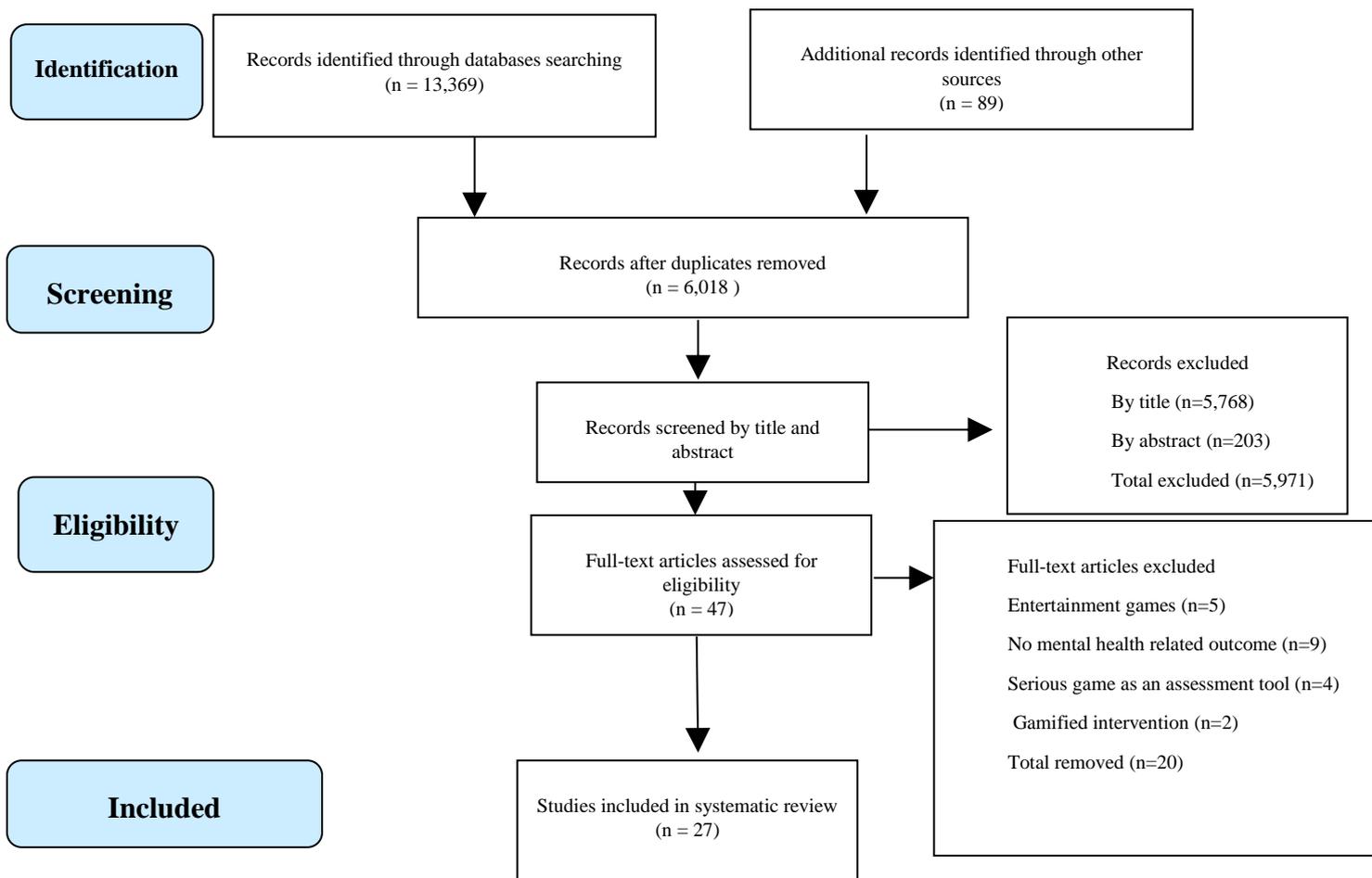


Figure 2: PRISMA flow diagram

4.4.1 Study Quality Assessment

The final 27 papers were rated for the quality of evidence using Downs and Black’s (1998) quality assessment tool. From the calculations, the mean was 19.1 and the mode was 17.

Out of 27 papers, 13 (46%) were categorised as providing ‘Fair’ quality evidence. The majority of papers scored 18 points, meaning that their quality assessment score was just below the cut off for ‘Good’. Furthermore, seven papers (27%) were categorised as providing ‘Good’ quality evidence and five papers (20%) were categorised as proving ‘Excellent’ quality evidence. Only two papers (7%) were categorised as proving ‘Poor’ quality evidence. See Fig. 3 for a histogram displaying quality of evidence ratings.

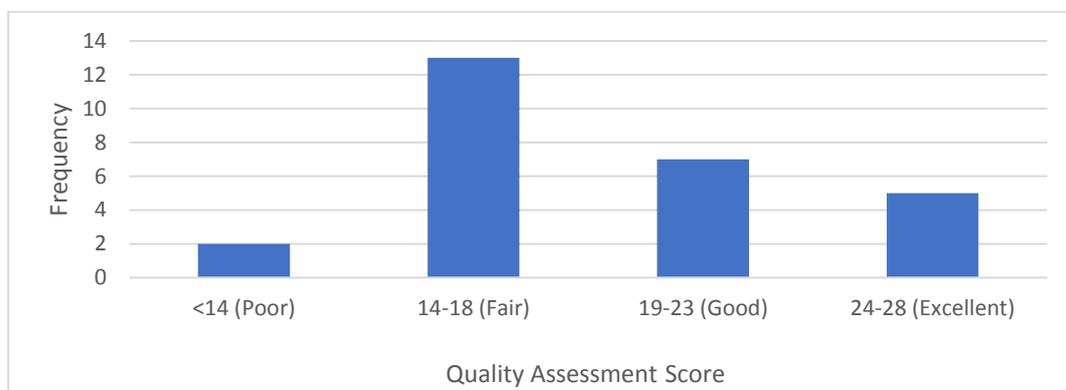


Figure 3: Histogram of quality of evidence ratings.

4.4.2 Study Characteristics

Study characteristics are given in Table 3. Table 9 describes the game intervention’s purpose, while Table 10 describes the actual gameplay and game objective (see Appendix B for Table 9 and Appendix C for Table 10 for more details).

Table 3: Study characteristics

Study	Design	Control	Diagnosis	Sample	Participants age	Duration intervention	Duration session	Follow up	If yes	Additional treatment
Playmancer (Fernández-Aranda et al., 2015)	Quasi-experiment	SVG-CBT (CBT without videogame)	Bulimia Nervosa	38	18 to 15	10-12 weeks	20 mins	no		CBT
MindLight (Schoneveld,	RCT	Played Max, a	Elevated anxiety	136	8 to 16	2 weeks	1h	yes	3 months	None

Lichtwarck-Aschoff, & Granic, 2018)		commercial puzzle platform videogame								
SocialVille (Nahum et al., 2015)	Quasi-experiment (Pilot study)	Played one block of every <i>SocialVille</i> social cognitive exercise.	SCZ	34	18 to 31	6-12 weeks	1-2h	no		None
Let's Face It! (Tanaka et al., 2010)	RCT	WL	ASD	79	10.5	19 weeks	1 hour	yes		n/a
Poki-Poki (Chung et al., 2016)	Quasi-experiment	CBT without videogame (offline CBT)	ASD	20	13 to 18	6 weeks	1h	no		none
X-Cog (Saleem et al., 2014)	Quasi-experiment (pilot study)	TAU	FEP	11	22 to 27	8 weeks	90 mins	yes	5 years	antipsychotics
X-Cog (Trapp et al., 2013)	Quasi-experiment	occupational therapy	SCZ	60	36.43	3 weeks	1 hour	no		antipsychotics and varied psychosocial therapies
SPARX (Poppelaars et al., 2016)	RCT	OVK (Dutch version of the Penn Resiliency Programme [PRP] prevention programmes based on CBT principles). Or WL	Depression	208	11 to 16	8 weeks	20 - 40 mins	no		CBT
SPARX (Merry et al., 2012)	RCT (non-inferiority trial)	TAU	Depression	187	12 to 19	n/a	n/a	no		CBT

SPRAX (Fleming et al., 2012)	RCT	WL	Depression	32	13 to 16	5 weeks	n/a	yes	1 months 2.5 months	CBT
Playmancer , (Fagundo et al., 2013)	Multiple case study (pre/post-test)	-	Bulimia Nervosa	9	30.6 years	9 weeks	20 mins	no		CBT
Playmancer (Tárrega et al., 2015)	Multiple case study (pre/post-test)	-	Gambling Disorder	16	24 to 46	10 weeks	20 mins	no		CBT
Dojo (Scholten et al., 2016)	RCT	<i>Rayman 2: The Great Escape</i> – commercial videogame	Subclinical Anxiety	138	11 to 15	3 weeks	2h	no		None
Flowy (Pham,et al., 2016)	RCT (pilot trial)	WL	CMHDs	63	18 to 65	4 weeks	n/a	no		N/A
FaceMaze (Gordon et al., 2014)	Quasi-experiment	typically developing children who played the game	ASD	34	6 to 18	n/a	4 mins	no		N/A
BrainGame Brian (Dovis et al., 2015)	RCT (Double blind placebo)	All tasks within the game were in a placebo mode.	ADHD	89	8 to 12	5 weeks	35-50 mins	yes	3 months	71 out of 89 used medication
BrainGame Brian (van der Oord et al 2014)	Quasi-experiment (Pilot study)	WL	ADHD	40	8 to 12	5 weeks	40 mins	yes	2 months	12 out of 20 were taking medication in training condition
BrainGame Brian (de Vries et al, 2015)	RCT	Low level training	ASD	86	8 to 12	5 weeks	40 mins	yes	3 months	24 out of 90 used medication

Journey of the Wild Divine (Knox et al., 2011)	Quasi-experiment	WL	Depression and Anxiety	24	9 to 17	n/a	n/a	no		6 out of 12 active treatment conditions were on medication
CogoLand (Lim et al., 2012)	Multiple case study (pre/post-test)	-	ADHD	20	6 to 12	8 weeks	n/a	no		None
gNats (Coyle et al., 2011)	Multiple case study (pre/post-test)	-	Depression and Anxiety	6	11 to 16	6 weeks	1h	yes	1.5 months	N/A
Navigation Game (Amado et al., 2016)	Multiple case study (pre/post-test)	-	SCZ	7	38.6	12 weeks	90mins	no		antipsychotics
The Journey (Stasiak et al., 2014)	RCT (pilot study, double blind)	attention placebo programme based on psycho-educational content.	Depression	34	13 to 18	10 weeks	25-30 mins	yes	1 months	N/A
Junior Detective Programme (Beaumont & Sofronoff, 2008)	Quasi-experiment	WL	ASD	49	7 to 11	7 weeks	n/a	yes	1.5 months and 5 months	small group and parent training sessions
Guardian Angel (Verduin et al., 2013)	Quasi-experiment	viewed educational slides	Alcohol Use Disorder	41	51.3	12 weeks	1h	yes	1 months	TAU
Kitchen and Cooking (Manera et al., 2015)	Multiple case study (pre/post-test)	-	MCI and Alz	21	60 to 84	4 weeks	unlimited	no		N/A
Supermecha (Prins et al., 2011)	Quasi-experiment	standard working memory training	ADHD	51	6 to 16	5 wees	30 mins	no		Medication, discontinued 24h before training session

Out of 27 studies, 20 unique SVGs were identified: *Playmancer*, *SPARX* and *BrianGame Brian* were tested in three separate studies, while *X-Cog* was tested twice and other SVGs were tested only once.

Study designs were mainly either quasi-experiments (11 studies out of 27) or RCTs (ten studies out of 27). The highest quality evidence comes from RCT studies (scoring ‘Excellent’), however quasi-experimental and case series study designs scored either ‘Good’ or ‘Fair’.

Many of the SVGs targeted symptoms of depression (eight out of 27) and various intellectual disability-related disorders: ADHD (four out of 27) and ASD (five out of 27). Studies that looked at SVGs for depression produced the highest quality of evidence (five out of 9 RCT trials).

Due to variability in study designs, the number of participants varied dramatically from one study to another. A median number of participants across all studies was 38.

Out of 27 games, ten were aimed at adults (aged 18+), 11 were aimed at adolescents (12-17 years old) and six were designed for children (<12 years old). Videogames for intellectual disabilities were exclusively aimed at children, while depression and anxiety games were directed towards adolescents. Games for adults were heterogeneous, addressing a wide spectrum of disorders, including eating disorders, schizophrenia, alcohol use disorder, gambling disorder and dementia.

The mean duration of SVG training was seven weeks across 24 studies (no information is available for three studies). The mean duration of the training session was 50 minutes across 17 studies (no information is available for nine studies).

Follow-up data was reported in ten out of 27 studies, with the average follow-up duration being 1.9 months.

Some games were used in tandem with other treatment methods, such as CBT or prescribed medication.

Six out of 27 studies compared SVG training against waitlist control and another six out of 27 studies compared SVG training against offline psychosocial intervention.

4.4.3 Outcome data from the studies

Table 4 (see full table in Appendix D) contains the outcomes relevant to mental health wellbeing that were measured in the study. These outcomes show the effectiveness of an SVG on mental health-related symptoms and outcomes.

Of the included studies, all 27 studies used one or more validated symptom scales to ascertain whether psychiatric symptoms or other mental health-related outcomes have improved over the course of the intervention. It does not appear that SVG interventions worsen the symptoms or result in the deterioration of the condition. However, in order to be more conclusive, research requires more long-term trials. 23 out of 27 trials had a significant outcome on primary outcomes.

Due to the heterogeneity of the results, a meta-analysis was not conducted.

Table 4: The summarised version of outcome data (short version)

Nº	Game Name/Author	Sample	Findings
1	Playmancer	N=20, in condition SVG+CBT N=18, in condition SVG-CBT (CBT without videogame) (control)	Clinical symptoms: p=0.046 Not sig: EDI-2, SCL-90-GSI/PSDI total scores, STAI or STAXI scores
2	MindLight	N=69, in condition MindLight N=67, in condition Max. Played <i>Max</i> , a puzzle platform videogame (control)	Subclinical anxiety symptoms: No significant effect
3	SocialVille	N=17, patients diagnosed with SCZ completed full SocialVille training N=17, healthy controls. Completed exercise-based assessments only	Facial Memory: p<0.03 GFS's social functioning: p<0.03 BIS: p=.04 TEPS Anticipatory Pleasure subscale (p <0.04) Not sig: emotional prosody identification; emotion and social perception, role functioning, SFS, Quality Life Scale, BAS, Consummatory Pleasure subscales
4	Let's Face It!	N=42, active treatment group played the <i>Let's Face It!</i> Game N=37, waitlist control group	Analytic recognition of mouth features: p < .05 Holistic recognition of a face: p < .001 No sig: face dimensions, immediate memory for faces, masked features, expression
5	Poki-Poki	N=10, active treatment group played the prosocial game CBT (<i>Poki-Poki</i>) N=10, control group underwent CBT without videogame (offline CBT) for 6 weeks (control)	SCQ-total scores: p=0.01
6	X-Cog Saleem,2014	N=5, active treatment group played <i>X-Cog</i> N=6, TAU (control)	Cognitive Symptoms: p < 0.01 Negative symptoms: p < 0.05
7	X-Cog Trapp, 2013	N=30, active treatment group played <i>X-Cog</i> N=30, received occupational therapy (control)	Positive Symptoms: p=.003 Attention: p=.003 Memory: p<.0005 Problem solving: p<.0005 Decreases in self-rated 'paranoid thinking' and 'depressive' symptoms: p=.029

			Not sig: pre- to post-test changes for processing speed, negative symptoms, the rate of relapse; total time in psychosis
8	SPARX Poppelaars, 2016	N=50, underwent OVK (Dutch version of the Penn Resiliency Programme [PRP] prevention programmes based on CBT principles). N=51, <i>SPRAX</i> N=56, OVK & <i>SPRAX</i> N=51, monitoring control condition	Depressive Symptoms: $p < .001$ No sig: suicidal ideation
9	SPARX Merry, 2012	N=94, allocated to <i>SPARX</i> N=93, to TAU.	Depressive Symptoms: a. CDRD-R: $p=0.079$ b. RADS-II: $p=.060$ c. MFQ: $p=.032$ Not sig: PQ-LES-Q, SCAS
10	<i>SPRAX</i> Fleming, 2012	N= 20, allocated to <i>SPRAX</i> N=12, allocated to waiting list condition (control)	Depressive symptoms: a. CDRD-R: $p=.0001$ b. RADS-II: $p=.05$ Not sig: PQ-LES-Q, HPLS, CNSIE
11	Playmancer, Fagundo, 2013	N=9	1. Anxiety Symptoms: SCL-90-R: $p=.050$ 2. Eating Disorder Symptoms: EDI-2: Only subscales bulimia ($p=.015$) and ascetism ($p=.019$) achieved statistical significance a. Not sig: STAXI
12	Playmancer Tárrega, 2015	N=16	1. Gambling Behaviour: a. SOGS: 95% CI [-7.45, 0.05], $p=.047$ b. TCI-R: 95% CI [-16.5, -1.19], $p=.027$ Not sig: BIS, Not sig: STAXI-2
13	Dojo	N= 70, allocated to <i>Dojo</i> condition (active treatment). N=68, allocated to play <i>Rayman 2: The Great Escape</i> (active control).	Anxiety symptoms: SCAS: $p < .001$
14	Flowy	N= 31, allocated to <i>Flowy</i> condition (active treatment). N=32, placed on a waitlist (control).	QLES-Q-SF: $p= 0.034$ Not sig: GAD-7, OASIS, ASI-3, PDSS-SR, hyperventilation symptoms
15	FaceMaze	N= 17, with ASD, completed <i>FaceMaze</i> (experimental condition). N=17, typically developing children (control).	Facial Expression: $p=0.001$ Nos sig: surprise recognition
16	BrainGame Brian Dovis, 2015	N= 31, full-active condition. N=28, partially active condition. N=30, placebo condition.	ADHD Behaviour: $p = .0042$ No sig: SPSRQ-C
17	BrainGame Brian van der Oord et al., 2014	N= 20, played <i>BrainGame Brian</i> (training condition). N=20, were on the waiting list (control).	ADHD Behaviour: $F = 11.95, p < .01$ for IA subscale and $F = 9.68, p < .01$ for H/I subscale Metacognition (BRIEF): $F = 6.80, p < .05$ Not sig: Other subscales of the BRIEF
18	BrainGame Brian De Vries, 2015	N=31, WM-training, includes five training-tasks, with increasing difficulty N = 26, flexibility training, consists of a switch task that increases in difficulty. N=29, mock-training, the WM, and flexibility training are also performed, but at a very low level.	Working memory score: $p < .001$ Flexibility (memory): $p < .001$ Not sig: executive functioning and motivational behaviour, social behaviour, paediatric quality of life
19	The journey of the Wild Divine	N= 12, completed <i>Journey of the Divine</i> (active treatment condition). N=12, waiting list.	1. Anxiety Symptoms: a. MASC: $F(2.23) = 12.18, p = .000$ b. STAIC: $F(2.23) = 5.31, p = 0.014$ 2. Depression Symptoms:

			(F (2,23) = 9.39, p= 0.001)
20	CogoLand	N=20, played <i>CogoLand</i> .	1. ADHD Symptoms: p≤0.01 for both IA and HI scales Not sig: EEG
21	gNats	Study 1: N=6, played <i>gNats</i> . *NB: Study 2 was also present in the paper; however, no outcome measurements were reported.	Clinical Symptoms: 1. No data reported; narrative discussion states that CBCL indicated improvement. Inconclusive YSR results
22	Navigation Game	N=7, completed <i>Navigation Game</i> .	1. Severity of symptoms: a. BPRS scores: p < 0.001 b. GAF scores: p < 0.01 Other Measures: EAS-Total score: p < 0.01 Not sig: SERS
23	The Journey	N=17, an active programme “ <i>The Journey</i> ” with CBT content (intervention). N=17, attention placebo programme based on psycho-educational content (control).	Depressive symptoms: a. CRDS-R: F (1,27) =20.6; p< .001 b. RADS-II: F (1,27) =3.39; p< .077
24	Junior Detective Programme	N=26, played <i>Junior Detective Programme</i> (intervention group). N=23, waitlist (control)	1. SSQ-P and ERSSQ: p < .001
25	Guardian Angel	N=19, played <i>Guardian AngelII</i> (intervention condition). N=22, viewed educational slides (control condition).	OCDS: p<0.05 AUQ: p<0.05 Not sig: the rate of relapse, TSEE-RP (at 16 weeks)
26	Kitchen and Cooking	N=21, (9 with MCI and 12 with AD), played <i>Kitchen and Cooking</i> .	Executive functions activity: p=0.003 Praxis activity: p=0.004
27	Supermecha	N=27, assigned to a <i>Supermecha</i> game condition N=25, assigned to standard WM-training (control)	CBTT: (F (1, 49) =8.30, p < 0.01 Memory span: t (26) =3.075, p < 0.01 Motivation level: F (1, 44) =81.41, p < 0.001

4.4.4 Engagement

The engagement was measured by dropout rates from the trial (see Table 5).

The dropout rate was reported clearly in 14 studies out of 27. On average, the dropout rate from the study was higher in quasi-experiments and uncontrolled trails (mean dropout rate is 21%). RCTs tended to have lower rates of dropout post-treatment (3.86%) and on subsequent follow-ups (10.32%).

Table 5: Dropout rates

Study	Dropout rate (%)	Follow up	If yes
Playmancer (Fernández-Aranda et al., 2015)	20%	no	
MindLight (Schoneveld, et al., 2018)	unclear	yes	3 months
SocialVille (Nahum et al., 2015)	22%	no	

Let's Face It! (Tanaka et al., 2010)	unclear	yes	
Poki-Poki (Chung et al., 2016)	10%	no	
X-Cog (Saleem et al., 2014)	unclear	yes	5 years
X-Cog (Trapp et al., 2013)	unclear	no	
SPARX (Poppelaars et al., 2016)	post-treatment 3.9%, follow up 7.9 %	no	
SPARX (Merry et al., 2012)	post-treatment 9%, follow up 10 %	no	
SPRAX (Fleming et al., 2012)	post-treatment 3%, follow up 16 %	yes	1 months 2.5 months
Playmancer, (Fagundo et al., 2013)	unclear	no	
Playmancer (Tárrega et al., 2015)	12.50%	no	
Dojo (Scholten et al., 2016)	post-treatment 6.5%, follow up 8.7%	no	
Flowy (Pham,et al., 2016)	42%	no	
FaceMaze (Gordon et al., 2014)	unclear	no	
BrainGame Brian (Dovis et al., 2015)	post-treatment 3.4%, follow up 9%	yes	3 months
BrainGame Brian (van der Oord et al 2014)	unclear	yes	2 months
BrainGame Brian (de Vries et al, 2015)	26%	yes	3 months
Journey of the Wild Divine (Knox et al., 2011)	20%	no	
CogoLand (Lim et al., 2012)	15%	no	
gNats (Coyle et al, 2011)	unclear	yes	1.5 months
Navigation Game (Amado et al., 2016)	22%	no	
The Journey (Stasiak et al., 2014)	unclear	yes	1 months

Junior Detective Programme (Beaumont & Sofronoff, 2008)	unclear	yes	1.5 months and 5 months
Guardian Angel (Verduin et al., 2013)	unclear	yes	1 months
Kitchen and Cooking (Manera et al., 2015)	unclear	no	
Supermecha (Prins et al., 2011)	unclear	no	

4.4.5 Game characteristics and user experience feedback

4.4.5.1 User experience feedback

User experience feedback was mainly collected from patients, only one study reported attitudes towards game from a clinician point of view (*gNats*). A detailed breakdown of user experience feedback per game can be found in Table 6. However, certain feedback trends did stand out. For instance, where feedback was available, participants were highly positive of the SVGs used and commented that they would use it in their day-to-day life. In a study that looked at clinicians' point of view, the same positive results were reported. Most negative feedback was concerned with poor-quality graphics (especially when compared to other videogames) and mode of delivery. In one study, SVG *MindLight* was compared to a commercial videogame and the received feedback indicated that although participants enjoyed *MindLight*, they preferred a commercial videogame.

It is important to note that most of the available feedback was only for SVGs designed for children and adolescents.

Table 6: Game characteristics and user experience evaluation

Game Name	Game Objective	Game Story	User Experience Evaluation
Playmancer	To improve emotional regulation and achieve a sense of self-control by completing three minigames.	Player is presented with an island that forms part of several islands in an archipelago. Player uses a customisable avatar to explore each island where different activities are available in a form of three minigames (i.e. diving, climbing, learning and training intensive relaxation tasks).	Patients feel comfortable using <i>Playmancer</i> a videogame (usability over 85%)
MindLight	To help little Arty to save his grandmother from evil	<i>MindLight</i> is an adventure biofeedback game. Game story is that little Arty left at the doorstep of a scary	Participants rated <i>MindLight</i> as more anxiety-inducing than a control commercial videogame. This means

	forces that have possessed her and the house.	mansion faced with the task of saving his grandmother from the evil forces that have possessed her and the house. There he finds a glowing headset that teaches him (and the player) to overcome his fears by changing his state of mind.	<i>MindLight</i> had its intended emotion-inducing effect. However, control commercial videogame was more likely than <i>MindLight</i> to induce feeling of flow in children.
SocialVille	To complete exercises at various locations around the city.	SocialVille has 19 different exercises which are gradually introduced in the course of training, and which collectively target the various social cognition domains. SocialVille uses a layout of a town as context for the social cognitive training exercises. Various locations around the city contain exercises that have to be completed by the player.	Participants were largely satisfied with the training. The exercise instructions were clear and easy to understand. It was also easy to navigate in the game and has a potential to be used daily. Users have little concern about security issues. Graphics was somewhat attractive.
Let's Face It!	Is to correctly identify facial subsets presented in the picture.	The Let's Face It! intervention is composed of seven computer games targeting various face processing skills. Players could select mode and level of play. Game has 24 levels of varying degree of difficulty. In the game, players are presented with a series of pictures, based on the task, players have to attend to faces, recognise facial identity and expression and interpret facial cues in a social context.	Not available
Poki-Poki	The aim is to engage in social activity by chatting, presenting virtual gifts, and imitating the other players to improve own avatar and become friends with other avatars.	Players had to explore a virtual online world with the help of a clinician.	Not available
X-Cog	To successfully complete 16 tasks within the game.	Game consists of 16 visuomotor, memory, problem-solving and attention tasks. Participants had to control characters that face several adventurous challenges, such as rescuing a princess which has been captured inside of a maze, protecting salads from hungry snails etc. Each task can be administered in five different levels of difficulty from 'beginner' to 'super professional'.	Not available
SPARX	to restore the balance in a fantasy world dominated by defeating gNats (Gloomy Negative Automated Thoughts)	<i>SPRAX</i> is an interactive fantasy game designed to deliver CBT. It utilises both first person instruction and a three-dimensional interactive game in which the young person chooses an avatar and undertakes a series of challenges	From study by Merry et al (2012): 71 (95%) of participants in the <i>SPARX</i> group believed that the type of support they received would appeal to other teenagers, and 64 (80.5%) of

	Gather SPARX and collect gems via tasks.	to restore the balance in a fantasy world.	participants in the <i>SPARX</i> group would recommend the treatment to their friend. Of those who completed SPARX and returned satisfaction questionnaires (n=80), 53.2% (n=43) would have liked the sessions to stay the length they were.
Dojo	to help high-risk youths learn to manage their negative emotions by mastering relaxation techniques.	<i>Dojo</i> is a biofeedback game that has three rooms (fear, frustration, and anger), each with one or two relaxation tutorials and a challenging game that is designed to trigger the emotion in question and offers the opportunity to practice the acquired techniques.	Schuermans et al (2015): Satisfaction with <i>Dojo</i> was high. It was noted that participants enjoyed playing <i>Dojo</i> and liked the use of a videogame as a form of therapy. Four participants commented on the limited number of rooms in the game (they would have preferred more).
Flowy	To engage users in a series of minigames where they use breathing retraining exercises and perform diaphragmatic breathing to alleviate anxiety.	The minigames in <i>Flowy</i> range in theme, from sailing a boat down a river to flying balloons into the sky. Users touch the screen with their finger as they inhale and remove their finger from the screen as they exhale to control the gaming mechanics. The goal of each minigame is to correctly follow the breathing indicator while advancing in the game narrative; users progress through levels and achieve goals by breathing correctly and staying calm.	Overall, received positive ratings. Participants stated that “Flowy is a useful intervention”, easy to use and simple. However, the majority of the participants felt like <i>Flowy</i> will not eliminate the root of their anxiety problem.
FaceMaze	To strengthen the link between the conceptual and motor representation of “happy” and “angry” emotions via overcoming obstacles in the maze.	In a game, player navigates a Pac-Man-like figure through a series of corridors, and removes face obstacles by producing the appropriate happy or angry expressions. Facial expressions as measured by the computer recognition emotion toolbox (CERT).	Not available
BrainGame Brian	To improve executive functioning by helping Brian, a young inventor who, throughout the game, to befriend the game-worlds inhabitants by creating increasingly elaborate inventions.	This game is made of extensive 3D world with multiple areas and characters. All the characters have problems which the player character, Brian, helps to solve by playing minigames and inventing clever machines. After each minigame the difficulty level of the game is adjusted to match the player’s level of performance.	Not available

Journey of the Wild Divine	The objective is to Learn breathing relaxation techniques by building bridges across a valley.	Biofeedback game, where a player has to perform an assortment of experiences (e.g. making a fire, building a wall and shooting a bow and arrow) in a fantasy land. The user has a goal of building a bridge across a valley. As the person's breathing slows and tension decreases, the bridge is built. If the user experiences frustration or anxiety, the bridge disappears. After a continuous amount of relaxation, the bridge is completed, and the user may 'cross' to the next activity.	Not available
CogoLand	Different levels in the game have different objectives. The core component is to learn to move avatar effectively via attention training paradigm embedded in the game.	Biofeedback training game using an EEG headband. It is a 3D world which the player can explore using their avatar, whose movement speed is controlled by the intensity of the players' concentration. Players would complete three minigames involving speed, control and memory, which took 30 minutes including breaks.	Not available
gNats	The objective is to travel through a tropical island and meet a team of wildlife explorers. Another objective is to learn strategies and challenge negative thoughts through interactions with NPCs.	In the game, players navigate through a 3D world in which they meet a series of characters. These characters introduce mental health concepts using spoken conversation, embedded animations, videos and questions regarding the player's own situation. Inhabitants of the island (NPCs) are influenced by gNats (negative automated thoughts) that are presented as little creatures.	Clinicians: All five clinicians reported positive overall impressions of gNats Island. They commented positively both on the impact of the overall intervention and on specific issues e.g. "the game changed the dynamics of the therapeutic interaction". Users: The majority found the game very enjoyable e.g. "It was a game and it was more fun than just talking."
Navigation Game	To successfully navigate through a virtual city.	It is a VR 3D game. Players have to navigate in the VR town, sharing a joystick. While one of the members in the group navigates, the others are helping him, in an interactive and collective effort. Participants should find their way (involving, therefore, attention and visuospatial organisation), to memorise their itinerary (which involves memory for details and topographic memory abilities), to plan different actions (encouraging planning ability, flexibility, executive functions, as well as prospective memory), depending on the instruction they have to follow.	Not available
The Journey	To earn points and progress to the next module.	It is a fantasy game-like environment i.e. the user selects and names an avatar, follows a narrative of a quest through magical lands where the content is linked to a theme (e.g. cognitive restructuring techniques), earns	The participants identified the following five features of the programme as their favourite: "it was computer-based"; "showed me things I didn't know

		points for completing modules and is rewarded with a simple minigame at the end of each module.	about”; “I could use it at school”; “it was made for adolescents” and “it talked about mental health”. The main identified weaknesses of the programme were technical glitches, excessive amounts of reading and perceived developmental inappropriateness (game was perceived as more appropriate for younger adolescents).
Junior Detective Training Programme	To graduate from the academy and successfully complete missions.	The game was set in the year 2030, where postnatal genetic screening indicated that the central character in the game (the ‘junior detective’) was best suited to a career as a secret agent, specialising in the field of controlled remote viewing. Player has to advance through levels in order to graduate from a detective academy. Game is completed through effectively applying social skills to game missions.	Not Available.
Guardian Angel	To assist individuals in recognising and coping with relapse risk factors by acting as a “guardian angel” to a character in recovery.	In this simulation, players serve as a “guardian angel” that essentially guides a character in early recovery to make daily decisions in support of recovery and continued abstinence.	Not available
Kitchen and Cooking	To successfully cook dishes by following recipes.	Player has to cook four different recipes (4 minigames). Each dish has to be completed within certain time frame. Player has to choose correct cooking-actions, ingredients in order to make dish successfully. Each of the recipes is harder to cook than the last.	Participants rated the game experience as interesting, reported to be highly satisfied and motivated by the game, to experience more positive emotions than negative emotions, and not to be fatigued both at the beginning and at the end of the training. A few participants played almost only with the clinician, some others played up to 70 scenarios per week, thus suggesting that the game most probably met their interest.
Supermecha	To successfully conquer villages and fight evil robots via working memory training.	The player has to save the world from an evil group of robots, named Mechas, which have taken control and invaded villages. The player must take control of a “good” robot, the Supermecha, fight the evil robots. The game consists of three levels and in each level several villages could be “reconquered.” Once a village	Children reported that they liked the task, would like to have the task at home, would like to do the task at home, and would often use the task at home.

		has been entered by the Supermecha, the evil robots can be shot but the shot's success is determined by the player's performance in a WM task.	
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4.4.5.2 Game characteristics

The core game characteristics of 20 unique SVGs are summarised in Table 11 (See Appendix E).

In the description of the games' objective, the story was derived largely derived from papers included in this review. However, some studies referred to previous research and did not provide a sufficient description of the game. Therefore, an additional search was carried to gain more information.

Most games used feedback (17 out of 27 games) to guide players and inform of their performance. A number of games used PC as a delivery platform, while only *MindLight* was played via Xbox 360. There was an even divide between games that utilised 3D and 2D graphics. The overall quality of graphics was simple and unrealistic.

Fourteen out of 27 games used evidence-based principles to guide game design. The most used theoretical background was CBT; however, some games used other principles (e.g., *MindLight*, *Flowy*, *Junior Detective Training Programme* and *Supermecha*).

Some patterns of game mechanics can be tracked down for particular mental health issues. For example, games that aim to alleviate anxiety tend to use biofeedback, while depression-oriented games use storyline, dynamic environment and avatars. Games that focus on cognition tend to be in 2D, relying on minigames and level progression.

The games tested in an RCT study design were more likely to use biofeedback, avatars, NPCs and storyline elements. In addition, all RCT games were grounded in evidence-based design. On the other hand, games in the quasi-experiment were more likely to utilise points, minigames and dynamic environment. Uncontrolled trial games contained a diverse number of game mechanic elements; therefore, it is challenging to highlight specific ones.

4.5 Discussion

4.5.1 Overview of results on effectiveness

In this systematic review, we have identified 27 studies that looked at 20 unique SVGs for various mental health disorders, including depression, anxiety, ADHD, ASD, eating disorders, schizophrenia and the first episode of psychosis, alcohol use disorder, gambling disorder, mild cognitive impairment and Alzheimer's disease.

Overall, the quality of the research has improved in recent years, with more RCTs emerging over the past five years (ten out of 27 studies), meaning reduced levels of bias. In the quality assessment, only two papers scored "Poor", while the rest fall within "Fair" and "Good" quality evidence. However, it is worth noting that reported studies were not reasonably powered (mean size of participants across studies = 56); in fact none of the studies reported sample size calculations. Unfortunately, such practice is rather common in SVG research and other areas of healthcare research too. Moher et al. (1994) highlighted the magnitude of underpowered studies resulting in null trials in literature. Therefore, it is premature to draw any concrete conclusions about the effectiveness of SVGs for mental health conditions.

The results of this systematic review indicate that SVGs may have a promising impact on certain mental health conditions, but not others. Games that were aimed at cognitive symptoms were most likely to produce a positive outcome. For example, games that were aimed at ADHD symptoms (*BrainGame Brian* and *Supermecha*) seem to be more effective in producing certain improvements in working memory and motivational behaviour. Effect on executive function and ADHD symptoms was mixed between studies, suggesting that the games *Cogoland* and *BrainGame Brian* (van der Oord et al., 2014) produced significant improvement in ADHD symptomology and problematic behaviours. However, RCT on *BrianGame Brian* found a decrease in ADHD symptoms in all three conditions of a game, including placebo versions of the game. It is important to note, however, that we cannot draw a negative conclusion from an underpowered study.

Games aimed at children with ASD targeted facial and emotion recognition (*Let's Face It! Face Maze*) and social skills (*Junior detective Training Programme*, *Poki-Poki* and *BrainGame Brian*). The results showed that were successful in producing a positive outcome, encouraging both social skills training and facial recognition.

Another class of games that were effective in promoting mental health outcomes were games those that tackled psychotic disorder symptoms (*SocialVille*, *X-Cog* and *Navigation Game*).

These games were effective in reducing cognitive symptoms of psychosis, but the effect on negative and positive symptoms was limited.

Games for depression come with the strongest evidence base, since four RCTs from this review looked at depressive symptoms. A study by Fleming et al (2012) produced positive results, suggesting that *SPARX* is as effective as TAU. However, other RCTs on *SPARX* failed to replicate their findings. One more SVG – *The Journey* – was positive about its effect on depressive symptoms, resulting in a substantial reduction.

Some games focused on only one mental disorder (*Playmancer* and *Kitchen and Cooking*) and the results were promising, providing some degree of improvement. However, none of these studies were randomised and contained a small number of the participants.

Lastly, SVGs on anxiety symptoms failed to produce convincing results, suggesting that although specifically designed games like *MindLight* and *Dojo* can produce a significant reduction in anxiety symptoms, they are no more effective than commercial videogames. The only SVG that produced promising results for anxiety treatment was *The Journey of the Wild Divine*; however, this was a small trial.

Overall, SVGs seem to be effective in improving cognitive symptoms of various disorders, including ADHD, ASD and psychotic disorders like schizophrenia. Disorder-specific symptoms are more likely to be improved in games aimed at depression, suggesting that games like *SPARX* are as effective as TAU. SVGs have limited effect on anxiety-related disorders; however, so do commercial videogames. Finally, the most effective games were theory-driven and based on CBT principles (*SPARX*, *The Journey*, *Playmancer* and *Poki-Poki*).

4.5.2 Overview on target population

Sixteen out of 27 games were aimed at adolescents and children with either depression, ADHD or ASD symptoms, which can be explained by the fact games might be a more natural and acceptable medium for children and adolescents when compared with adults. However, currently, games are played within a variety of age groups. According to the Entertainment Software Association (2016) report, the average gamer player age is 35, with 30% of players being 18-35 years old and 27% being 50+ years old. The only games aimed at adults were used to train cognitive abilities (*Kitchen and Cooking*, *SocialVille*, *X-Cog* and *Navigation*

Game), while games for younger players seem to be more fantasy-oriented and generally have a more engaging story (*SPARX*, *Dojo* and *MindLight*).

4.5.3 Overview on platform of delivery

Many of the identified games were delivered via PC, which is consistent with previous reviews (Fleming et al., 2014; Lau et al., 2017). Currently, the majority of apps for mental health are available via smartphones and other mobile devices. In fact, over half of the population in the United States owns a smartphone and 83% of these users do not leave their homes without it (Smith, 2013). The 2016 ESA report further suggests that 56% of people who play videogames use a PC, and there is now almost an equal amount of people who use a dedicated game console (53%). In addition, more people use smartphones for gaming (36%). Altogether, SVGs should not be limited to only one platform of delivery if they are to be as accessible as possible. The games *Flowy* and *Kitchen and Cooking* were delivered via mobile devices, with user experience feedback suggesting that participants liked the game and platform of delivery. Another finding is that only two games incorporated elements of social play (*Poki-Poki* and *Navigation game*), which is further representative of a ‘time-lag’ between commercial entertainment games and serious games, since 51% of the most frequent gamers play a multiplayer game at least weekly. Research suggests that online social networking can be beneficial for mental health and engagement (Lenhart, Purcell, Smith, & Zickuhr, 2010; Rice & Barman-Adhikari, 2014).

4.6 Limitations

This study provides a valuable insight into the effectiveness of SVGs on a variety of mental health-related outcomes. The inclusion of uncontrolled trials and quasi-experimental study designs allowed for an understanding as to how the field has been developed in the last couple of years and what kind of games were designed.

This systematic review has a number of limitations. First, there is a risk of bias in some studies that did not report certain methodological information, often referring to previous research that was hard or impossible to track down. Therefore, some data could not be included in this paper, potentially compromising the quality of the review. Second, it is possible that the results of this review are at risk of the publication bias. In the future, publication bias can be minimised by checking registered trials and determining which have been conducted but not published.

4.7 Future Directions

This review also looked at user evaluation feedback and the degree of engagement with game interventions; both suggest that SVGs are a feasible medium for potential therapies, or at least can be used as an adjunctive treatment tool. The rate of dropouts were lower (mean dropout rate was 21%) when compared to those found from CBT (26.2%) when using data from the meta-analysis by Fernandez et al. (2015). However, both dropout rates and user evaluation feedback were reported in half of the studies, meaning that information can be over or under-represented. In addition, none of the studies looked at possible facilitators of motivation in players.

One of the possible future direction is to examine more closely user-centred design, investigating target groups within a patient population that might benefit the most from the SVG approach, exploring their motivations and preferences.

In addition, the effect of commercial videogames should be investigated further, potentially comparing their effect on the mental health-related outcome against SVGs, especially regarding the alleviation of anxiety, since both SVGs were as effective as commercial videogames (*Dojo/Rayman 2: The Great Escape* and *MindLight/Max*)

Lastly, SVGs lack the graphic quality that can be currently offered by commercial videogames. As commercial videogames are continuously evolving and becoming increasingly sophisticated, SVGs may become outdated relatively quickly and, therefore, may lose their appeal and capacity to engage users.

4.8 Conclusion

From the previous research, we know that digital interventions can be effective if people engage – particularly those that use CBT. Traditionally, engagement in these digital interventions has been poor (although research is rather mixed and inconclusive here). Using serious games might be a way to improve engagement and, therefore, effectiveness in real-world situations of these type of interventions.

SVGs can potentially be effective in improving mental health-related outcomes; however, this is true for some mental health disorders, but not for others. This review combined heterogenous papers with different methodologies, study designs and outcomes. Therefore, one should be careful to draw definitive conclusions about the effectiveness of SVGs. This review suggests that, in the future, research should consider designing SVGs for adults, using

smartphone-based or console-based platforms of delivery. In addition, further exploration of user-centred design is required to develop more engaging SVGs for health improvement.

Chapter 5: Determining Initial Design Implications for an SVG for Psychosis

This chapter contributes:

- An overview of the existing apps and videogames that promote self-efficacy in chronic conditions;
- Stage 1 of the game design process – what elements and mechanics can we use for our SVG from a literature review mentioned above;
- Stage 2 of the game design process – a summary of game design principles and game elements from health behaviour change interventions and therapeutic SVG for mental health conditions.

5.1 Introduction

To develop an SVG that is effective, educational and fun, researchers must understand the complex designing domain. As Winn (2008) suggests, “Designing effective, engaging serious games requires a theoretical understanding of learning, cognition, emotion, and play” (p. 134). Therefore, in SVGs, the critical point is the relationship between the game and the theoretical foundation (Bellotti, Berta, & De Gloria, 2010). The right balance between the two can be achieved via following existing principles for SVGs design and analysing existing digital interventions for a health behaviour change that contributes to the self-management of chronic conditions.

By “SVG design principle”, we mean a set of verified steps/rules one has to follow to create an effective and engaging SVG. While “game design elements” are defined as building blocks of the game that are integrated into a core game mechanics. An example of a game design element would be leader boards, feedback, badges, 2D/3D graphics or narrative etc. (for more detailed list, see Chapter 4, Appendix E). Research suggests that different sets of game design elements have the capacity to provide different learning environments within the game, some more engaging than others (Bedwell et al., 2012; Bellotti et al., 2010; Sailer et al., 2017).

Currently, there are no principles or guidelines for the development and design of SVGs for any mental health condition. Therefore, we conducted a search that focused on existing publications on SVG design principles for health behaviour change (HBC). In addition, we

looked at case studies of self-management videogames that promote self-efficacy in physical and mental health conditions. Also, we discussed the content of these videogames and what game elements and mechanics can be used from them to design our SVG.

5.2 Videogames That Promote Self-efficacy in Chronic Physical Health Conditions

As discussed before, SVG research is well established within physical health condition self-management; in particular, this is true for child and adolescent populations. Since there are few SVGs for mental health self-management, we decided to also consider some examples from physical health, summarising common strategies used to encourage self-management behaviour(s). We have decided to choose the game examples discussed in a systematic review by Lazem et al. (2015), which included one of the most comprehensive lists of SVGs for diabetes that focused on self-management.

We focused on diabetes and no other chronic health condition, since it is one of the most researched conditions across both physical and mental health domains in terms of SVG development.

5.2.1 Diabetes

Lazem et al. (2015) reported 12 self-management SVGs for diabetes. Table 7 offers a brief overview of some SVG for diabetes to show the variety of gameplay content. We have decided to provide a description of only four SVGs to show the variety of gameplay, since other games were similar to the ones we have chosen to discuss below.

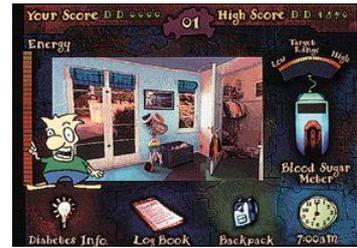
Table 7: Game characteristics (Diabetes)

Name of the SVG	Gameplay	Screenshot
Packy & Marlon (Brown et al., 1997)	An action-adventure side-scrolling Nintendo console game for children and adolescents with type 1 diabetes. In the game, rats and mice have invaded diabetes summer camp, and it is up to diabetic elephant heroes Packy and Marlon to find food and diabetes supplies to save the camp. In four simulated days, players guide their elephant to meet game challenges and to stay healthy enough to win by keeping his blood glucose in a normal range through blood glucose testing, taking insulin, and eating appropriate foods from food groups.	

Starbright Life Adventure Series CD-ROM

(DeShazo, Harris, & Pratt, 2010)

A computer game that takes children with diabetes through an interactive day in the life of a child with diabetes so that they can learn how to manage this chronic condition. The game offers fast-paced exercises, quizzes, and arcade-style challenges that provide information intended to help players gain more control over their disease.



The Magi and The Sleeping Star

An action-adventure diabetes simulation videogame that was announced in 2009 and has not yet been published. It is supposed to be a high production value adventure game in which the player is a magus, a powerful young magical hero who has type 1 diabetes. He goes on a quest to save the world while using his magical abilities to defeat robotic enemies along the way. The magi's magical power is a direct reflection of how well the player is managing his blood glucose level by making proper insulin and nutrition choices in the game.



Power Defense

(Bassilious et al., 2011)

The young person with diabetes is challenged to maintain a balanced blood sugar level, as represented by a power station output level, and is provided with a range of tools and materials, such as a coolant that represents insulin. The player also has to survive "attack waves" which represent food, and to try and maintain an optimal energy (blood sugar) level. While the players have to answer diabetes-specific questions



These games focus on overcoming barriers to self-management (e.g., lack of knowledge about diabetes and what is required for successful self-management, motivational barriers [how to engage in HBC and sustain it over time]), and teaching the player about the relationship between food, insulin, physical exercise and blood glucose level. Almost half of the SVGs contained educational topics related to diabetes: diabetes symptoms, the biology and mechanics of insulin injections.

Most games were built upon existing theoretical frameworks, the most frequently used one being SCT (discussed in section 2.6 and will be mentioned further in the thesis). The games' content typically involved players in problem-solving and decision-making simulations of diabetes self-management, giving players an opportunity to rehearse self-management skills and diabetes-related knowledge within the game, and to explore the cause-and-effect relationship. Some games involved other users like carers, clinicians and friends with or without diabetes.

5.3 SVGs and Apps for Psychosis Self-management

We carried out an internet search, as well as a reference searching from the systematic review (see Chapter 4), to identify any existing SVGs for psychosis self-management. These games mainly focus on psychoeducation. The majority of the existing games for psychosis are therapeutically oriented, meaning they are meant to alleviate certain psychosis-related symptoms.

Games like *Bipolife* and *Bias Blaster* were not trialled, so therefore were not included in the systematic review in Chapter 4.

Table 8: Game characteristics (Psychosis)

Name of the SVG	Gameplay	Screenshot
Bipolife (University Hospital, Montpellier)	is a serious game with a purpose to help bipolar patients to deal with their conditions, through three main messages: to pursue the treatment, to have daily routine and to request the psychiatrist in case of relapse. Game is a life simulation of person with bipolar disorder. The aim of the game is to “manage” the character by attempting to main his/her mood in euthymic state. Game is aimed at people with bipolar (to gain insight into condition) and their friends/relatives (to understand how living with bipolar disorder feels like).	 <p>The screenshot shows a 3D-rendered hospital room. A character in a dark suit is standing in the center. To the left is a desk with a computer monitor. To the right is a medicine cabinet. A yellow tooltip box with the text 'Interact with the medicine cabinet.' is positioned near the cabinet. In the top left corner, there is a clock showing the time 18:41.</p>

Pogo's Pledge (Shrimpton & Hurworth, 2005)

is a game designed for an educational purpose, thus combining learning with fun? In this case, the game was designed to enhance service users' understanding of psychosis. In the usage scenario anticipated by the designers, service users could play the game during several sessions at a community mental health centre or at home and discuss their gaming experiences afterward with a clinician. It is a medieval fantasy quest to provide educational messages about psychosis for young people who were experiencing psychosis for the first time.



Bias Blaster (van der Krieke, Boonstra, & Malda, 2014)

The aim of the game is to beat interpretation bias in psychosis. It is a bubble-shooter based cognitive bias modification interpretation game, implemented as web-browser game. The aim of the game is to deplete a multitude bubble cluster, continuous threat of stacking bubble-masses increases the cognitive task load. When in trouble, the player is left the option to load the bomb to regain further progress in the game.



According to the systematic review by van der Krieke et al. (2014), most of the existing digital self-management interventions for psychosis focus on psychoeducation (a reported 28 digital interventions). Theories for HBC postulate that psychoeducation is an essential component for enhancing self-efficacy, because it provides a basis for change. Most of the reviewed interventions by van der Krieke et al. focused on the following aspects of psychoeducation: providing general information about schizophrenia and psychotic disabilities, medication, other treatment options, and various community services, such as housing, employment and rehabilitation services. However, some interventions also contain online psychoeducation therapy groups and a channel for peer support (Cucciare & Weingardt, 2010; Kuosmanen et al., 2009). Other prevalent topics included in the digital interventions were medication adherence, the management of daily functioning (the most common approach was through SMS text messaging) and strengthening therapeutic alliance with clinician.

The review did note that existing interventions do not focus on positive outlook or personal qualities, attitudes and beliefs. Also, only some digital interventions were developed in tandem with service users. This might go some way to explain why eMental health interventions for self-management do not always contribute to service user empowerment; user-centred development is not yet in common practice in this population, and in some interventions the clinical perspective predominates.

5.4 Summary of SVG Design Principles from HBC Literature

Self-management of any chronic condition requires adopting, learning and exercising new behaviours. Due to the insufficient literature on game design principles for self-management in mental health conditions, we turned our attention to other domains closely related to self-management, such as HBC.

From the HBC literature, we know that behaviour is typically the result of multiple influences, often making it resistant to change. Therefore, a behaviour change must be approached as a complex, multiple-step process. Rather than attempting to change behaviour directly, behavioural scientists attempt to change mediators. Changes in mediators, in turn, change behaviour (Baranowski et al., 1997).

Behavioural theories typically guide the selection of mediators. Examples of such mediators include immersion, attention, functional knowledge, self-regulatory skill development (e.g., goal setting, self-monitoring, decision-making), self-efficacy, internal motivation and feelings of competence, autonomy and relatedness. For the purpose of this MPhil, we have already identified such a mediator: self-efficacy.

The behavioural theory also provides procedures that facilitate behaviour change. For instance, the Elaboration Likelihood Model (Petty & Cacioppo, 1986) supports that story characters viewed as credible, attractive and likeable are more likely to be persuasive than others. SCT (Bandura, 1986) specifies goal setting, modelling and skill development as behaviour change activities. Although initially these models were used for the design of HBC interventions, they subsequently became pillars for the design of SVG concerning the self-management of physical health conditions like cancer and diabetes (Thompson et al., 2010).

In order to build an engaging and effective SVG that will change health behaviours, one should consider the existing game examples and their components (from a systematic review in Chapter 4; SVGs reviewed from Chapter 5 [see above and below] and literature review on

HBC, namely Baranowski et al., 2008; Doherty et al., 2010; Mohr, Burns, Schueller, Clarke, & Klinkman, 2013; Thompson et al., 2010).

Below we outline game design principles for SVGs derived from HBC literature:

1. Design in collaboration with stakeholders

Literature stresses the importance of a cooperative relationship between HCI designers and key stakeholders (people who will use the end product can contribute with their expert knowledge if required). All of the reviewed SVGs in this chapter (see section 5.3), and where information on design process was available for SVGs in Chapter 4, were built in collaboration with healthcare and mental health professionals. Fewer SVGs for mental health involved service users due to the perceived difficulty of accessing this population (Doherty et al., 2010).

When working with therapists and other mental health professionals, it is important to be clear about the motivations and methodologies of a design process. Clearly identifying objectives of the project is very beneficial (e.g., what condition does SVG aim to target, what population and what behaviours/symptoms etc. it should aim to change/improve?).

Information regarding design implications can be obtained via interviews, which is also a good way of finding out more about the user group, their preferences, their environment, normal working patterns, materials that they use and the possible complications that can arise when game is incorporated in a clinical environment. The literature also notes that therapists can provide a good insight into the client group, however it is good practice to involve the service user group where possible (Doherty et al., 2010).

It is recommended to conduct interviews in situ, so designers can experience the clinical environment and gain a better understanding of it.

If a researcher has access to the key user (in our case patients with psychosis), one of the first steps is to better understand the users and their needs. Researching literature and reports are critical to building up an idea of potential end users and their likely environments, typical therapeutic settings and what tools are already available to use (e.g., non-computerised self-management programmes like WRAP and IMR; see Chapter 2). It is also worth considering a user's profile (e.g., ethnicity, gender, educational level and other socio-cultural factors) before the initial design ideation/interview study, because the existing literature notes that

appropriate design choices for intended (specific) users, can improve client engagement and strengthen the delivery of a digital intervention like SVG.

Another factor to consider was the use of familiar technologies and the build on existing skills. Clients are more likely to engage with the new digital interventions if they are familiar with the platform of delivery; this links with the point above, emphasising the importance of end-user screening.

2. Promoting and supporting self-efficacy in SVG for HBC

Self-management requires learning and practising certain behaviours overtime to make one feel consistently well. HBC is part of the self-management of any chronic condition. However, there are factors that can promote, mediate and sustain HBC, thus insuring adequate adherence to self-management routine. One such factor is self-efficacy, which is a common target of the SVGs for HBC.

In theory, there are two primary ways in which interventions (not only digital) can promote self-efficacy: via personal success and by observing others (i.e., models) successfully perform the behaviour (Bandura, 1986; Starks, 2014a). Personal success has the greatest effect on self-efficacy (i.e., monitoring medication intake for a week, correctly responding to triggers for relapse, feeling better, experiencing satisfaction at a job well done and receiving positive feedback); therefore observing others perform a task or behaviour and receiving feedback is the most common way in which individuals learn a new behaviour (i.e., observing a videogame character engage in a sequence of actions, feel better and experience satisfaction). Key model attributes include perceived similarity and competence (Schunk, 1987; 1986). Perceived trustworthiness, attractiveness and likeability are also important attributes (Petty & Cacioppo, 1986). For instance, levels of self-efficacy often define the goals that people make for themselves. When self-efficacy is high, people make more challenging goals and vice versa (Bandura, 2004).

In the videogame, designers have the capacity to create an environment that will enable users (patients) to learn and practice behaviours, and acquire skills necessary for a HBC. Self-efficacy is a mediator between the intention to perform a behaviour and the act of doing it. Therefore, research on SVGs design principles for HBC recommends targeting self-efficacy as one of the key mediating factors.

In the videogame, two primary methods of promoting self-efficacy (personal success and observing others) can be practised repeatedly, while at the same time acquiring skills necessary for self-management. For instance, character modelling and dialogue can convey knowledge, demonstrate skills and enhance self-efficacy. Modelling a coping style in which characters model an imperfect performance initially, but persevere and gradually improve through personal effort and skill refinement, emphasising the importance of using strategies, verbalising and/or demonstrating how to use the strategies, would enhance knowledge, refine skills, and enhance both self-efficacy and competence. An example of how to achieve this in a videogame would be to have an ‘expert’ character (i.e., one who self-manages and is in control) to guide other characters in the game who are attempting to self-manage. Providing encouragement, feedback, and demonstrating how to use skills and strategies to self-manage would serve as a model for the player.

Providing choice, connecting goals to personal values, providing immediate performance-related feedback and structuring the game in levels with challenges that gradually increase in difficulty would enhance competent self-efficacy (Baranowski et al., 2013).

3. Focus on knowledge and skills

Basic knowledge of the health behaviour (i.e., how many servings of vegetables do I need each day?) and how to manage one’s behaviour (i.e., how do I overcome problems that keep me from meeting my goal?) provide a necessary – but not sufficient - foundation for behaviour change (Bandura, 1986). Skills that enable an individual to act on this knowledge are also needed to establish a strong foundation for HBC. For example, when a patient with bipolar needs to set up a healthier diet or regular exercise, they need to be skilled in choosing appropriate ingredients for cooking or knowing how to perform an exercise. Other important factors that derive from knowledge acquisition and skill formation is setting realistic goals within the game, self-monitoring and solving problems (Shunk, 2003). These factors combined together will enable one to self-regulate their behaviour.

Psychoeducation is another example of ‘knowledge’ that patients can acquire in the game. An example of an SVG with psychoeducational elements would be *The Journey of the Wild Divine*. The aim of the game is to teach adolescents to identify triggers and signs of anxiety via biofeedback. One of the key elements of the game is psychoeducation. After performing a series of in-game tasks, players will encounter virtual mentors and guides who provide an

explanation about how players performed in a task, as well as give advice on relieving stress and enhance wellbeing, thus improving performance in the game (Knox et al., 2011).

Reported clinical uses of videogames include psychoeducation in chronic disease management (e.g., diabetes, asthma) to increase treatment adherence (Yoon & Godwin, 2007), and physical therapy and rehabilitation following traumatic brain injury (Jannink et al., 2008).

In the game, knowledge and skills can be learnt via a virtual coach or tutor. Some games use mini-puzzles and minigames that a player can complete using acquired knowledge or skills (Starks, 2014b). For example, playing brain teaser games to practise cognitive skills like attention, memory and problem solving. Once a player completes these brain teaser games, feedback may be given to indicate where they are at and what the player can do to improve his/her performance.

4. Goal setting and monitoring

Goals are a statement of intention and give focus and direction to change efforts (Zimmerman, 2000). They provide a standard, or benchmark, against which progress can be assessed. Specific, proximal, and moderately difficult (i.e., attainable with effort) goals are more likely to be attained if there is a balance between difficulty, optimal time to achieve the goal and possession of the necessary skills. For example, a goal that meets these criteria can be “take a pill each morning this week”. Therefore, a person will have to have a combination of the following three prerequisites for goal attainment:

- (1) Knowledge – why do I need to take the pill every morning?
- (2) Proximity – if I take a pill, I will feel better in a long-term.
- (3) Difficulty – Is it hard for me to take it every morning?

Goals can be both in the game and in real life. One of the criticisms of the ‘edutainment’ genre is that goals for play and goals for learning do not align (Ciavarro et al., 2008; Gee, 2005). Therefore, it is essential for designers to build realistic, attainable goals within the game. The above example can be incorporated into a game as a part of reward system – if the patient takes a pill consistently each morning, he/she will get a bonus or present to support the effort.

However, setting goals is not enough, one should monitor goal progression. Keeping a record of goal attainment provides information about goal progress, and supports and reinforces behaviour change (Bandura, 1986). Having a calendar or progress bar in a game can allow patients to track medication intake daily. The subsequent tracking of progress will provide a record towards the goal of adhering to medication.

One example of real-life goal setting can be improving the quality of the client-therapist relationship and the degree to which clients engage with treatments that play a significant role in the success of interventions (Robinson, 2009).

5. Encouragement, Engagement and Motivation to change

According to SDT, the behaviour is driven by three basic needs: competence (ability to successfully perform a behaviour – influenced by repetition and specific, positively framed feedback), autonomy (having choice and control over behaviour) and relatedness (connecting the behaviour to important others or personal ideals).

Creating a learning environment that promotes high levels of basic need satisfaction enhances the likelihood a behaviour will become internalised and integrated into one's sense of self (i.e., "I am a person with bipolar disorder who self-manages"), thus increasing the likelihood it will be maintained over time.

In SCT, encouragement is called facilitation and/or social support. It refers to the environmental and social factors that can assist in goal attainment. Social support can come from real-life in the form of family and friends, or from the game environment (nonplayable characters). Even sounds can provide a valuable praise (i.e., hearing "good job!" when a mission or puzzle is completed).

The importance of engagement has been discussed before in Chapter 3. It is, however, important to stress that designing for engagement in the mental health domain must place an emphasis on engagement with the treatment, rather than on engagement with the technology. There is little point in developing a system which, while deeply engaging for the user, does little to assist in achieving the overall therapeutic objectives. Successful technologies will achieve a balance, whereby an appropriate level of engagement with the technology enhances engagement with the overall therapeutic process (Coyle & Doherty, 2008).

6. In-game barriers

The barrier element is sometimes referred to as impediments; these are factors that hinder goal attainment. Like facilitators, they can be environmental and social, such as in-game puzzles that must be solved before the player can move to the next level. In simulation games, barriers – like outcome expectations – can be designed to mimic real-life situations. While barriers are an important part of behaviour changes, game-based barriers need to be designed in a way that develops the player's coping skills.

To the extent that realistic barriers can be simulated within games, they can force the player to think through how he/she would handle the barrier in real life. Barriers and challenges can also be used to show a barrier that is usually unseen. *Re-mission*, a game about cancer, simulates the inside of the body as the player fights cancer cells. This type of challenge in gaming can help players relate to the challenges they face in life by helping them to see them; this can be especially helpful with games that simulate health challenges not immediately felt, such as diabetes, which often causes few external symptoms.

7. Use of relevant theoretical background

It is important to build not only a fun SVG, but also an effective one. The literature suggests that one of the successful principles of SVG design is the use of relevant theories, which provides a coherent framework to organise ideas and rationale for game design (Cheek et al., 2015; Dunn & Elliott, 2008). Health interventions to promote behavioural changes that are based in theory and evidence, and tailored to psychological constructs, have been found to contribute to increased adherence and effectiveness (Noar, Benac, & Harris, 2007). In this instance, the psychological constructs of most interest are those that help explain which features of a serious game will support the individual to engage with the programme, maintain interest in completing the tasks and incorporate therapeutic concepts into everyday life.

For example, SVG *SPARX* (designed to deliver cognitive behavioural therapy for the treatment of clinically significant depression) was developed using CBT and learning theory, with input on its game design coming from youths and stakeholders. In each module within the game, users are explicitly introduced to therapeutic content using a virtual therapist or guide, and then they transition to a fantasy setting to undertake CBT-based challenges and develop CBT-based skills within an overall narrative of restoring balance to the fantasy world. Although this game is mainly psychotherapeutically oriented (the main aim of the

game is not self-management), it demonstrates how to successfully integrate existing evidence-based practices like CBT in a game environment.

8. Appropriate use of game elements in an SVG design to enhance HBC

The aspect using appropriate game elements to facilitate HBC and engagement has been mentioned in some literature, however it has not been discussed in extensive detail (Baranowski et al., 2013; Poultney et al., 2016). There is a well-acknowledged need for establishing *what* goes into an SVG in terms of health knowledge and the appropriate theoretical model. However, there is an emerging discussion in the SVG design community about the importance of *how* the content is delivered.

The question of *how* can be answered by considering different game elements, which will be discussed in more details below, and what is the best combination of these elements with the content of the SVG. Poultney et al. (2016) argued that in order for games to be effective in supporting an HBC, “it must be ‘serious’ enough to reflect on the users’ condition” (p. 25) and should provide enough of a level of guidance to achieve a specified HBC goal. However, it is equally important for a game to be fun and generate a certain level of enjoyment. The author further suggests that the balance between ‘seriousness’ and fun within the game can be attained via using appropriate game elements. By achieving the right balance, SVG will be more interesting, engaging and motivating to initiate HBC (Maheu-Cadotte et al., 2018).

Game elements, which can be seen as building blocks or shared features of games (e.g. points, difficulty adaptation or story), are suggested to be instrumental in improving the learner’s engagement in SVGs (Sailer et al., 2017; Wang et al., 2016). Therefore, an SVG may be composed of several game elements and these game elements may be similar across SVGs. A list of game elements can be found in Appendix E.

Based on Csikszentmihalyi’s (1990) flow theory and the theoretical propositions of other authors’ in-game design, Pavlas (2010) suggests that game elements operate by influencing antecedents of engagement, such as the learner’s ability to concentrate on task, his sense of control, the feedback he receives and a deep but effortless involvement.

Findings from a recent meta-analysis investigating the effectiveness of SVGs on healthy lifestyle promotion underlined the necessity of strong theoretical foundations in designing SVGs and the need to further explore which game elements are the most impactful (DeSmet et al., 2014; Maheu-Cadotte et al., 2018).

From reviewing SVGs for HBC, it appears that the most used game mechanics element was feedback, while the least used element was leader boards. A number of games use the PC as a delivery platform, although there is a growing consensus that SVGs should be delivered via mobile devices (Laamarti, Eid, & El Saddik, 2014). There is also a shift in using more 3D graphics rather than 2D graphics. However, the overall quality of graphics is simple and unrealistic (and of poor quality when compared to commercial off-shelf games).

Games for mental health improvement that were tested in an RCT study design (see Chapter 4) were more likely to use biofeedback, avatars, NPCs and storyline elements. In addition, all RCT games were grounded in evidence-based design. On the other hand, games in quasi-experiments were more likely to utilise points, minigames and dynamic environment.

A game element that has been extensively explored in SVGs for physical HBC (but not mental health) is the social component. To motivate engagement in-game challenges and increase expenditure of effort, the game mechanics of collaborative game play and teamwork add a social component that can make players feel strongly committed to remaining in the game, in order not to disappoint their partner or team. Collaborative learning and teamwork also involve strategising, teaching and coaching with one's partner, which are well-documented and powerful methods of learning (Baranowski et al., 2013); for players with health problems or chronic conditions, these are ways to increase communication and social support related to their health issues.

Other game elements that have been discussed in the physical health domain, but which still remain to be implemented in a mental health field, is the use of the element of fun or enjoyment from playing a game. It is challenging to define the meaning of 'fun' within videogames, but the consensus among game designers is that concept of 'fun' is linked to the concept of 'flow' (when a skill level is perfectly matched to the challenge level within the game) (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2014). When a player is in the 'flow', they are more likely to be more immersed in the game, and have increased intrinsic motivation and level of engagement with the gameplay.

5.5 Summary and Implications for Design

Currently, there is no serious game design framework for either mental health improvement or self-management of any psychiatric condition. However, future research can learn by

combining key principles that emerged from HBC literature, and the literature on designing technologies for mental health and other chronic conditions like diabetes.

Existing digital interventions for psychosis self-management, including SVGs, mainly focused on psychoeducation and a development of the understanding of the condition in service users. However, little attention is given to targeting person's beliefs, attitudes and self-efficacy.

SVGs for physical health provide a more detailed insight into how games are built to deliver psychoeducation and practice self-management skills, but also to empower a service user.

In theory, effective SVGs for any psychiatric condition self-management should include: elements of psychoeducation; clear set goals within the game that should align with real-life therapeutic goals; incorporate social play and support to increase engagement and motivation to play; realistic barriers within the games that users can relate to; likeable mentor character or playable protagonist in increase self-efficacy; and the ability to monitor progress and receive immediate performance-related feedback. Another aspect that can be included in a game is making it 'fun', however research is somewhat controversial regarding that.

The key design principle is relevance and ensuring that gameplay, goals and aims of the game are aligned with user's real-life needs. To design the game as realistic and relevant as possible, researchers are encouraged to collaborate with both clinicians, patients and other users of the game.

Chapter 6: Interview Study With Service Users and Mental Health Professionals to Derive Design Implications for SVGs for People With Psychosis

- This chapter contributes:
 - A qualitative interview study with the patients and clinicians to identify whether patients and clinicians would like to use videogame as a self-management tool (in part or entirely);
 - Initial design ideas from clinicians and patients, for instance what attributes of the game they would like to see/not to see in an SVG;
 - Initial ideas on how this SVG can be implemented successfully within existing practice.

6.1 Background and Rationale

One way to increase engagement and promote self-efficacy with self-management interventions is with SVGs (Baranowski et al., 2013; Thompson et al., 2010; Thompson et al., 2012). Currently, there are no SVGs for psychosis self-management and self-efficacy promotion.

The SVGs mentioned in section 5.2 are not intended to promote self-efficacy and focus almost exclusively on psychoeducation (*Bipolife* and *Pogo's Pledge*), while the game *Bias Blaster* is a therapeutic game aimed at improving cognitive deficits associated with psychosis.

Therefore, we would like to address this gap in the literature. A review of the existing literature suggests that to build an effective SVG for the self-management mental health condition, one should follow a series of recommendations and guidelines for the design of mental health technologies (Doherty et al., 2010).

Chapter 5 suggests that one key principle is to design digital interventions in collaboration with clients (patients) and clinicians. Identification of crucial opinions, preconditions, expectations, and the general readiness of all stakeholders is essential for the successful development and implementation of serious games for therapeutic purposes.

This is a qualitative semi-structured interview study with mental health professionals and patients who experience psychosis. The main aim is to derive design implications for a future SVG that will improve disease self-management in people with psychosis.

7.1.1 Objectives

Interview with patients:

- (1) Identify whether patients would like to use videogame as a self-management tool (part of a whole);
- (2) Identify what aspects of self-management patients find the most challenging, or what aspects of self-management would they like to see in a game;
- (3) To learn about the patient's experience with playing computer and videogames.

Interview with mental health professionals:

- (1) To learn how acceptable SVGs are to mental health professionals as a self-management tool for psychosis;
- (2) What attributes of the videogame would mental health professionals like to see/not to see in an SVG;
- (3) To understand mental health professionals' views on how this SVG can be implemented successfully within the existing practice;
- (4) To learn about self-management strategies and struggles that people with psychosis experience, and how they can be addressed in an SVG.

6.2 Method

6.2.1 Study design

This study was a qualitative study using semi-structured interviews (schedule for the interviews can be accessed via Appendix F). This method was proposed because it allowed us to:

- (1) Gather in-depth accounts of initial opinions and motivations behind self-management;
- (2) Investigate whether service users with psychosis and mental health professionals see SVG as an acceptable self-management tool;

(3) Understand how SVG can be used as a self-management tool within existing NHS practice;

(4) Explore gameplay ideas for the SVG.

The aim was to recruit up to 12 service users with a psychotic disorder and up to 12 mental health professionals who work within a mental health setting. Recruitment began in August 2018; there was no follow-up. It was a mixture of community and inpatient participants. Two sites were used to recruit service users: Camden & Islington NHS Foundation Trust (Camden Early Intervention Service) and the Ashness Care Ltd – an independent healthcare provider supported by NHS that is a residential care home for severely mentally ill people. Mental health professionals were given inclusion/exclusion criteria and, therefore, decided what patients should contact the researcher.

Sampling was purposive, because the researcher wanted to ensure the inclusion of a particular segment of the population (participants who had played a videogame(s) for any duration in the last two months, mix of gender, ethnic background, age and game preference). By “any videogame”, the researcher meant any genre of the videogame and method of delivery. This included AAA videogames like *Skyrim*, or more casual games like *Candy Crush*. AAA games are usually produced by mid-sized to major publishers, have greater development and complex storylines and/or character development.

Interview with service users: It was estimated that up to 12 participants would be recruited based on recommendations by Smith and Osborn (2008). The final sample size was determined by a saturation of themes; i.e., if by interviewing ten participants no new themes were identified, recruitment was ceasing.

Interview with mental health professionals: It was estimated that up to 12 mental health professionals would be recruited. The final sample size was determined by the saturation of themes.

Interviews with mental health professionals and patients were recorded and transcribed (four-to-six hours per 30-45-minute interview), coded and categorised using the NVIVO 12 computer programme (NVIVO, 2017). Thematic Analysis was used to analyse interviews (Braun & Clarke, 2006). The MPhil student – Oleksandra Danilina – interviewed participants and transcribed the interviews.

6.2.2 Setting

Service users: Community patients were recruited from Camden & Islington NHS Foundation Trust (Camden Early Intervention Service) and inpatients were recruited from Ashness Care Ltd. The researcher did not approach potential participants directly to take part in the study. The researcher attended team meetings within mental health teams and informed them about the study, and spoke to care coordinators and other members of staff to ask them to approach service users about the study. In addition, with permission of the site manager and the ethics committee, leaflets were distributed around the site, encouraging potential participants to speak to their care coordinator if they were interested to take part in the study.

Mental health professionals were identified from one site – Camden EIS. Mental health professionals were recruited through the attendance of local ward staff meetings and were presented about the research study.

6.2.3 Procedure

Presentations/talks were given to the manager, the team or individual team members about the research project. After the presentation, invitation letters for service users and mental health professionals were given out to team members. Individuals meeting the inclusion/exclusion criteria were approached by keyworkers/care coordinators/clinical staff, and given invitation letters to take part in the study. If potential participants met both inclusion and exclusion criteria, the keyworker then passed on the contact details of the participant to the researcher, or the participant contacted/approached the researcher directly. The researcher then liaised with these potential participants to ensure that they met the outlined inclusion and exclusion criteria by the researcher.

Interviews for both service users and mental health professionals took place within the Camden & Islington NHS Foundation Trust (Camden Early Intervention Service) and the Ashness Care Ltd. Full informed consent was taken. The participant (service user) initially discussed the research with their keyworker/care coordinator. Participants were given a participant information sheet, which was fully explained (and was used to assess their mental capacity), and participants were given the opportunity to ask as many questions as they liked. They were given a detailed description of the research phases and what was required from them (such as time commitments), an outline of what the session would entail, where it was to be held and when. They were informed of the reason why the research was being conducted and what we were hoping to achieve from this project. They were given at least 24

hours to consider whether they wanted to take part in the project, so they did not feel pressured.

Withdrawal procedure: Participants were allowed to withdraw at any point in the study, which was made clear in the participant information sheet and consent form. Personal data was deleted upon research completion and research data was stored in accordance with UCL archiving policy.

6.2.4 Participants

Participants were ten service users and ten mental health professionals. The following inclusion and exclusion criteria were used:

Inclusion criteria

For service users:

- (a) Aged 16 to 65 years old;
- (b) Met criteria for a psychosis-spectrum diagnoses (schizophrenia, schizophreniform disorder, schizoaffective disorder, delusional disorder, psychotic disorder not otherwise specified defined by any criteria, bipolar disorder with psychotic symptoms);
- (c) Had the capacity to give informed consent;
- (d) Were able to complete the study in English;
- (e) had played any videogame(s) for any duration in the last two months.

For mental health professionals:

- (a) Any mental health professional who worked with people with psychosis. Some examples of the recruited professionals include: a clinical psychologist, counselling psychologist, psychological therapist, a practitioner with specialist training in CBT (such as a post-graduate diploma), trainee clinical psychologist, trainee counselling psychologist, or assistant psychologist, specialist nurse, assistant nurse, a volunteer and social worker;
- (b) Had at least six months of clinical experience working with people with psychosis (e.g., nurses, social workers, volunteers).

Exclusion criteria

For service users:

- (a) Non-English speaking (due to translation costs and impact on qualitative analysis);

(b) Had an acquired brain injury or substance misuse judged to be the acute cause of their psychotic experience;

(c) Lacked the capacity to give informed consent;

(d) Have not played any games in the last two months.

For mental health professionals, no exclusion criteria were specified.

6.2.5 Statistical methods

For service users: It was estimated that up to 12 participants would be recruited based on recommendations by Smith and Osborn (2008). The final sample size was determined by the saturation of themes; i.e. if by interviewing ten participants no new themes were identified, recruitment will cease. Smith and Osborn (2008) recommend 12 to 16 participants, as thematic analysis is an idiographic approach concerned with understanding particular phenomena in particular contexts and, therefore, does require large sample.

For mental health professionals: It was estimated that up to ten participants would be recruited. Interviews were recorded and transcribed (four-to-six hours per 30-45-minute interview), coded and categorised using NVIVO 12 computer programme (NVIVO, 2017).

Thematic Analysis (TA) was used to analyse interviews (Braun & Clarke, 2006). A core concept of TA is that the analyst should become immersed in the data. Interviews were listened to and the transcripts read a number of times. Analysis was conducted in three stages:

1. Free line-by-line coding of each interview – codes were extracted if thought to represent service users' recovery/treatment needs;
2. Codes were translated across interviews and related codes were grouped together;
3. 'Analytical' themes were developed and agreed upon in supervision.

6.3 Results

In the end, ten mental health professionals were recruited because researcher reached saturation of themes and ten service users were recruited due to the time constraints.

From interviewing mental health professionals and service users, nine themes were identified.

This section consists of two parts. Part 1 reports self-management strategies that service users find useful to cope with the day-to-day management of psychosis. The self-management strategies presented here comprise of actions, routines, and processes that service users

executed to cope with psychosis. In this part, we also report self-management struggles that people with psychosis experience on a day-to-day basis.

Part 2 will contain seven themes and looks at service users' videogaming habits, reporting what game elements and mechanics service users, and what mental health professionals would and would not like to see in the SVG. We also report attitudes and concerns regarding the use of the SVG as a self-management tool and potential ideas for implementation (this will be discussed in more details in the next chapter).

Part 1 explores the notion of self-management for service users and MHP, including the reported struggles, while Part 2 is about exploring what SVG we should create to resolve some of the struggles discussed in Part 1 and what successful self-management strategies we can include in the gameplay (also from Part 1).

Part 1 – Self-management strategies, routines, and struggles

Theme 1: Self-management strategies

Overall, both MHPs and service users describe similar strategies for psychosis self-management. Some of the successful strategies include: participation in the meaningful activities, following diet, family support, medication adherence, having a positive attitude towards the psychosis, simple routine to follow that ties up well with day-to-day routine, having personalised approach and a recovery plan, psychoeducation (understanding what psychosis is and what is needed to manage it), socialising with other people, having good therapeutic relationship with the care coordinator and playing videogames. In general, MHPs acknowledge the importance of personalisation of the self-management:

... it's [self-management] got to be quite individualised, what works for one person will not work for the next – CL_08

Much emphasis is placed on building a dialogue with the service users, guiding them to recovery, and assisting them with learning new self-management techniques and information. Therefore, building a rapport is seen as more beneficial than telling service users directly what to do.

Service users, mostly, did not know what self-management entailed and when asked about “what do they do to keep themselves well?”, they did not realise that some of the simple activities (e.g., dieting, brushing teeth etc.) are all part of the self-management routine. It is possible that terminology was confusing to service users, therefore researchers had to explain

in more details what self-management is. However, even after the explanation, some participants could not explain what helped them to stay well. After conversing for a bit, some self-management strategies became clearer.

Some of the successful strategies for psychosis self-management shall now be detailed as we explore the point of view of both MHPs and service users. We also look at some of the characteristics of people with psychosis who self-manage successfully.

a) Simple, meaningful activities that are well integrated into the daily life of the service user
MHPs stress the importance of exploring the interests of service users, their daily routine and then try and encourage people to keep carrying out these activities every day. Simplicity and the ease of integration of the routine into the day-to-day life is seen as the essential factors for the adherence to the self-management plan. One MHP notes:

I think, thinking about the sort of clients that are able to use them [self-management strategies] effectively, and that they're meaningful for them, that it has to be something that they can do part of their everyday routine, so I'm thinking about mindfulness or help activities like staying fit and engaging in a healthy diet, those kinds of things. – CL_03

Another MHP states:

It's got to be fairly simple to do... Generally, it's got to be something really small because any change in behaviour is actually a huge amount of effort and trying to maintain that is really difficult for anything, like whether you're trying to go on a diet or lose weight or get up earlier or anything that we know is good for us, so yeah, I think something that's really simple, it fits easily into lifestyle. – CL_05

Another MHP states that self-management activities do not have to follow “classic” ideas of the intervention for psychosis and sometimes it is daily, simple tasks that help:

... it's just really everyday stuff. Got for a walk, get out the flat, walk around the park, ideally around nature, the dog, go and see friends, cook something, put the TV on, those are more practical everyday things people do to self-manage. And I think that really is just a case of getting out of them own head a little bit. – CL_08

The range of simple day-to-day activities is vast and includes dieting, exercising, going for a walk, cooking, embroidering, etc:

To keep well, I try to keep myself active; I go for good walks. Especially when I start feeling kind of down, I'll go out and have a good walk, getting fresh air, get away from my house. To get well, I do comply with my medication and I make sure I do eat healthily now. – SU_03

b) Family support

Family participation in the self-management of psychotic symptoms is seen as another significant factor by both MHPs and service users, and family involvement can be manifested in a variety of ways. For instance, one service user notes that his/her family is very helpful when it comes to seeing any changes in his/her behaviour, which might indicate the start of the relapse.

They're the ones who normally are able to figure out the symptoms, because personally for me, when I am in that negative headspace, I become really paranoid, and what is happening to me, I perceive it to be real, and it's a bit hard to distinguish between whether or not it's really. – SU_02

The same benefit of family observation is mentioned by other MHPs, for example:

Family and friends supporting their work are really, really helpful. They can help self-management because they can be an extra source of ... They're kind of an extra pair of eyes and sometimes they notice that things that are going wrong before the person themselves does. – CL_07

Family can also act as a good source of encouragement to support people with psychosis to self-manage. Two ways in which family can support service users is emotional/psychological and/or economical:

They [family] always try to encourage me to socialise more, and get out of the house, that way if you're with other people your focus is on something else, and you're not thinking about the voices. – SU_02

Well, [family] mostly [supports me] economically. But they also say that if I needed to talk, they are there for. – SU_04

Just my cousin really, yeah, he helps me out – makes sure I'm following my routine. Makes sure I don't just lay around - I'm gonna do what I'm gonna do. Even if it's just getting up and getting dressed properly and playing games all day, or whatever. – SU_06

However, certain family dynamics can also be seen as a barrier to self-management (see [Self-management struggles in people with psychosis](#)).

In addition, some MHPs note that also family can be good at observing changes in the mood and behaviour, however, sometimes they can be seen as overly controlling:

I think sometimes it's really appropriate that it's someone in the family or friend, sometimes it can damage relationships because it can end up being a flashpoint of like, "Oh, you're nagging me or criticising me." It depends on the relationship, so sometimes it's better to have a professional [to do it]... – CL_05

c) Insight into the condition and the general attitude towards psychosis

This point was mainly brought up by the MHPs, they see general self-awareness and self-knowledge as an important step to the successful self-management.

I think self-knowledge is a kind of vital step. People need to have a good understanding of themselves, an understanding of what works and what doesn't. – CL_07

It's a very individual thing, I think. It depends on what insight they have. – CL_02

Some service users, however, also acknowledge the fact that they try to adapt their lifestyle to how they feel at the moment. Therefore, this was interpreted as having insight on their behalf; e.g., understanding that they do not feel well and, therefore, require (a), (b) or (c) to be done. It did seem that self-awareness of the condition came from experience, since most people who reported noticing symptoms and taking measures not to exacerbate symptoms, were older part of the caseload. For example, one service user says:

Since I became stable, I haven't been in a state so bad that I would require to call somebody, or ... I've been close, but I was able to control myself from experiencing voices...I think it comes from practice and time really. – SU_04

Another one notes:

I just notice it, how I feel a bit today. Just trying to get better, so I just try and push. – SU_06

MHPs report that having an insight into condition ties closely with the general attitude towards having psychosis. Being positive, and being proactive and ready to act is seen as a positive factor for the successful self-management while having a passive, somewhat fatalistic attitude, is perceived as an impediment:

I also think that active part of their attitude to mental health is important because you find that some people have a very kind of fatalistic attitude sometimes where, and this may be cultural as well, where they feel that this is just something that sort of happens to them periodically. It's out of their control. I think that this is also going back to the self-knowledge thing. And if you feel that way, if your experience is that this is a thing that just happens to you, then your role in it is going to be very passive. – CL_07

d) Psychoeducation

Psychoeducation is seen as a way to boost the empowerment in people with psychosis. MHPs perceive psychoeducation as a significant step in beginning successful self-management of the symptoms. The understanding of psychoeducation varies from knowing basic terminology used for psychosis-related topics to understanding what triggers relapse and how to manage it. Some MHPs mention that they provide extensive information on substance abuse and its link to mental health.

Some examples of psychoeducation include working directly with the MHP:

They [service users] have psychoeducation from here [EIS]. For example, we might be thinking of people's day-to-day routine... I just saw one of my clients, and we're talking about how they have more chances of becoming well, basically by sleeping better, eating properly, not using drugs. If you use drugs, do you use them mixed and how to risk minimisation. – CL_01

Or sometimes using unconventional methods like visual displays:

Visual displays were always the easiest way to manage it [psychosis in service users] I guess. And that's everything from personal care, to all the other bits. Each

has a huge whiteboard in their room where they could write on as much as they want. I always felt that was the easiest way to manage and educate. – CL_04

One MHP says that psychoeducation takes time and the thing people struggle with the most is terminology:

Terminology, with a patient straight away. It's much slower, introducing things slowly in everyday language, basically. And not trying to cram everything into the first...you can feel like, I need to cover everything in the first few meetings, whereas most people are going to work with us a little while. – CL_08

Service users also express a desire to know more about their condition and possible ways to self-manage it. However, some are not happy with using available resources especially internet because they find it overwhelming.

e) Socialising with others

Socialising is seen as another good way to self-manage by both MHPs and service users. In the interview, both sets of participants mainly talk about interacting with friends and other people with psychosis. Recent research reports that feelings of loneliness are strongly associated with an increase in certain psychotic symptoms, such as paranoid ideas and persecutory beliefs (Eglit et al, 2018; Lamster et al, 2017). One MHP states:

I think it [socialising] is good for some people. I know some people find it a good distraction, especially if they have a lot of thoughts, paranoid thoughts or as a distraction from hearing voices. Some people do use ... I think with the isolation that can exacerbate things. If there are other people, that can help.” – CL_02

Other MHP points out that socialising is the way to encourage service users to self-manage:

I also think it helps to have social interaction around it [self-management], so social support, someone who is prompting you with your permission and the way that you can kind of step up, so it's not a nag, or it's experienced a criticism, but someone who's a bit of a cheerleader to keep you going... To recognise your achievements with it, and also to help you ... to pick you back up when things tail off, when they try to self-manage you don't do it consistently and when you have not... – CL_05

MHPs note that socialising can be done in a number of ways (not only within the family). For instance, at EIS where the interviews were conducted, there are a number of interest groups

that are facilitated by care coordinators and are open to any service user. One MHP comments on groups:

They [groups] are quite popular. Yeah, there's a board games group and a cinema group which are both quite popular.... And so those provide opportunities for socialisation which I think is helpful for self-management. And also courses and things offered by entities like The Recovery College, and Minds and Camden, and some of our community. Some are kind of directly about self-management, and others I think can help self-management through providing kind of again, kind of rewarding and meaningful activities. – CL_07

Same MHPs note that young people can benefit the most from attending these groups and forming friendships with other service users:

We know of a few, especially younger people who come here who might meet each other through groups, or on the wards and then become friends. Sometimes you know we've seen these real kind of helpful supportive friendships bloom. – CL_07

In general, the attitude towards social interventions and socialising was very positive and seen as highly therapeutic:

I think any social intervention is a great intervention. That can be more powerful than talking in sessions when people actually just go out there and try something new, and learn from that experience. So, I'm a huge advocate for referring and for my clients to engage in those types of groups. – CL_09

The things I like when I cook it makes me happy when I eat it. I couldn't do that in the hospital. That makes me happy. I like playing dominoes with my friends. That makes me happy. – SU_07

The young people we have interviewed were the least likely to attend groups within EIS. We were given different reasons, including a lack of time, difficulty to get to the EIS, a lack of peers who attend the groups and boredom. However young people did express a strong desire to know other people with psychosis. In fact, the desire to know more people with the same condition is expressed by nearly every single service user participant. Young people want to meet other young people with psychosis:

Researcher: *Why would you want to know more other people with psychosis?*

SU_01: *Because I want to see how they're coping and what they've done to support themselves, particularly about this condition. What they do to treat it.*

Researcher: *Would you mind what sort of age there are?*

SU_01: *Yeah around my age.* – SU_01

Another service user says:

I guess it [knowing other people with psychosis] provides you with guidance, like you get to understand how other people manage it, and how they deal with the stress, and coping, and how it has impacted their lives. – SU_02

One service user said that by knowing other people with psychosis it feels like you are not alone:

If you don't know anybody then you think you're the only one who has it, and it makes you feel a bit odd than anybody else. So, it would be nice to speak to other people. Definitely. – SU_03

However, some service users say they would like to know more people with the same condition but would need to get to know them first before getting personal:

It's very difficult to know which moment, which state they are. So, it's hard for me to know how to approach them... So, I would require knowing a lot more about them, before I interacted with them about psychosis. – SU_04

f) The good therapeutic relationship with the care coordinator

Therapeutic alliance is long identified as a strong predictor of therapeutic outcomes, including the likelihood of whether people with psychosis will self-manage (Shattock et al, 2018). One MHP says:

I think what works really well, in terms of... it depends on the therapeutic relationship. When you have a good therapeutic relationship with people, and they value what you are talking about, and just grow things together, that make people feel better. – CL_01

Most of the MHPs see themselves as a guiding figure but not authoritative, trying to collaborate with the service user rather than tell them what to do. Other MHPs see their role as listeners, and someone who tries to motivate and encourage service user to stick to the routine:

I guess I don't particularly as a psychologist I don't see myself as an expert and the other person as coming for my expertise, but more of a joining of expertise that they really have

their expertise as well, so we try to bring it out together. Really hearing their experience and using that with maybe an idea or a course or a theory that I know, like testing out whether that fits for that person rather than saying, "This is what you should do". – CL_05

I kind of try to make sure that they feel like they are being listened to so that they kind of open up to the conversation and you make sure they feel, [like I am] providing space for them to express any concerns or difficulty that they're going through. – CL_06

Some service users also talk about the importance of good therapeutic relationship, saying that their care coordinators “help them out”:

I speak to my care coordinator, he just gives me good advice, or speak to anyone like a psychologist. Anyone with good advice, that's what helps. – SU_05

g) Videogames

Some MHPs and service users note that they see videogames as a potential coping mechanism with some symptoms of psychosis. Mostly, young people seem to use videogames as a way to relax, relieve stress and socialise with others.

Researcher: What sort of thing would get you really focused and relaxed?

SU_02: Reading, playing games, talking to people, like really focused on what the person is saying. – SU_02

So, a lot of youngsters are very anxious and socially struggling so the game is the focus of the conversation. They don't have to reveal anything about themselves or their identities. The game is the focus when you're good at the game. Really bad players of the game, they're really lovely with as well, so it brings them into the group a bit more. It's really fun. – CL_04 (talking about playing Mario Kart [racing game] at CAMHS with young people with psychosis)

For example, one service user actively plays local co-op *FIFA* (football game) with some of his friends and said he finds it a great way to socialise with his friends. Older service users perceive benefits of the videogame as cognitive training and something fun to do to pass time.

h) Medication adherence

Medication adherence is seen as another major contributing factor to successful self-management by both MHPs and service users. However, MHPs acknowledge that

medication adherence largely depends on the insight and general attitude towards psychosis and medication:

It's a very individual thing, I think. It depends on what insight they have. I mean, I've had some patients whose medication alone has made such a huge difference ... I think that mostly those with insight is usually quite good. They're usually quite open about any changes they want to be made and whether things are working or not. – CL_02

Well I was very unwell, but they put me on medication, and it changed me unbelievably. It took time, but it's changed me and now I'm meant to be very well. – SU_07

In addition, the majority of the MHPs seem to agree that medication is a good way to manage positive symptoms of psychosis and in general it is a good baseline for self-management but other strategies are needed to cope with negative and cognitive symptoms.

People can come in with positive symptoms of hearing voices, seeing things, medication can kind of contribute significantly in managing that kind of symptoms. But eventually it comes to the point that they want to kind of find out other strategies. – CL_06

Service users that we interviewed, all take medication and seem not to have a problem with medication adherence however some of them are wary of side-effects:

Good, I guess [talking about medication experience]. Overall, good, but I've been looking into the different symptoms that they have, and they scare me a bit, like the increase in weight. I mean, you go to forums, and you look at people talking about. – SU_02

Theme 2: Self-management struggles in people with psychosis

People with psychosis experience various struggles when it comes to self-management, and we were interested to learn what these struggles are, and whether we can try and address some of them in the SVG. Accounts of both MHPs and service users are provided below. The self-management struggles include stigma, desire to carry out life unrelated to psychosis, motivational issues, lack of insight, isolation, family unwillingness to cooperate, cognitive symptoms, stress and medication adherence.

a) Stress

Everyday stress is identified as a common factor that people with psychosis struggle with on a day-to-day basis. It is consistent with the existing literature which states that people with psychosis are more vulnerable to the effect of stress-related events (Tessner, Mittal, & Walker, 2009):

Everyday life stresses because if you're more vulnerable ... For one person it might be it has to be a really significant, traumatic event, but for others it might just be a really stressful time at work. I think stress is a massive one. – CL_03

For some service users, stress is one of the biggest triggers for their positive and negative symptoms:

What tends to trigger it is if I am unhappy or stressed. If I'm feeling really unwell, I'll be stressed a lot, and that can really trigger it. – SU_01

Usually, either I read something on the internet, it's stuff with being stressed. If I'm stressed, then paranoia happens. And when paranoia happens, I make connections with things that shouldn't have any connection. – SU_04

b) Stigma

Stigma has been identified as one of the impediments to self-management mainly by MHPs; this is especially an issue for young people who do not want to be associated with mental health conditions.

Sometimes they will engage very well with the service, but other people will struggle a lot, especially younger people, will struggle a lot to engage with the service because they start receiving the label. – CL_01

Some MHPs see stigma as the main factor to why young people do not want to attend EIS groups:

Alongside that they want to be like their friends. They don't want to have to be taking medication, they don't want to have to keep coming to a mental health team, certainly it's not ... We're talking more about mental health and psychosis particularly, but it's still, the stigma is still definitely there. If it isn't overtly, a lot of people hold it for themselves, that they feel stigmatised themselves, that they're under a mental health team, or it's a failure. Yeah, there's lots of stigma around it. – CL_03

Stigma is also related to “the desire to carry out normal life”, which was another subtheme that we have merged together with stigma:

I suppose the more legitimate reason is to my mind, that they, again, they want to go and do normal things. They don't want to be in a group with other people with a disability or a condition. They want to go and ... In their mind, that's not normal. And they want to go and do something normal. – CL_08

Some service users, especially the younger ones, say that they prefer to socialise with their friends. One service user commented that he had a bad experience talking to other people with mental health problems. Therefore, he prefers not to get involved now:

And it's like, you know there's like so many people with other problems that it can make you not safe, but it's okay. There are not many other people there, there are mainly old people, but yeah. – SU_05

c) Motivation and engagement

Motivation to engage in a self-management routine is the struggle that was mentioned and talked about the most by MHPs; some service users see it as an impediment too. However, there are service users who said that they do not have any problem with motivation.

One MHP talks about motivation when asked what is the biggest struggle that people with psychosis face in terms of self-management:

Motivation, I think. Generically, whether you have psychosis or not. Yeah, either it's the motivation to start something or the motivation to keep it going and they obviously have to find something that fits in with daily life. Some people struggle with the fact that a technique may not always work every single time, and so then it becomes not very rewarding to do it. – CL_05

Some MHPs think that people struggle with motivation as a side effect of cognitive and negative symptoms of psychosis:

I think, a lot of things that I came across mainly has to do with the motivation. So, people might have an idea of what they want to do. But I think, in terms of cognitive function, that you might have been kind of affected because of the crisis that they have gone through, or it could be just a residual symptom from crisis that people just might end up generally lacking in motivation and kind of needing to have that

kind of encouragement to do something. So that's the kind of major challenge that I came across, and many times. – CL_06

So, for example, with clients with negative symptoms, there's a lot of appraisals around there's no point in trying. If I try, it will never work out. What's the point? I'll only fail. It keeps them in a pattern of stuckness and can come across as low motivation to clinicians when actually, there's a big cognitive block there operating for them. – CL_09

Most of the service users report motivational issues too but are struggling to expand on the reasons behind it.

When MHPs are asked how they tackle motivation issues, several tactics are identified: 1) Encourage service users to try new things, 2) Have a good therapeutic relationship with the service user 3) Integrate self-management as part of a daily routine. One MHP also thinks that people who are likely to “self-reflect” are better at gathering motivation and stay more engaged.

MHPs think that motivation is one factor that is the most difficult to tackle:

Hmm. How do you try and give people motivation? It's about reflection. It's about saying, "Well, look when you do these things, how do you feel afterward?" It can be about keeping a mood diary, something like that. Look at what have you have done that day, how was your mood at the end of the day? And it's just about getting them to reflect reality, yes, when I do these things, when I do engage, when I do these techniques, when I do use these management skills, I do actually feel better. – CL_08

d) Insight and attitude

Having good insight and a positive attitude has been identified as a positive factor for self-management. However, vice versa, having poor insight and passive attitudes can have a negative impact on self-management.

Research suggests that having poor insight can lead to exacerbation of positive symptoms, namely paranoid delusions (Giotakos, 2017). One MHP notes that:

A lot of my caseload have very little insight, so a lot of it is just managing their own emotions and feeling invalidated. They may feel persecuted by their neighbours, for example, and they get very frustrated and think people don't believe them. And they

really struggle to manage themselves emotionally. I think a lot the distress that they feel, that they're quite isolated in their opinions. – CL_01

Some MHPs believe that having a passive attitude is also an impediment to self-management:

And if you feel that way, if your experience is that this is a thing that just happens to you, then your role in it is going to be very passive. – CL_07

One MHP believe that it is not necessarily a passive attitude or poor insight, but rather readiness to change:

It could be a matter of readiness for change. Maybe they haven't reached the stage that they want to talk about something or work on something because it's hard work. – CL_09

Another MHP believes poor attitude and a lack of insight stems from not knowing what psychosis is:

First of all, not knowing what they are facing. If it's the first episode of psychosis people are not used to hearing voices, they will struggle for people to believe that the paranoid thoughts are paranoid thoughts are not real. They will struggle to come to terms with what is happening to them, I think that is the first thing that you notice in people. – CL_01

e) Family

Similar to insight, family support has been identified as one positive factor for self-management. However, a relative's unwillingness to participate in the self-management or refusing to accept the condition can have a negative impact on the self-management and overall wellbeing of the service user. One of the MHPs says:

I mean a family can be a blessing and a curse. Depending on the family and depending on the family's own attitude too there sometimes. We'd like to think that families would be a great source of support and in many, many cases they are. But also, in a not trivial number of cases families can really be a source of stress. – CL_06

Families can be seen as a source of distress if there is no acceptance of the diagnosis, poor understanding of the condition or unhelpful attitude towards self-management (e.g., arguing):

I've encountered families who have this persistent belief that the person's actually just kind of faking because they don't want to work. – CL_07

Not really. I mean, overall the only way it impacts my relationship with my family is that it makes them feel very worried, and scared, because they feel as if ... they have a constant fear that it might happen again, so they are always on the watch, watching to see if anything is happening. – SU_02

Yeah. They [family] don't always understand everything about it [psychosis], which you can't expect them to, but they do. They know. – SU_03

f) Medication adherence

Medication adherence is seen as a struggle by MHPs but not by service users. When service users were asked whether they have any problem with medication adherence, all of them say that they take it even though they do not like the side-effects – they understand it is necessary:

Good, I guess [medication adherence]. Overall, good, but I've been looking into the different symptoms that they have, and they scare me a bit, like the increase in weight. I mean, you go to forums, and you look at people talking about [side-effects], they might not be true, but I've also looked at scientific stuff about the whole psychosis stuff, and they might have a negative impact on my memory, and stuff, and I'm like, "Yeah." I'm really worried about it, personally. – SU_02

MHPs attribute poor medication adherence to poor insight:

So, in his head, going forward, he's well enough not to be on it. He doesn't know it's the pattern that's happened the last two years in similar times, similar stressors and there's a possibility of it happening next year. So, he doesn't want to take the medication. – CL_04

In addition, MHPs state they do not understand that medication is part of the self-management routine and the reason why they [service users] need to struggle with side-effects:

I guess... the side-effects of medication, and taking medication when you're feeling well, and that kind of thing. Usually people struggle with that. – CL_10

It is worth noting that medication adherence was the only subtheme on which service users and MHPs disagreed.

Part 2 – An opinion of the use of SVG, initial gameplay ideas, game elements and implementation suggestions.

This part explores what SVG we should create to resolve some of the struggles discussed in Part 1, and what successful self-management strategies we can include in the gameplay (also from Part 1). In addition, we look at the videogaming habits of service users and explore ideas for implementation to deliver the most feasible scenario of SVG uptake.

This part contains seven themes:

- (1) Implementation – where MHPs talk about how the game can be implemented within mental health services, including the age, gender, diagnosis of the players, length of the gameplay, place of delivery (e.g. home/hospital/elsewhere) and mode of delivery (mobile, PC, console);
- (2) Game preferences – games that those with psychosis play and what they like about them;
- (3) Attitude towards the use of SVG as a self-management tool, we look at the attitude of both MHPs and service users;
- (4) The idea of the multiplayer game – what do MHPs and service users think about service users potentially playing with members of their family/friends, MHPs or other people with psychosis;
- (5) The idea of messaging/chatting within the game – what do MHPs and service users think about in-game chatting, in which different ideas are explored like free messaging and pre-generated messaging;
- (6) Gameplay ideas and game elements that MHPs and service users do not want to see in the game;
- (7) Gameplay ideas and game elements suggested by MHPs and service users.

Theme 1: Implementation (age, gender, diagnosis, mode of delivery, how often a game is played and length of gameplay)

We asked MHPs to talk about a potential service user to whom they would recommend our SVG; we were interested in age, gender and diagnosis. Previous research indicates that the average age of the game player is 35 years (Entertainment Software Association, 2017).

Other limited research into acceptance and feasibility of SVG for mental health reports that

MHPs would be cautious prescribing a game to people with psychosis (namely schizophrenia) and would recommend such games to adolescents or young adults (16-20 years old) (Eichenberg et al., 2016). Therefore, we were interested to see what MHPs think and explore the rationale behind these decisions.

We found that MHPs are more likely to recommend SVG to the younger population (16-20 years old); some say they would recommend this game to people under 30. The gender of the player does not seem to matter; however, two MHPs felt that young males might be more interested in playing a videogame. When we asked why MHPs would recommend an SVG to the younger population, the general consensus was that their (MHPs') thinking is based on stereotypes of videogaming:

I mean, I'll be going off stereotypes a little bit. I imagine it would be younger, under 30, male. Diagnosis? I mean, I'm not sure. – CL_02

I guess probably 15- to 19-year-olds, that kind of age group, I would imagine. That is difficult for them to ... Even more, I've worked in CAMHS, it's even more difficult to encourage people to go to counselling, to be open, to perhaps talk about how they're feeling, their difficulties. In one sense, this is a good way of engaging and starting that conversation. – CL_03

I feel I'm influenced by who's being interviewed, and I think it would be teenagers. Or a CAMHS type population. – CL_09

However, it is worth noting that two MHPs – who are gamers themselves – are more aware of the demographics of videogame players and say that gender or age would not matter for them, and they would prescribe a game to anyone who is interested in videogames.

I – this sounds really weird – I think that a clinician's enthusiasm for a game like this would push it towards a younger audience. And I think that because of the stereotype of videogames, that would be where it's pushed towards and a general clinician kind of audience. Yeah, I don't think, because I don't think age, or gender would come into play. – CL_04

There's a stereotype of videogame players, mostly young and male. I don't think that's really borne out by statistics. Maybe the youth part, but actually I think in reality, the gender, there's actually much closer to gender parity, people who play videogames. – CL_07

In terms of diagnosis and general condition of the service user, MHPs do not have any specific diagnosis where they would not recommend a game.

I wouldn't be worried about offering that to that population of people. – CL_01

Some MHPs state that the only factor they would consider is the level of insight a service user has and their interest in videogames:

Yeah, I imagine with those that like gaming that had some insight, and they're interested and keen to learn, then it's something worth trying, maybe. – CL_02

The only condition for which MHPs would be cautious to recommend the game is if service users have paranoid ideations and if their delusions are related to the technology, in particular their phone.

I've got one patient in particular; he's got no insight. He's constantly feeling - well I've got two actually - constantly feeling like their being hacked all the time. Messages are being changed on them phone and things like that. I think they might be a little bit more sensitive to having something on them phone. If it was a matter of them coming in and using a computer, I think they might be a bit more open to that. – CL_02

Yeah because I think no insight will be very hard to, like people struggling to kind of do day-to-day things I think, let alone playing a game is going to be also very challenging. – CL_10

Overall, previous interest in videogames in service users is the biggest factor in deciding whether or not to suggest a game.

People who already play videogames would be immediate ... There's less of a hurdle to get those people over. I think it would probably skew younger, your kind of target groups. But other than that, I think it could be a pretty diverse group actually, you could potentially reach with it. – CL_07

It would be somebody definitely who has played a videogame before, and who's definitely got an interest in playing games. – CL_06

When we asked MHPs how often they imagine service users should use the game, there was no consensus, mainly because MHPs wanted to see the game first. However, some MHPs say that they would recommend playing a couple of times a week, either in between sessions or

just as a part of self-management routine. Service users also state that they would need to see the game first to decide how much they would spend on it, but who are potentially open to playing it every day or every other day.

In addition, we asked MHPs how they imagine a game should be used: as part of the session, possibly part of the group activity that takes place within EIS, or as something service users should be able to take back home. Most MHPs imagine service users playing it at home:

... it would feel a bit mean to say we can only play it here. I've got this great game, but we can only play it in the office. That would feel a bit mean. No, it would be nice if there was a kind of freedom to it, that they could play it here, but they can go ... they can play it here with a clinician maybe and then they can go on their own time and continue that gameplay. – CL_08

Some MHPs think that this game can act a good “introduction” to EIS and as a psychoeducation package that service users can use at home and then ask questions during sessions with care coordinators.

I think also for early intervention as well; another key point is that this is the first time that they've come onto services, the first time they've become on works, the first time they would ever have to manage their own mental health sort of, so they're bound to need more. If it [game] helps, then give it a go. – CL_03

One MHP says that they would like to play this game during sessions but think that service user would get the most out of the game if they were playing on their own.

Part of the point of self-management is that it is “self-management”, and I think although there would be an impulse [to get involved] ... If you're a professional who's maybe playing this game with someone, a service user, there's an impulse to try and make it therapeutic in the right way and make sure, they get the right lessons from it. When someone is self-managing, they might make decisions about... They might have views about their own health and what's right for them that I don't agree with. – CL_07

In addition, some MHPs are further interested in using the game as part of the session, but only if it was short:

I would definitely be interested, and I think if it was like a short, complex, maybe like 10 minutes kind of stage, then that because practically, might not be able to dedicate our own time to do that with them. If it was like a quite short, focused conquest. – CL_06

In terms of mode of delivery, both MHPs and service users agree that the smartphone is the best platform due to its accessibility and availability.

I think, if this was sort of able to be on a smartphone or iPad arrangement, I could imagine many people downloading this and using it. – CL_09

Yeah, I think that the capacity of phones now they can support videogames from an era of PlayStation one and stuff like that. So, I don't think you would lose anything from being on a phone. But I think you would allow it to hit a wider audience I guess, and I guess it could become a bit more interesting in terms of features they could go to. – CL_04

Definitely, yeah. Although I do think a mobile phone is handy. You can just bring it out anywhere when you're feeling down and use it. It's more portable. – SU_03

Mobile should be better because, I think not everyone plays console. – SU_05

Some service users said a PC or console is their preferred mode of delivery, but that they would use a game on the smartphone too.

It depends. It's easier if it's a controller, a big controller, than just typing on your phone. – SU_01

Laptop, because it is easier. – SU_02

One MHP brought to our attention that neither a smartphone nor laptop are good options for their caseload due to financial constraints.

There's a major material barrier, which is who has access to, and uses a device that can play a videogame, right? A significant number of our clients have phones like this, and don't have computers. I think several of my clients who just don't own anything that could play a videogame like this. – CL_07

Themes 2: Service users' game preferences (commercial games)

Research is limited on game preferences and habits for people with psychosis. To our knowledge, there is only one survey study (Abdel-Baki et al., 2017) that looked at whether people with psychosis play games. However, there is no research on what game genre people with psychosis prefer, nor what they like about the games they play.

The young people with psychosis that we have interviewed said that they prefer AAA games like *FIFA*, *Skyrim*, *Call of Duty* and *GTA*, and play mainly on consoles, while older people with psychosis give preference to casual games like *Candy Crash* and played mainly on their phone. The three genres that stand out were a strategy, simulation and RPG.

When we asked what service users like about the games they play, there gave many responses - namely the feeling of being rewarded within the game, being good at something, using skills to win the game, using different tactics to adapt to the game situation, feeling like they are engaging their brain when doing concentration-demanding tasks and general sense of fun.

I like that you have to use a lot of tactics and strategy to win. So, in Call of Duty if you're not really cunning, you could die easily, and it wouldn't help the team if you kept dying, not beating the objective ... Generally, just like exploring. In an adventure game there's lots of monsters to beat. It's quite good how you play it. – SU_01

I guess it's just a virtual life. I've always been interested in virtual life gaming. When I was a kid, I Used to play Fable something, a game where you get to choose different class, and you just kill monsters, and stuff. I liked it because I was actually good at it, and it's really entertaining. – SU_02

I guess it's just like, for me, visually, to physically control it. And the TV screen, it's fun, there's... I find it rewarding, makes you calmer. If you play the game, the better you get, it's like repetition to be honest.... And also, when you play videogames, you get, I don't play them by myself, I play with friends. It's like nice to speak to them all day. So yeah. – SU_05

We also asked service users' general opinion on the use of commercial videogames. From the positive, service users see videogames as a way of entertaining themselves, socialising and distracting themselves from everyday stress including psychotic symptoms.

You get entertainment from it, because you enjoy winning. If you get a good kill streak on Call of Duty you'd be like, "Oh yeah I've done so well to get here," and you have more fun killing. Or winning ... your level gets upgraded. Weapons and everything else. You get a reward from it. – SU_01

They're good. They provide a distraction; they immerse you in a different world. Sometimes people use games to express different points of view, which you normally wouldn't experience. Yeah. They're good. – SU_02

There are not many negatives on the use of commercial videogames. Some service users point out that games can be seen as a procrastination tool, but it is not necessarily a bad

thing if you get other things done. Nevertheless, two service users highlight the fact that playing games all the time is not good for an individual, and some pointed out the excess violence within certain videogames.

Depends on how much time is spent on it. Some people I know from China ... spend like hours – their whole lives – on videogames, and there are like internet cafes of videogames. – SU_04

Theme 3: Attitude towards the use of SVG (Clinicians and SU, positive and negative)

Not much is known about the attitude towards the use of the SVG as a self-management tool for people with psychosis. Overall, the attitude is very positive from both MHPs and service users.

From an MHPs point of view, they see SVG as a safe environment to learn and practice new skills in an engaging way – especially for young people. If it is going to be a multiplayer game (see Theme 4), there is a scope for helping people to learn how to socialise. Most MHPs perceive SVG as a motivating experience and a good tool to deliver certain aspects of self-management, like psychoeducation, and that it potentially can be used to increase cognitive abilities through minigames or puzzles.

I think it could be a good idea. We talked about apps, there's loads of apps that you can use. This is just another form of using a different kind of tool to learn or develop skills. I don't think it can be a bad idea if it's not offensive or negative or detrimental to the health. – CL_03

I guess I like the fact they're [SVGs] quite engaging, there's elements of fun, it's quite motivating in that sense of reinforcing. – CL_05

One MHP said that they see SVG only as an adjacent tool to the existing line of treatment:

It could be an adjacent tool, it could be an introductory tool, it could be for say teenagers, who say, adamantly don't want to be anywhere near mental health services. They've got at least something they can do. It's an equivalent, I would say, to a self-help book, in a creative way. – CL_09

Service users see SVG among the same lines as MHPs and think about it as an interactive environment to learn more about their condition.

You might want to think of ... everything thinks a bit differently so you might be able to offer a [solution] you didn't think about before. – SU_06

I think that would be a good idea. Because they can treat themselves on how to be better from their cure. If they have struggles with psychosis it would better to play a game that would show them they're not ... the condition isn't that bad. They can like to improve from it. – SU_01

No one from MHPs directly opposed the use of SVG for people with psychosis, one clinician was initially concerned about withdrawing people even more from interacting with others and potentially the game feeding into some of their delusions. However, the latter concern was mainly raised when MHP was talking about people who already have a history of technology-oriented delusions (it is important to note that it is a fairly common type of delusions among people with psychosis):

My other side for me feels that perhaps it's just kind of feeding into the fact that they are quite isolated, quite insular, and I'm not sure how that ... If that's necessarily a good thing that you're teaching them skills without having to have any interaction with people Maybe it might trigger, can't some kind of delusions or ... Because it's another world, it's a kind of virtual reality, you're taking on someone else, you're not yourself. – CL_03

Other MHP thinks that SVG might encourage further videogaming addiction:

The only disadvantage I can ... I probably have a couple of clients that I think probably, probably play videogames too much. I got one guy in particular who's ... I know it's just ... he's not very able to leave his flat the minute, he's very paranoid and I know he spends pretty much half of his week playing FIFA. So, if someone finds something useful as a tool, brilliant. If they're spending them entire life living sort of digitally ...then I think that tiptoes into not actually being helpful. – CL_08

One MHP does not have a negative attitude towards the SVG per se, but was concerned with certain game elements like chatting and in-game messaging which will be discussed further.

Theme 4: Multiplayer (family, clinicians, other people with psychosis)

Multiplayer mode has not been explored as an option for SVG, so we want to understand what MHPs and service users think about it, and with whom would service users like to play

– other people with psychosis, MHPs, their family and friends? The aspect of chatting and messaging is explored separately in Theme 5.

MHPs and service users are positive about service users playing with other people with psychosis. Both see this as an opportunity for service users to exchange tips on self-management and general experience of the psychosis.

I'd like to do that, yeah. We're all in the same boat, and no one is going to treat you different because we all have it. – SU_01

Just get some good tips on how to improve the psychosis, I mean maybe, suggest where to put stuff in it. – SU_05

Multiplayer's good. I think multiplayer's are particularly good actually when you're trying to reach people with psychosis, because psychosis is very isolating... I think a lot of people with psychosis struggle with the people around them don't get it. So potentially multiplayer could bring in making connections with other people who have some similar experiences. I think that could potentially be really good. – CL_07

MHPs see multiplayer games with other people with psychosis as a way to tackle the isolation people with psychosis might experience, and to also learn transferable skills.

There are no negative attitudes towards multiplayer games with other people with psychosis, but there are significant concerns over open chatting (Theme 5).

Another aspect of multiplayer gaming that we want to explore is playing with the clinician. The inspiration of playing with MHP came from the game *Playmancer* (Fernández-Aranda et al., 2012), where MHP complete the gameplay together with the players, sitting side-by-side and providing gameplay tips.

Service users are positive about the idea, while attitude among MHPs is ambivalent. Some express strong interest:

Yeah, that's kind of when you said about coming with it be here, that I actually imagined doing it with somebody, it could be a good tool to kind of do something together and then use that. So the game is the focus, but then you could explore some of the ideas that might come up, or what strategies that might come up from the game together in person. – CL_10

While others think that playing with service users will remove the autonomy:

Part of the point of self-management is that it's self-management, and I think also there would be an impulse ... If you're a professional who's maybe playing this game with someone, a service user, there's an impulse to try and make it therapeutic in the right way and make sure they get the right lessons from it. When someone is self-managing, they might make decisions about ... They might have views about their own health and what's right for them that I don't agree with, and that should be okay
– CL_07

One MHP is strongly against the idea due to the potential addition to the workload for MHPs and services:

I don't think we have time for things like this in sessions. In sessions, we are trying to think about relapse prevention, we are trying to think about many different things, this could be an adjunct. Like, you can check out this game and tell me what you think, do it as your first between session task. But in terms of really spending hours going through this and playing games, I'm speaking for myself, I do not have time for things like this. I've got too much on my head. – CL_09

Playing with friends and family is met enthusiastically by service users, most see it as an opportunity to bond with their family and increase the family's knowledge about the condition (understand the condition better):

Yes! It'd help them to understand my diagnosis or why I go through, or why I ask them certain questions; for them to notice, just ... there's a lot of information in there, gives them a lot of information. – SU_03

MHPs are less open to the idea of playing with the family, mainly because not all service users have a good relationship with the family members and, therefore, this option will be somewhat limiting.

Theme 5: Chatting within the game

Communication within the game can enhance the player experience, add richness to the social interaction and elevate enjoyment from the game (Chen et al., 2006; Cole & Griffiths, 2007). This communication can take many forms; for example, live chatting, forums, in-game messages or talking through the microphone. As with the multiplayer idea, chatting has not been explored as a potential add-on to the SVG.

Service users are mainly positive about chatting, because they see it as an opportunity to exchange knowledge and get to know other people. However, there are a couple of service users with experience of playing ‘massively multiplayer online games’ (otherwise known as MMOs) who say that they like the idea but there would like to see some degree of censorship.

Yeah as long as it's, genuine people and they've got genuine problems not random people talking crap. – SU_06

[On the forum], it was just I and another patient, and that other patient was constantly talking about suicide in the videogame group. I'm not sure how to react to that. So, there would be people talking about that. I would offer comfort, but only if it's real. I think there should be a special chat for that. Yeah, you could divide the chat, for the game and for those who need help, just need to say something. – SU_04

One service user suggests using a separate forum instead of in-game chatting, where people can express their concerns and exchange tips.

Some of the existing commercial games use pre-generated messages (like in *Animal Jam*), so suggested that as an alternative. Some MHPs think it is a good idea, however most service users do not like it.

Among MHPs, the attitude towards free chatting is ambivalent:

I don't think it'd be a major concern. I can see why it would be a concern, but I also think it would potentially come with benefits, because it would open up the possibility of people making a connection through this game. Which is very limited if you can only express in generic, "How are you?" "I'm not so great." [talks about progenerated messages] You can't really have much of a real ... Much harder to make connections. So, I think there're positives and negatives. – CL_07

Some MHPs say that service users can talk to each other freely during group activities and, therefore, they do not see the game any different from that.

It's always a tricky one cause on one level you want to interact with others and the other part of you kind of is, probably, honestly a little nervous about it... Yeah, I don't know why but ... I don't know why I'm hesitating but I am for some reason. People do that anyway. Why are we worried about it? It's possible for them to develop negative ... negative interactions. But then you can wait for them to do that

in real life, can't we, because no one's stopping them doing that. In any format, so yeah, I don't know. – CL_08

However, some MHPs are strongly against chatting:

So that's because I've seen too many clients be sexually groomed and harassed and assaulted. Yeah. I don't know my clients to have any more harm come to them, they are already traumatised enough as it is. So, this is... I would not deem this safe. And that is how strongly I'd feel about this [chatting]. – CL_09

Yeah, the conversational trees and stuff, that's really good. I guess free conversation would be a bit more ... Like if it wasn't monitored the conversation you can have in that kind of gaming, I'd be worried about that a little bit. – CL_05

Theme 6: Game elements and gameplay scenarios that clinicians and service users do not want to see in the videogame

Service users are open to any genre, and have general comments about the game elements and ideas that they do not want to see in the game: e.g., complex gameplay, aspects that take a long time to learn, complex control and bad graphics, no plot, repetitiveness, brevity, cost involved, presence of violence or something that requires much concentration.

If it was too short. If it was too repetitive. It'd get boring really quick. Also, if it was too much talking, too much of it. You really wanna just get on with the game. – SU_03

Probably something, which ... it takes a long time to learn how to play the game, like probably if you need complicated controls, or something. It has to have an interesting story, and an interesting concept. – SU_02

I like violent games. Don't get me wrong, but it's got its place. I think maybe violence may be bad if someone's having thoughts about hurting people it might just give him ideas? – SU_06

Younger male service users are more open to the concept of violence.

There is also a strong emphasis on the fun aspect of the game, which is brought up and emphasised by both MHPs and service users.

It's like, I don't want it all to be about mental health. It's about the "fun" element as well, but also something about growth. – CL_09

MHPs have a similar reservation to service users, and thought violence and death should be absent from the game. They want to see a simple, user-friendly interface and graphics, and not too much information. Contrary to service users' views, MHPs do not want to have a competitive element to games, such as leader boards.

I personally don't like the idea of a leader board, I think it increases a kind of competitive element. When clients have a lot of self-defeating thoughts, beliefs about failure... If they're anywhere that's not on the top, one: they might not believe they're on the top, and two: if they're not on the top, it can really affect their mood, and probably the likelihood of playing the game. – CL_09

Theme 7: Gameplay ideas (genre, mechanics, game elements) that MHPs and service users do want to see in the game.

We asked service users and MHPs what genre do they imagine a game to be, and what game elements and mechanics would they like to see.

Service users prefer simulation and/or strategy-based games with the following elements: access to information/guides if they get stuck within the game, forums, leader boards, badges, feedback within the game to track their progress, achievements, avatar customisation and narrative.

Yeah, I like that. How I would want to dress, I would like my character to dress that way. How they would fight, what weapon they would use, how they would interact with all the characters. – SU_01

I think something that's very easy to use, [you don't gotta read a load of instructions?], one that's got good interface you can know what you're doing, it's simple to work out, and of course something that stands out; bright colours and stuff. – SU_03

In terms of gameplay ideas, most service users want to see puzzles or quests, problems related to real life, psychoeducation elements, idea of progress and change (evolution) throughout the gameplay, bright colours and an easy-to-use interface. Some of the younger participants want to see fantasy elements, while the older population is more interested in real-life gameplay.

Like a cross between Sims and like FarmVille, that sounds like a good idea. – SU_06²

Maybe like the houses idea or something- like it's very colourful, which is yeah, which is really great, I like, friendliness of- yeah that's nice. – SU_05

I think for myself close to real life. I'm sure it's going to be adapted for all ages. I don't know. That's a hard one. I could go either way on that one. – SU_03

MHPs are concordant with service users and also favoured strategy/simulation-type games.

The game elements that MHPs want to see within the game are the following: points, badges, avatar customisation, multiplayer (other people with psychosis), NPCs, the ability to track progress, feedback and puzzles.

You have this life. You have something that you can manage yourself, you can sleep better if you do this. You can get more points if you go out, go to the cinema and will be a passenger point [inaudible] but if you cannot do it, is okay to access. – CL_01

In terms of gameplay ideas, there are many suggestions, so we try to sum up the most complementary ones: something that will allow to challenge thoughts (e.g., delusions), calming landscape, exploring different symptoms and solutions to the problem, including the clinician to some extent in the gameplay, game goals related to real life, personalisation of the gameplay and constant access to the information/strategies that a service user would learn. Below we provide some of the gameplay ideas that we have heard during the interview:

I guess, ideally, is challenging your own thoughts, somehow. I don't know how you would represent that in a game format ... If your thoughts automatically tend towards the paranoid or feeling that was that action or is that person saying something that's specific to me or intending to harm me?" Being able to think of alternatives or interpretations would be quite useful. – CL-02

I'm quite a big fan of landscapes to have kind of calm and serenity, so I don't know whether there would be any feature for any kind of beach or something that's – CL_03

² Here service user refers to simulation game the Sims and a farming online multiplayer simulator FarmVille

And it would also be interesting whether you could personalise ... You can kind of choose the problems when you're setting up your game. – CL_05

I was thinking it'll be a nice feeling to own that kind of strategy. If you've gone through some kind of specific strategy than if you've experienced that within in the game, you can have it as something you have achieved, and you can go back and familiarise yourself. – CL_06

... and with those gems you can buy special things, like you can plant a tree. You can build a pond, You can buy a fish for your pond. So, it's not only maybe helping the people, but it's about building your environment. – CL_09

There has to be a layered texture to this. You have to give something exciting for the player, almost like, I would prefer some kind of fantasy, like it's a wizard that you go to, that you need to give him stuff for his potions and then he gives you more advice and tips. I would personally be playing this all the time. I think that would be really fun. And I'd want to buy a tree for my garden, and I don't know, a white tiger or something. It's nothing to do with mental health, but that's bloody fun. – CL_09

6.4 Discussion

A number of themes arise from our qualitative investigation of self-management strategies for people with psychosis, including findings on the use and opinion of the videogame as a part of the self-management routine. Our aim in this final section is to optimise the utility of these findings by integrating it with the existing research, as well as summarising and explaining other novel findings that might not be that well researched.

6.4.1 Self-management in people with psychosis: strategies that work and reported struggles

Consistent with the previous research (Scott et al., 2015; van der Krieke et al., 2014), strategies like participation in the meaningful activities, following diet, family support, medication adherence, having a positive attitude towards the psychosis, a simple routine to follow that ties up well with day-to-day routine, having a personalised approach and a recovery plan, psychoeducation (understanding what psychosis is and what is needed to manage it), socialising with other people, having a good therapeutic relationship with the care coordinator were all previously known to be positively associated with self-management adherence and improvement of psychotic symptoms. However, a novel and previously

unreported finding was the use of videogames as a coping mechanism. Most service users seem to play videogames as a way to distract themselves from psychotic symptoms – something that makes them feel rewarded and it is one of the mechanisms to socialise with others.

It is also important to note that certain self-management strategies are appealing to a different extent in different age groups. For example, younger service users from our interview study expressed a strong interest in getting to know more people with the same condition, preferably the same age, which is consistent with the recent findings (Douglas et al., 2018) that peers have more influence in altering young people's behaviour than adults. In addition, group activities within the EIS are not appealing to young people, perhaps due to stigma and the lack of participation of people of the same age. Whereas with an older population, it seems that group activities are more favoured.

It is worth noting that most of the service users do not understand the notion of 'self-management' and wanted to know more about the condition, other people with the same condition and what they can do to on a day-to-day basis to improve their symptoms. Some service users are struggling to identify what helps them to keep well on the day-to-day basis however after conversing for a while, we have managed to identify some coping mechanisms.

6.4.2 Self-management struggles

Although research has described the efficacy of self-management tools, there is little research with regard to what exactly people with psychosis struggle with the most when it comes to self-management.

Certain problems like medication adherence, a lack of family support, stigma and poor therapeutic relationships were known to us before (Blixen et al., 2016). However, issues like insight, personal attitude towards the condition and motivation are rarely discussed in extensive details although widely acknowledged. Therefore, the root of these struggles is hard to underpin.

The motivational issue is the most discussed struggle among all participants and is thought to be linked to many other self-management struggles.

In the literature intrinsic motivation is linked to treatment success and better adherence to self-management interventions (Medalia & Saperstein, 2011). One of the main questions is how to elicit intrinsic motivation in service users, since it is so closely linked to cognitive

deficits associated with psychosis. Research does seem to suggest that targeting cognitive deficits may yield enhancements in motivation, improve overall level of learning and increase levels of self-efficacy (Saperstein et al., 2016). One of the promising interventions in this area is cognitive remediation therapy. It is a skills-based therapy that aims to improve cognitive skills such attention, problem solving, executive functioning, memory etc. via small, repetitive tasks where at the end of each task, participants are given personalized feedback and get to choose their individual goals.

6.4.3 Videogame ideation

An idea to use SVG as part of the self-management routine is met positively by both MHPs and service users. Both populations see it as an opportunity to learn new skills in an interactive environment and potentially engage people with psychosis more into their self-management routine.

Overall, SVG is seen as a good introduction tool for those new to the EIS. By “new” we mean people who have never been to EIS. Ideal user should have got any necessary medical treatment and is now in the stage of self-management and recovering. The results from this qualitative study are different to the survey results of Eichenberg et al. (2016), where it was found that clinicians opposed the idea of using SVG as a therapeutic tool for people with psychosis. It is worth noting, however, that the only precaution MHPs express is the use of the potential SVG with people who have strong delusions and ideations about technologies, and who have poor insight.

Interviews also highlight that many MHPs would prescribe a game to the young people with psychosis rather than to older people. However, after talking to the researcher and describing statistics regarding gamers’ gender and age, most are happy to reconsider and instead suggest the game to people who are interested in games, regardless of their age or sex.

In terms of implementation, most service users do not have a strong preference when to play the game, while MHPs are more likely to request the game be played between sessions at the home of the service user. The rationale behind it was mainly not to add workload to the clinician and give something that service users can explore in their spare time.

Consistent with previous research, the game preferences of people with psychosis are similar to the preferences of the normal population (Abdel-Baki et al., 2017), although there was an

increased interest in simulation games possibly due to isolation and idea of escapism (Hilgard et al., 2013; Loffredo & Tavakkoli, 2016).

Overall, game elements and ideas that both MHPs and service users want to see were simulation/puzzles/real-life struggles integrated within the game, badges, achievements, narrative, bright colours, easy UI, easy mechanics, psychoeducation material and the element of fun. All of these elements were previously highlighted in the research of development of SVG for diabetes by Thompson et al. (2010), so it was expected to see these particular elements as desired ones.

Some game elements and ideas were highly criticised, mainly by MHPs. For instance, the use of violence, short gameplay, no element of fun and feeling like an intervention was simply put in a digital format. MHPs do not like leader boards and the element of competition which service users welcome.

Lastly, we wanted to explore the idea of using a co-op-style gameplay. Multiplayer modes within the game are becoming increasingly common in games and people are playing games online with both friends, family or strangers (Depping & Mandryk, 2017). Most popular online videogames focus on competitions wherein individual gamers face opposing players, however other multiplayer aspects really on collaboration with other players – or a combination of both – in order to achieve a mutual goal. These games facilitate social interaction among players through text chat, voice chat and other channels, such as avatar expressions. Gaming in a social context can greatly enhance the player experience within the game, namely through increasing the overall level of enjoyment (Bowman et al., 2013) and an increased level of engagement (Ravaja, 2009). Other positive effects of multiplayer gaming include friendship development and social support, both online and offline (Fox & Brockmyer, 2013). However it is worth noting that negative social interactions can occur, like harassment and cyberbullying (Fox & Tang, 2017).

A multiplayer mode has not been explored as an option for SVG, therefore we wanted to understand what MHPs and service users think about such a format, and with whom would service users like to play – other people with psychosis, MHPs, their family and friends? Both MHPs and service users are accepting of the idea; playing with other people with psychosis is seen as the most positive and likely scenario, which is concordant with the desire of service users to know other people with psychosis, mainly to exchange tips and talk about the psychosis experience. Playing with the clinician is seen as time-consuming by MHPs,

although the idea of playing a game and then using some of the aspects during the session was welcomed.

However, this multiplayer element is hard to execute without a ‘chat’ option, which is perceived with caution by some MHPs. The main concern is “predatory behaviour” (the use of explicit language, bullying etc.) within chats (Chen et al., 2006), and the difficulty that comes with moderating the discussions. Pre-generated messages did not produce much enthusiasm from neither MHPs nor service users. The only form of communication that participants were willing to explore was the use of the emojis.

6.5 Limitations

This is one of the first qualitative studies that explored people’s motivations and reasons behind self-management struggles for psychosis conditions in-depth. In addition, it is one of the first studies to explore the attitude towards to use of SVG in this population. Usually, SVG and technology design in general is criticised for the lack of engagement by end users in the design process (Matthew-Maich et al., 2016). Therefore, we have attempted to collect the perspective of both MHPs and service users.

This study has some limitations that must be considered. Firstly, we did not recruit the intended number of service users (we initially aimed for 12) due to the time constraints imposed by the MPhil and the complicated recruitment process. The researcher was not allowed to contact service users directly and relied upon a third party to do so.

Another limitation is the difficulty faced engaging some service users with in-game design. Even though all expressed an interest in the idea of using SVG, the actual fantasising and ideation were highly limited. This finding can be explained by the hindered ability of some people with psychosis to express themselves (Islam et al., 2010). In addition, some antipsychotics were found to decrease creativity, as antipsychotic treatment appears to be connected to a number of negative subjective effects on cognition and emotion (Moritz et al., 2013).

6.6 Conclusion

In this chapter we found that one of the biggest issues that people with psychosis struggle with is motivation. MHPs and people with psychosis themselves believe that factors like lifestyle management, peer and family support, medication adherence and psychoeducation contribute to the successful self-management.

Both groups are accepting of the use of SVG as an adjunctive tool to self-management routine and perceive it to be a novel and engaging way to learn about psychosis self-management. Among desired game elements, there is a strong consensus on having badges, bright colours, simple and engaging narrative, simple UI and no violence or elements of competitive play (a concern raised by MHPs). Certain elements like multiplayer mode are met with high enthusiasm, while other elements like chatting are seen as potentially harmful to the service user.

Consensus seems to be that both service users and MHPs want a game to have an element of fun and something that can be universally used across multiple ages and different genders, ideally at home.

Relating to previous chapters, the concept of engagement and motivation was touched upon by MHPs and service users. Both groups noted the problem with engagement when it comes to following a self-management routine (more on this in Chapter 2.5). However, it is hard to underpin the exact cause of motivational and engagement issues. Some MHPs believe that more accessible, easy to follow, easily integrated routine can facilitate engagement. It is worth noting that topic of self-efficacy was not well explored because the main focus of this interview was about current self-management strategies and SVG ideation. Some MHPs and service users alluded to self-efficacy and importance of having control over the condition, however not in much detail.

Following the problem with engagement, both groups think that SVG might be a plausible solution for engaging people, especially young people.

Chapter 7: SVG Design Phase – the Creation of Concept Art, Game Mechanics and Recommendations for Future Research

- This chapter contributes:
 - Description of the potential gameplay, narrative, game elements and aesthetics with reference to the previous chapters and research;
 - Recommendations for how our SVG can be researched and tested further;

7.1 Introduction

This chapter describes the stages of the SVG design from the conceptual idea to the creation of the low fidelity (paper) prototype of the game after the initial groundwork and an interview study. We will also provide a potential plan on how our SVG can be researched and tested further.

The author believes that it is crucial to document the design process of the SVG due to the lack of reports and research in this area, especially in the mental health domain. We hope that this research will stimulate further discussion and work, proving an opportunity for further research. In addition, from a methodological point of view, documenting the design process allows researchers to plan and deal more effectively with the design process (Michie et al., 2017).

The description of the game is articulated over four subsections, which are structured according to the elemental tetrad of the game design proposed by Schell (see Figure 4, Schell, 2014).

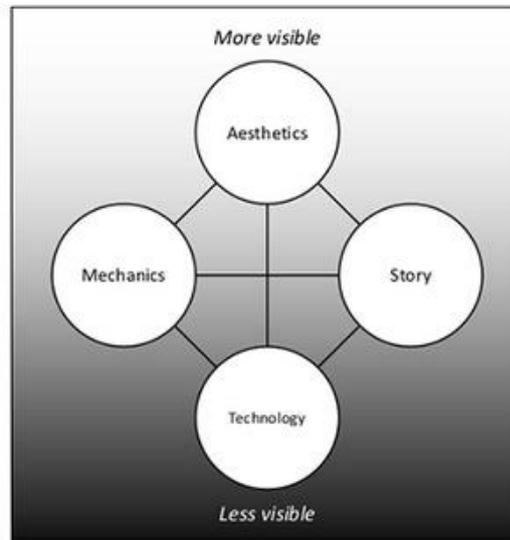


Figure 4: Elemental Tetrad of Game Design by Schell (2014)

The first subsection presents the initial groundwork, where we will summarise what we have learnt from an interview study and the literature reviews detailed in the previous chapters, as well as how these pieces of knowledge can be manifested in our SVG. We will also report a series of introductory meetings with game designers to initiate the designing of 3D art, illustrations and a paper prototype of an SVG.

The second subsection will describe a general plot and gameplay idea. The third subsection will be on aesthetics. The final section will outline the mechanics.

Next, we will provide ideas for implementation of the SVG and further research directions.

7.2 Groundwork

Existing digital interventions for self-management, including SVGs, mainly focus on psychoeducation and development of the understanding of the condition in service users. However, little attention is given to targeting a person's beliefs, attitudes and self-efficacy.

In this game, we would like to target people's self-efficacy skills and promote general engagement with the treatment.

The literature suggests that one way to promote self-efficacy is by delivering psychoeducation materials and practising self-management skills in a safe environment (Baranowski et al., 2008). From the interview study, we understand that both clinicians and service users believe that psychoeducation is an important component of self-management,

and that there is a definite need to know more about the condition and how to manage it. Ideally, psychoeducation should be delivered in simple words and not overwhelm the service user.

With regards to practising self-management skills in the safe environment, we think that the medium of the game will allow service users to practice hypothetical scenarios that will empower them in real life, enhance learning and provide opportunities of choice in a meaningful game-like context. Based on the SDT, SCT theories (Chapter 2) and HBC literature (Chapter 4), we know that all of the above are linked to intrinsic motivation and self-efficacy enhancement. From the interview, we know that a possible area for self-management targeting may include managing voices, increasing motivation, decreasing levels of stress, improve socialising with others and establishing a self-management routine.

It is also important that a game addresses realistic barrier that users can relate to, for example: stigma, desire to carry out a life unrelated to psychosis, motivational issues, a lack of insight, isolation, family unwillingness to cooperate, cognitive symptoms decline, stress and medication adherence. Although it is not possible to tackle all the issues within the game, we believe that some issues are easier to work on within the game format, for instance: stigma and isolation (daily facts about mental health and access for forums), motivational issues (will be tackled throughout the gameplay), cognitive symptoms (brain teasers like minigames with the elements of cognitive remediation) and stress (elements of mindfulness within some minigames, also in general games are believed to reduce levels of stress) (Russoniello et al., 2009).

Previous research into cognitive remediation therapy found that this skills-based intervention has a potential to enhance intrinsic motivation, learning and self-efficacy (Saperstein et al., 2016).

There is some limited research into gamifying cognitive remediation therapy. For example, *SVG X-Cog* (Saleem et al., 2014) which was previously mentioned in a systematic review (Chapter 4), used cognitive remediation therapy as its theoretical backbone for the gameplay. The results showed a general small improvement in symptoms. However, it is worth noting, that this was a small study and motivation scores were not examined. Nevertheless, literature does suggest that there is a potential to link cognitive remediation therapy to motivation and self-efficacy.

Some of the brainteaser minigames might look like this (see Figure 5):

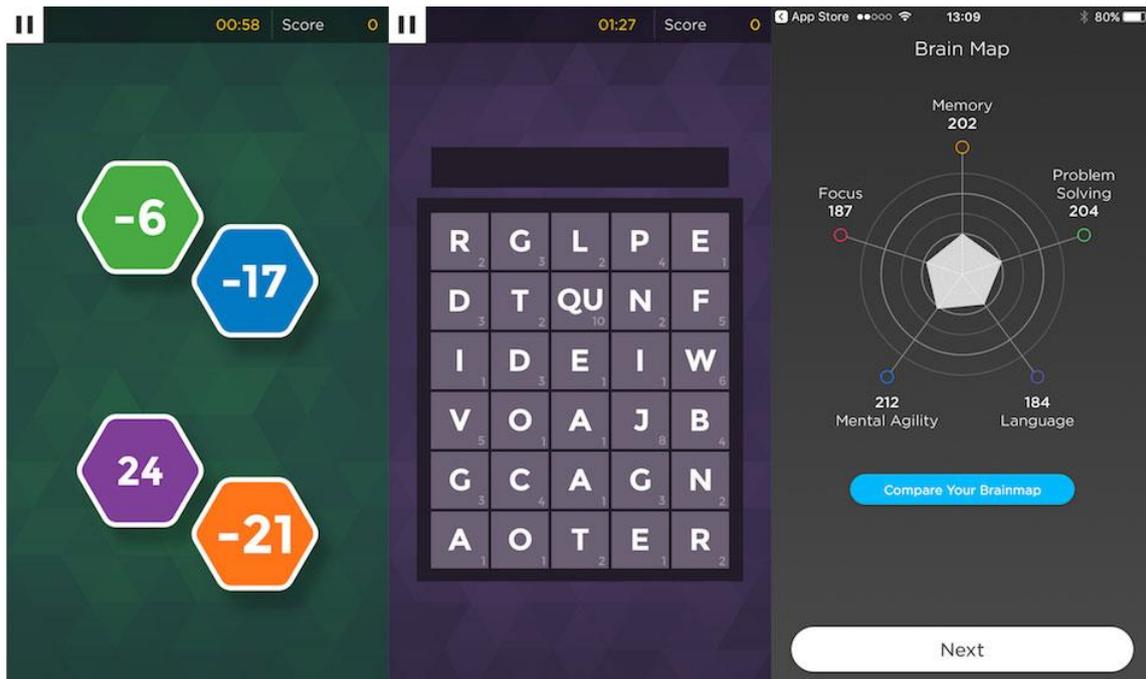


Figure 5: Screenshot from the game PEAK Brain App, showing minigames and puzzles to improve various cognitive skills. Used to demonstrate an overall concept of brainteasers.

Here, game targets language (build as many words as you can) and problem solving (pick numbers in ascending/descending order). Feedback can be received after each session and improvements can be noted via diagram proposed on the right. We propose to design mini-games around the gameplay so there is a contextual relation with the main game. For example, to recover memory scrolls of the new self-management technique, player has to play a memory word game. Or to gain extra coins for their village, play needs to play a maths game; and the better they do, the more coins they get.

In addition to the above, the game should also allow players to monitor progress and receive immediate performance-related feedback, utilise badges and earn daily goal rewards. Previous research noted that these particular game elements seem to contribute the most to the overall feeling of engagement with the content within the SVG and promote learning (Baranowski et al., 2013; Thompson et al., 2010). In particular it is important for service users to be able to track their own performance to encourage self-awareness of learning progress. Research suggests that people with psychosis who utilize feedback to self-monitor progress in learning, have been shown to have greater improvements in self-efficacy scores (Saperstein et al., 2016).

In terms of the user interface, from the interview we learnt that it is important for both clinicians and service users to have a user-friendly layout of the game; simple words, bright colours and ideally something that service users can learn to use on their own. It also became obvious that clinicians would take a more passive role in the gameplay, because otherwise the game may introduce additional workload.

The idea of a multiplayer format – especially with family members and other people with psychosis – was met with great enthusiasm during an interview study. There is not much research on the use of the multiplayer within the SVG format, but we believe that if it were to be integrated within the gameplay, there is significant potential in tackling issues surrounding isolation, stigma, and potentially this can help to facilitate further social interactions at the hospital itself (e.g., at the workshops).. In addition, nearly all service users within our sample expressed a desire to know more people with psychosis.

Service users and MHPs expressed the desire for a SVG to be in a mobile format. This desire is also concordant with the existing literature, since about 90 to 95% of people own a smartphone now according to Statista (2016). In addition, more people use smartphones for gaming than ever. Therefore, if it is going to be a mobile game, it should be available through Google Play and Apple Store, so service users can download it themselves once they obtain an access key from MHP.

Care coordinators and MHPs who work directly with people with psychosis should be the first point of contact when deciding whether this game should be suggested to the service user. We think that selection of the potential player should depend entirely on MHPs, since it is possible that some service users do have technology-related delusions which may be exacerbated by the use of a SVG. It is ideal for them to be interested in the videogames, as previous research suggested that people with an initial interest in videogames are more likely to be engaged with the digital treatment (Fleming et al., 2016).

We envisage that our SVG should be used at home, ideally for 15-20 minutes daily (this number was suggested by MHPs and service users). MHP can suggest service users to work on particular self-management techniques that service users can explore in the game. Alternatively, service users can use SVG as a starting point for discussion with the MHP about self-management and what they can do to keep themselves well. However, this particular aspect of SVG implementation has to be investigated further after the completion of a high-fidelity prototype, since many MHPs and service users wanted to see the game first

before giving any concrete suggestions on when, where and how long for they would use a SVG. The game is not intended for early diagnosis group e.g. service users who were just admitted to EIS, rather it is intended for service users that have already been through acute treatment and now are in the stage of self-managing.

Lastly, both sets of participants emphasised the importance of ‘fun’ within the game and that the feeling of playfulness was important to them. Therefore, we have collaborated with game designers to summarise our ideas and discover how we can marry ‘purpose’ and ‘fun’ within our game. This aspect was mentioned before in Chapter 3, where it was proposed that “seriousness” and “fun” elements have to be balanced in order to achieve the highest potential of a SVG (Maheu-Cadotte et al., 2018).

From the previous research, we know that it is paramount to collaborate with stakeholders, as this will have an overall positive impact on the game design (Khaled & Vasalou, 2014). This also includes various experts such as game designers. Service users and MHPs told us what they want to see in the game, while researchers identified the overall context and goals. Game designers can tell us what is possible to build and what is the best way to achieve our in-game goals.

We ran a series of six Skype meetings over two months to identify what is plausible within the game from a game designer’s perspective. The initial group was composed of a researcher, two game designers and an illustrator.

During the first meeting, the researcher introduced the findings of her research thus far and then presented brief ideas of the gameplay. The focus was on psychosis, existing self-management techniques and resources, as well as results from the interview study and literature review. Next, the subsequent meetings focused on connecting in-game actions with real-life self-management goals (e.g., if a person hears voices in real life, how we can help them to learn how to cope within the game?) or regarding mindfulness-based activities strongly believed to reduce stress (Grossman et al., 2004), how can we incorporate these activities within our videogame?

After the meeting, the researcher and game designers would experiment with prototyping tools, producing possible game ideas and pitching them to one another. The final prototype was chosen based on the game mechanics that could satisfy the results of the interview study. Following the preliminary meetings, the team envisioned a fantasy simulation-strategy game, in which the gameplay involves various aspects of psychosis self-management, such as

hearing voices, battling negative symptoms, improving cognitive symptoms and increasing psychoeducational knowledge. A number of minigames will serve as a source of fun and learning, which will support the main game.

3D game assets that we have developed can be found via link provided in Appendix G.

7.3 Gameplay Idea

The service user (player) is a newly elected mayor of a fictional magical village. However, the village is in a deep stagnation after recent apocalyptic events that have left many people without any prior knowledge of how to take care of themselves. Many members of the village have various mental health and physical health problems related to psychosis. These problems prevent them from leading a normal day-to-day life. As a new mayor, it is up to the player to teach his/her villagers to self-manage themselves and restore the village to its former glory.

During the gameplay, the player will be required to patiently take care of villagers, reconstruct the village and learn together with the inhabitants of the game about psychosis and self-management. As part of the game, the player will be encouraged to interact with nearby villages (other players) and help them to recover too.

All psychoeducational material will be delivered by a Wise Wizard that still remembers some of the magical techniques on how to manage oneself (psychosis self-management techniques).

7.4 Aesthetics

The visual style of our SVG will contain cartoon graphics resembling the ones seen in *FarmVille*. However, the village and nearby areas will be designed in a medieval style, with some elements of a Viking lifestyle also featuring. We thought that adding a medieval feel to the game will tie it nicely together with the overall feeling of a fantasy element that we are attempting to bring to the game.

Initially we considered a “realistic” setting:



Figure 6: Picture depicting realistic "Viking" village.

Also, the design creates a more cartoon-like setting:



Figure 7: Picture depicting cartoon "Viking" village.

We have agreed that a 'cartoon'-like environment was more appropriate for our game because of its versatility. In general, stylised-cartoon graphics are a popular style across all common gaming platforms: computers, consoles and mobile devices.

Because of its visual adaptability, the style works well with any game genre and it can be altered to suit nearly every gamers' needs, whether the target audience was an adult or a child (Masuch & Röber, 2005).

Overall, the rendered village will look like this:



Figure 8: Proposed design of a "village" for our SVG

The characters have a caricatured, slightly exaggerated human aspect; their look resembles Viking villagers with various features (male/female/non gender specific) and other characteristics (age/hair colour/eye colour/style of clothing/ethnicity etc).



Figure 9: Character Design

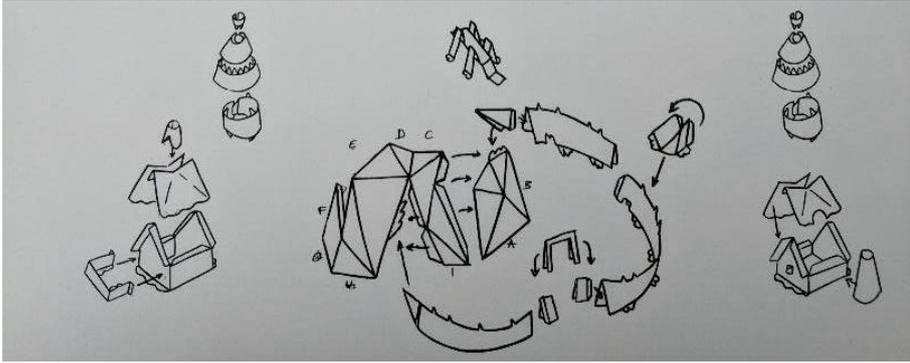


Figure 10: Paper prototype creation 1

The game scenes are in 3D, with villagers' movement being three-dimensional also.

The following paper prototype was proposed to explore the game mechanics and convey the feel of the game when exploring further acceptability of the game with the end users:



Figure 11: Paper prototype creation 2



Figure 12: Final paper prototype

We suggest using a similar prototype for future development and evaluation of a proposed SVG. See section 7.6.1 for more details.

7.5 Game Mechanics

The general plot is set in a fictional universe, where the service user (player) is an elected mayor of a small settlement, which is inhabited by peaceful bots (villagers). These villagers will have different mental and physical health problems related to psychosis (e.g., some will hear voices, others will struggle with diet or have problems with sleeping). These problems will be represented as ‘thought bubbles’ above the villagers’ heads. The service user as the ruler of the village will have to ‘manage’ his/her population using self-management techniques that the player will learn and discover throughout the course of the game.

To learn about self-management and successfully administer learnt techniques, there will be a Wise Wizard (i.e., NPC) who delivers education material to the player, step-by-step. For example, “One of the villagers hears voices: what I can do to solve this problem?” and the Wise Wizard will suggest solutions to the problem, such as “mindfulness to manage voices”. The player will be presented with a brief overview of what mindfulness is and how a player can practice it in real life (e.g., course suggestion, existing workshops within the service provider). Some villagers will require longer management than others. By completing daily tasks and looking after the villagers, the player will receive in-game currency (coins) and gems (for completing special tasks and logging in daily). Successful management of the virtual population will give the player in-game currency (gems and coins) that can be used to build houses or buy various elements of décor for the surrounding area. The happy population will be productive and more likely to work effectively, which will bring the player more coins that can be spent on beautifying and upkeeping the village.

Another way to get gems and coins is through the minigames. Some of them will contain elements of brain teaser games that aim to improve cognitive abilities like attention, problem solving and memory retention. However, other minigames will be available just for ‘fun’ and will not to carry any educational content in it.

The idea is that by (self)-managing the villagers, service users will learn more about self-management, and thus become more likely to listen and become aware of the different techniques. Using the game as an interactive medium will inform service users about self-

management in general; in the future, they will be more likely to attempt these methods themselves in real life.

As the game progresses, the environment around the village will improve (go from grey to green), allowing the player to buy new patches of land and expand their settlement.

We would like to introduce certain elements of social interaction within the game and took *FarmVille* as an inspiration. Therefore, we want to allow players to visit each other's Settlements, to leave presents (e.g., resources) or leave challenges (e.g., exchange villagers with particular mental health problems) that the other player can use to rehabilitate and send back. Coins/gems will reward such interactions.

Finally, there will be a number of badges available for in-game achievements that can later be seen in the personal cabinet of the player. We have decided to display the 'middle' of the leader board, so players do not feel demotivated if they are at the bottom of it.

7.6 Plan for Development and Evaluation of a SVG

Next, we will look at how our SVG can be researched and tested further, suggesting a plan of action.

7.6.1 Future research to test our SVG

After the creation of a paper prototype of the SVG and accompanying illustrations, we propose for any future research to carry out a focus-group study with the MHPs. Focus groups would allow us to explore the evidence and which self-management techniques can be implemented within an SVG, and to gain the first feedback on the gameplay/game mechanics. One of the main concerns here is the safety of the service users from the MHPs' perspective.

Following the interview analysis, we have identified possible gameplay scenarios and in-game actions that a player should be able to perform. Most in-game challenges are based around reported struggles that people with psychosis experience in day-to-day life (e.g., motivation, voices, negative symptoms). To deliver an effective game, we must ensure that the in-game problems can be targeted via appropriate in-game actions (these responses/actions should be similar to those that a service user would use in real life).

Therefore, the aim of the focus-group study should be to organise a group of four or five MHPs, showing them what the game is going to look like, what struggles have been put in the game format and gather their opinion on what would be the best way to solve these

problems (e.g., if in the game character hears voices, what would be the most appropriate thing to do?).

Once in-game actions are confirmed with MHPs, a prototype SVG can be developed further to produce the first high-fidelity prototype (programmed). Previously, we have produced 3D assets in 3dMax, which can be used in Unity or UE4 (Appendix G). The final version should show the aesthetics, introduce the gameplay, mechanics of the game (e.g., controls) and have some of the key in-game actions available (e.g. taking care of the villagers, ability to travel to another village and exchange resources/villagers).

The next stage of the research should focus on the first evaluation and iteration of a high-fidelity prototype, which will contain three parts:

(a) Part 1: *Expert evaluation*

An expert-based evaluation will be organised to verify that, according to a sample of clinical therapists, the activities within the game are safe and will not result in the deterioration of a condition in a person with psychosis. This procedure will provide the first scientific evaluation of the project. The assessment will involve a group of three experts. Participants will have no previous knowledge of the game. The experts will play individually for about 20-30 minutes each, testing the minigames and activities. At the end of the evaluation session, the researcher will ask experts their opinion on the game's safety. Appropriate iterations will be made before Part 2.

(b) Part 2: *1st UX evaluation*

After appropriate iterations from Part 1, the first playable prototype should be tested with a target population (people with psychosis). Ideally, recruitment should be carried within NHS EIS services.

Workshops should be organised, with the aim being to have around 15 people play the first prototype for 20-30 minutes. To evaluate player experience, we recommend the use of an extended Short Feedback Questionnaire (eSFQ), created by Kizony and colleagues for the rapid assessment of game experiences (Kizony et al., 2003).

The aim of this activity is to obtain a deeper understanding of the opinion of the players and, more importantly, to give them the opportunity to express their approval/disapproval about the game and give their suggestions concerning modifications and improvements on the

design. To facilitate this activity, the designers developed a feedback poster divided according to four questions:

1. What did you dislike?
2. What did you like?
3. What would you change?
4. What would you add?

(c) Part 3: *Redesign*

After Part 2, iterate the game accordingly and produce a new version of the prototype.

The final study should focus on the evaluation of outcomes and be a second evaluation study – safety, engagement, acceptability, efficacy – and have two parts

Part 1: An expert-based evaluation should be organised to verify that, according to a sample of MHPs, the activities within the game are safe and will not result in deterioration of a condition in person with psychosis. However, at the end of the evaluation session, the researcher should ask questions about the game's safety and how MHPs imagine using this SVG within existing mental health practices.

The final part is the second UX and efficacy evaluation.

The final focus is to evaluate:

- (1) User experience via the Game Experience Questionnaire (IJsselsteijn et al., 2013);
- (2) Self-efficacy via the Self-efficacy Questionnaire (Erickson et al., 2018);
- (3) Self-efficacy and player experience can be additionally measured via a short semi-structured interview.

We propose the recruitment of 12 service users and divide them in two groups, one should play the SVG for three months, while the other group will receive paperback self-management content and will have to work through it on their own for three months. At the end, a Self-efficacy Questionnaire should be administered to two groups, and additional interviews and IJsselsteijn et al.'s (2013) Game Experience Questionnaire should be administered to the group that played SVG.

We suggest 12 people for initial feasibility study, taking into account the difficulties in recruiting. For a more robust and summative study, bigger sample size is required, ideally with power calculation.

7.7 Conclusion

This chapter outlines stages that formed the first part of the design process of the SVG for self-management in people with psychosis. We propose to follow the layout of a fictional fantasy village, which can be used to tackle a number of struggles associated with psychosis in one game format, such as: stigma and isolation, motivational issues, cognitive symptoms and stress. The following game format additionally allows to incorporate other add-ons to practise self-management techniques and increase self-efficacy scores, such as cognitive remediation mini-games or mindfulness exercises.

From the literature reviews and the interview study we propose to include the following game elements to facilitate self-efficacy and enhance motivation with the self-management treatment: psychoeducation material, ideally integrated within the gameplay; use of hypothetical scenarios where player can make choices and practise self-management skills; NPCs; personalization of any kind; feedback on the performance and overall game progress; use mini-games to help with cognitive symptoms; leaderboards, badges and rewards.

Game has to be easily integrated within day-to-day life therefore brief but frequent interactions will be recommended. MHPs should act as gatekeepers and potential points of contact if service users want to discuss anything new related to self-management that they have discovered from the game. However, MHPs shouldn't be involved in a gameplay. We do consider as a possibility, for service users to "travel" to other villages, owned by other service users. This way we can explore the potential of social interactions within SVG.

We also provided a potential plan on how our SVG can be researched and tested further.

8. General Discussion

- This chapter contributes:
 - Recommendations for future research
 - Final discussion to answer research questions outlined in Chapter 1, referencing the contributions made by this thesis
 - Limitations, Future Implications and Conclusion.

8.1 Introduction

This is the concluding chapter of the thesis, which will bring together other chapters and build upon the material discussed previously to answer whether SVG is a feasible tool for self-management for those diagnosed with psychosis, and whether it may promote self-efficacy (see 8.3 Contribution). We will discuss limitations to our approach and how future research can be improved.

This chapter will also provide a list of recommendations for further research that can be utilised in future works, and possible ways to improve research into SVG design in the future.

8.2 Revisiting the Research Questions

The title of this thesis is “To determine the feasibility of an SVG for enhancing self-efficacy in self-management in people with psychosis”. By “feasibility” we mean determining whether an SVG is appropriate for further testing and if there is a need, scope and place for it, within the existing healthcare system (Bowen et al., 2009).

Now, we will revisit the research questions and outline how the evidence that we have discussed in the thesis may address the questions.

1. *What evidence is there to suggest that SVGs have the potential to be an effective tool to promote engagement and self-efficacy in self-management interventions in people with psychosis?*

In order to answer this question, we have identified what is already known about similar self-management interventions for psychosis in the app and web formats, and the methods that have been used to evaluate and develop them. We have conducted a series of literature reviews and one systematic review (see Chapters 2-5). We also looked at technology usage among people with psychosis and talked about how videogames can be used to engage,

motivate and enhance self-efficacy. In addition to the above, we looked at the evidence of the overall effectiveness of the SVGs to have a positive effect on mental-health related outcomes.

We found that people with psychosis use technology in the same way as a healthy population; smartphone usage and ownership are in the same range as elsewhere in society. Also, people with psychosis do tend to play videogames, however, not much research has been done to find out the precise motivations behind the playing.

We also found that there is an abundance of technology-based interventions for psychosis self-management, and most of them utilise CBT as a theoretical backbone. The effect sizes are small-to-medium, with acceptability rates being described as high among both patients and MHPs. The results for non-gamified computerised self-management interventions are less conclusive for engagement ratings due to the variability in reporting them (e.g. rate of daily response, dropout, satisfaction) (Depp et al., 2016). The rates of adherence and attrition are similar to those found in the short-term trials of in-person interventions for serious mental health problems (Free et al., 2013). However, long-term results on sustained engagement seem to be mixed and less conclusive, suggesting that research should focus on other mediums of self-management interventions delivery such as SVGs (Álvarez-Jiménez et al., 2013; Villani & Kovess-Masfety, 2017).

Existing digital interventions for psychosis self-management, including SVGs, mainly focus on psycho-education and a development of the understanding of the condition in service users. However, little attention is given to targeting a person's beliefs, attitudes and self-efficacy. The SVGs mentioned in section 5.2 are not intended to promote self-efficacy and focus almost exclusively on psycho-education (*Bipolife* and *Pogo's Pledge*), while the game *Bias Blaster* is a therapeutic game aimed at improving cognitive deficits associated with psychosis.

SVGs for physical health provide a more detailed insight into how games are built to deliver psycho-education and practise self-management skills, but also act to empower a service user.

From the previous research, we found out that SVGs can be used as a potential medium to engage patients with chronic conditions, as they (SVGs) provide people with flexible learning environments in which they can learn about their medical condition in a dynamic and personalised setting that allows for accessible and appealing exploration, information seeking and practice (Cannon-Bowers, Bowers, & Procci, 2011; Charlier et al., 2016). Games can adapt content and challenges to the age, educational level, personal interest and specific

medical conditions of the gamers, thereby allowing them to design a self-management plan with their own personal educational goals, which is likely to result in a more effective educational approach (Barlow et al., 2002; Fogg, 2003). In contrast with other electronic media, contemporary games typically combine both intrinsic and extrinsic motivational elements (Ryan, Rigby, & Przybylski, 2006), active learning processes (Smith & Foley, 2006), the provision of immediate feedback (Garris, Ahlers, & Driskell, 2002) and opportunities for socialisation with others (Hawn, 2009; Maloney-Krichmar & Preece, 2005). Based on these powerful and persuasive game mechanisms, it is hypothesised that playing health games impacts the gamers' learning, which results in increased knowledge and a better adoption of healthier lifestyles, and increased engagement with self-management behaviours (Thompson et al., 2010).

In addition to the above, SVGs have a potential to enhance psychological mediators of change, such as self-efficacy, which is predictive of future behaviour. If one's ability and competence to perform a particular health behaviour is high, the individual's health knowledge is more likely to translate into positive health behaviour (Bandura, 1982; Maibach et al., 1991). Improvement in health self-efficacy perceptions is an important goal for health-promotion interventions such as videogames, which provide an environment where people can experiment, perhaps sometimes fail, but ultimately learn. As people become more successful, they are likely to perceive themselves as being more efficacious in the tasks and skills they are rehearsing, and become more engaged with the treatment (Brown et al., 2013; Lewis et al., 2002; Lubans et al., 2008; Marshedi et al., 2017).

Games provide a convenient medium to learn, set goals, track progress and engage. For instance, players can observe personal success (through mission completion etc.), and observe others (either players or NPCs) engaged in a sequence of actions. Character modelling and dialogue can convey knowledge, demonstrate skills and enhance self-efficacy. Modelling a coping style in which characters model imperfect performance initially, but persevere and gradually improve through personal effort and skill refinement, thus emphasising the importance of using strategies, verbalising and/or demonstrating how the strategies can be used, would enhance knowledge, refine skills, and enhance both self-efficacy and competence.

The bottom line is that technology is an acceptable option for delivering self-management interventions, including SVGs. From the physical health domain on chronic conditions we

know that SVGs are effective in promoting self-efficacy and motivating people who play these games to engage in HBC. Therefore, if we utilise right theories of HBC, motivation and the appropriate self-management theoretical background, it is possible to argue that SVGs have the potential to be an effective and engaging medium for the delivery of self-management interventions in people with psychosis.

2. Which game elements and game mechanics are likely to be effective in promoting engagement and self-efficacy in self-management interventions for people with psychosis, and how can these be used within a SVG for self-management of psychosis?

The answer to this question was explored in Chapters 5-7. We have reviewed literature on SVG design principles for HBC. In addition to the above, we looked at case studies of self-management videogames that promote self-efficacy in physical and mental health conditions, and what game elements and mechanics these games utilised in their gameplay. We also reported what game elements service users and MHPs would like to see in the future SVG for self-management of psychosis.

Research suggests that different sets of game design elements have the capacity to provide different learning environments within the game, some more engaging than others (Bedwell et al., 2012; Bellotti et al., 2010; Sailer et al., 2017). Therefore, it is important to choose the most appropriate combination of the game elements in order to target psychological mediators of change like self-efficacy and facilitate overall engagement with the treatment. There is also an additional challenge to ensure the correct balance between elements of “fun” and “seriousness” within the SVG. One needs to be careful about simply “inserting” an existing self-management program into a game format without following appropriate design guidelines.

After researching the literature (Chapters 2-6), existing examples of SVGs for self-management and results of our interview study (Chapter 7), we came up with the list of game elements and game mechanics that are likely to be effective in promoting engagement and self-efficacy in people with psychosis. The final prototype was chosen based on the game mechanics that could satisfy the results of the interview study and results obtained from literature reviews.

We propose to design a fantasy simulation-strategy game, in which the gameplay utilises the following game elements and mechanisms:

(a) elements of psycho-education – SVGs should aim to provide learning material in an accessible, simple language. The main aim should be not only acquiring knowledge of self-management, but also being able to exercise skills that enable an individual to act on this knowledge. This approach establishes a strong foundation for HBC, competence building and subsequent increase in self-efficacy. In the proposed gameplay (Chapter 7), we think learning about self-management techniques and challenges should come primarily from the NPC “The Wizard”. Learnt self-management techniques can be applied to the villagers who experience psychosis-related struggles. Some techniques will be more effective than others and take a longer or shorter time to be effective, based on the symptoms. This way the player can learn about different self-management strategies, how to use them and when.

(b) setting clear goals within the game that should align with real-life therapeutic goals – this links with point (a). In-game skills should be exercised in the game scenario which is to some extent relatable/transferable to the real-life scenario. Arguably, this is one of the hardest elements to pursue, as it requires a certain level of expertise in the health domain, SVG design and creativity. However, setting realistic goals inside the game drives the acquisition of knowledge and skills, and the enhancement of self-efficacy and engagement. These factors combined will enable one to self-regulate behaviour in the long term.

In the proposed SVG, the player should be able to choose villagers that present with the symptoms similar to those of the player. For instance, if a player has trouble sleeping, the game can generate a villager with the same problem. After learning from the Wizard about different self-management techniques related to improving sleep, e.g. mindfulness, the player can use it on the villager while at the same time learning about the technique in an interactive manner and possibly use it themselves and/or discuss it with their care coordinator.

(c) aim to incorporate social play and support to increase engagement and motivation to play – collaborative learning and teamwork also involve strategising, teaching and coaching with one’s partner, which are well-documented and powerful methods of learning (Baranowski et al., 2013); for players with health problems or chronic conditions, these are ways to increase communication and social support related to their health issues. This may include playing with other people with psychosis or their relatives/friends. However, it is important to consider means of communication within the game, and the extent to which players can talk to each other.

In the SVG, we propose to start using some elements of the social play akin to FarmVille, where players can visit each other's settlements, help to gather resources and possibly set up challenges such as exchanging villagers where Player A cannot help recovery, but Player B might have enough skills/resources to do that.

(d) to set realistic barriers within the games – this point partially links to (b) and also means that barriers within the game should be challenging yet surmountable with the appropriate level of skill. If barriers are too easy to overcome, the SVG will be too boring; if barriers are too hard, players may quickly become disengaged from the gameplay. Therefore, it is important for researchers to seek expertise from game designers to ensure that challenges/skills are balanced out well throughout.

In the SVG, there will be villagers who present with different symptoms and, as the game progresses, the player will need to learn to utilise different combinations of self-management techniques.

(e) to include likeable characters or playable protagonists to increase self-efficacy – we recommend allowing as much personalisation as possible within the SVG, so that it feels like a “safe space” and a true reflection of the player. Game tailoring also increases engagement and self-efficacy as there is more relatedness between player and the in-game character/role. It is also a good idea to use NPCs which can either convey knowledge, demonstrate skills and/or allow the practice of strategies based around self-management.

In the SVG, we propose that players can customise their village, deciding on the location and layout of the settlement. Possibly, players can also customise villagers and name them if they want to.

(f) the ability to monitor progress – this element is needed to ensure that players can set realistic goals within the game which meet their personal needs and expectations. Self-monitoring is associated with an increase in self-awareness, competence and self-control. This also includes the introduction of badges and points that are extensively used in SVGs for self-management in chronic physical health conditions.

In the SVG, we propose weekly and monthly updates that will reflect what the player has learnt, including how many villagers they have helped. Mini-games that we would like to incorporate in the SVG can also show progress related to cognitive symptoms of psychosis, such as attention, memory and executive functioning improvements. By completing various

daily and weekly challenges, players will get badges and extra points which they can spend on learning new techniques, perfecting the ones they have learnt and customising their village.

(g) receive immediate performance-related feedback – players need to receive immediate feedback, with appropriate suggestions to ensure effective learning and sustain long-term engagement with the treatment and SVG.

In-game examples can be found in point (f) above.

(h) user interface – from the interview we learnt that it is important for both clinicians and service users to have a user-friendly layout of the game; simple words, bright colours and ideally something that service users can learn to use on their own. We recommend running workshops and focus groups to ensure that the user interface is appealing and simple enough to engage with, as different players will have different levels of experience with videogames.

(i) triangulation with other treatments – consider using minigames and puzzles based on cognitive remediation therapy to target cognitive deficits associated with motivational issues found in psychosis. We propose to design mini-games around the gameplay so that there is a contextual relation with the main game. For example, to recover memory scrolls of the new self-management technique, the player has to play a memory word game. Or to gain extra coins for their village, the player needs to play a maths game, and the better they do, the more coins they get.

To summarise, there is an abundance of game elements and game mechanics that are likely to be effective in promoting engagement and self-efficacy in self-management interventions for people with psychosis. We propose a fantasy-simulation SVG where these game elements can be incorporated and used. For concept art and more a detailed description of the gameplay, please see Chapter 7.

8.3 Contribution

This research makes a number of contributions to the current body of research in the area of SVG design for self-management interventions for people with psychosis.

8.3.1 SVGs can potentially be used to engage people with psychosis in self-management routine and enhance their self-efficacy

Chapters 2-7 focus on the SVGs' potential to engage players in a meaningful way and enhance psychological mediators of change, such as self-efficacy.

One of the main struggles for people with psychosis is to sustain long-term engagement with the treatment. Of course, there are other problems with psychosis, such as stigma and accessibility. We have looked at technological tools for self-management such as apps and websites (Chapter 2) which seem to be acceptable and potentially effective among people with psychosis, although certain challenges around adherence and a lack of engagement still do exist.

Another issue that we have highlighted is a lack of the digital interventions that focus on empowerment and self-efficacy, which are believed to be paramount in sustaining self-management routines and facilitating positive health behaviour change.

Therefore, research suggests that one of the main reasons for incorporating videogames into healthcare services is their ability to increase motivation, engagement and enhance self-efficacy (Kato, 2010a; Kelley, Wilcox, Ng, Schiffer, & Hammer, 2017; Przybylski, Rigby, & Ryan, 2010).

SVGs can provide people with flexible learning environments in which they can learn about their medical condition in a dynamic and personalised setting that allows for accessible and appealing exploration, information-seeking and practice (Cannon-Bowers, Bowers, & Procci, 2011; Charlier et al., 2016). Games can adapt content and challenges to the age, educational level, personal interest and specific diseases of the gamers, thereby allowing them to design a self-management plan with their own personal educational goals in mind, which is likely to result in a more effective educational approach (Barlow et al., 2002; Fogg, 2003). In contrast to other electronic media, contemporary games typically combine both intrinsic and extrinsic motivational elements (Ryan, Rigby, & Przybylski, 2006), active learning processes (Smith & Foley, 2006), the provision of immediate feedback (Garris, Ahlers, & Driskell, 2002) and opportunities for socialisation with others (Hawn, 2009; Maloney-Krichmar & Preece, 2005). Based on these powerful and persuasive game mechanisms, it is hypothesised that playing health games increases the gamers' learning, which results in increased knowledge and a better adoption of healthier lifestyles and self-management behaviours (Thompson et al., 2010).

It is important to note that there is a bidirectional relationship between self-efficacy and motivation. Patients are more likely to engage in a health-promotion programme if they are highly motivated and motivation levels are in turn influenced by self-efficacy (Hardcastle et

al., 2015). Therefore, the motivational ‘pull’ from SVGs, and well-integrated game elements and mechanics that promote self-efficacy, can complement and enhance each other.

8.3.2 SVGs seem to be an accessible and feasible option for self-management

Initial research has indicated that MHPs and service users were accepting of using other digital tools (mainly apps and web-based interventions) for self-management. These tools were also found to be potentially practical in existing healthcare practices. However, little research has been done into the acceptability and feasibility of SVGs for people with psychosis.

Most of the argument for using SVGs for people with psychosis comes from the literature on HBC in the physical health domain (Chapter 5) and existing SVG for other mental health conditions (Chapter 4).

Generally, not much is known about the attitude towards the use of the SVG as a self-management tool for people with psychosis. From our interview study (Chapter 7), it is possible to suggest that the attitude is very positive from both MHPs and service users.

From an MHP’s point of view, they see SVG as a safe environment to learn and practise new skills in an engaging way – especially for young people. If it is going to be a multiplayer game, there is scope for helping people to learn how to socialise. Most MHPs perceive the SVG as a motivating experience and a good tool to deliver certain aspects of self-management, like psycho-education, and that it can potentially be used to increase cognitive abilities through minigames or puzzles.

In terms of implementation, from the interview study, we have concluded that both MHPs and service users want the game to be used frequently, but for a short period of time and as a supplement to the main line of treatment. Overall, the SVG was seen as a feasible and potentially engaging medium for people with psychosis.

8.3.3 SVGs need to comply with design practices from HCI and theoretical practices from health research in order to be engaging and effective

This point was mainly explored in Chapter 5 where we have looked at the existing apps and videogames that promote self-efficacy in chronic physical and mental health conditions. We have also determined initial design implications for a self-management videogame for people with psychosis.

From existing practice, we found that there is a lack of communication and drawing of practices from HCI and mental health research, especially in the field of psychosis self-management. Currently, there is no serious game design framework for either mental health improvement or self-management of any psychiatric condition. However, future research can learn by combining key principles that emerged from the HBC literature, and the literature on designing technologies for mental health and other chronic conditions, such as diabetes.

In theory, effective SVGs for the self-management of any psychiatric condition should include: elements of psycho-education; clear, set goals within the game that should align with real-life therapeutic goals; social play and support to increase engagement and motivation to play; realistic barriers within the games that users can relate to; a likeable mentor character or a playable protagonist to increase self-efficacy; and the ability to monitor progress and receive immediate performance-related feedback. Another aspect that can be included in a game is making it “fun”, however, research is somewhat controversial in that regard.

The key design principle is relevance and ensuring that gameplay, goals and aims of the game are aligned with the user’s real-life needs. To design the game to be as realistic and relevant as possible, researchers are encouraged to collaborate with clinicians, patients and other users of the game.

8.4 Limitations

This thesis has limitations that need to be considered before interpreting conclusions and findings.

Firstly, most of the studies presented on the SVGs for self-management in physical and mental health conditions are uncontrolled trials and quasi-experimental designs. From one side, including heterogeneous designs has allowed us to understand how the field has been developed in the last couple of years and what kind of games have been designed, especially for mental health. However, one should be careful to interpret the results from these studies definitively as conclusive. We think the research at this point shows a clear potential of SVGs for self-management intervention, engagement with these interventions and enhancement of self-efficacy, but it is important to have more robust trials done in the future to determine effectiveness of these interventions in a the long term.

Secondly, most of the studies on SVGs are underpowered, employing a small number of participants. Therefore, this links to the point above, that there is a potential to investigate further but we should be cautious about interpreting the results.

Thirdly, in the interview study, it was hard to engage service users in videogame design ideation. Even though there was a clear interest in the topic, it was evident that service users struggle to express their thoughts and ideas. This issue can be explained by the hampered ability of some people with psychosis to express themselves (Islam et al., 2010). In addition, some antipsychotics were found to decrease creativity, as antipsychotic treatment appears to be connected to a number of negative subjective effects on cognition and emotion (Moritz et al., 2013). Therefore, it is important to consider alternative methods to explore participatory design, namely, using visual aids, inviting artists to aid creative flow, and organising workshops with service users and other experts.

8.5 Implications and Future Research

We propose the following principles for implications and future research, based on the reviews and data collection in the thesis. We believe these principles might facilitate research into SVGs for self-management in people with psychosis and other mental health conditions.

1. To change attitudes towards digital interventions in clinical practice.

Digital interventions are becoming a central focus of mental health service reforms worldwide, including in the NHS (Bhugra et al., 2017; NHS, 2014). To be up to date with the digitalised era and needs of the service users, the NHS must start to draw upon technological innovations like apps and SVGs. The current healthcare system had been criticised for previous problems with integrating technology into care and one of the problems for failed integrations is believed to be staff's attitudes towards the use of technology and organisational issues (Bucci et al., 2019).

During our interview study, we have noted that neither MHPs nor service users raised concerns about privacy, use and the storage of data gathered via digital devices. In addition, MHPs did not feel threatened by the introduction of an SVG into services and feel replaced; conversely, the overall attitude was rather positive. However, previous studies highlight suspicions from both MHPs and service users about the use and storage of private information collected through digital interventions (Berry et al., 2016). Another qualitative study (Bucci & Morris et al., 2018) note the concerns of MHPs that digital interventions may

completely replace face-to-face contact with service users and promote avoidance behaviour. In our interview study, MHPs stated that they see digital tools as complementary to the main therapy delivered by services and do not think it threatens to replace clinical support.

Conversely, MHPs do realise the potential of digital interventions and believe their main advantages are the facilitation of engagement with the services, availability and accessibility.

However, to improve implementation within the service and the uptake, these attitudinal barriers must be resolved to facilitate the future of digital interventions in healthcare. Also, there are several practical barriers within the NHS, such as digital infrastructure and the time availability of MHPs.

It will also be interesting to explore in more detail the attitude towards the use of apps and SVGs for self-management within the NHS, as most existing qualitative studies focus only on self-tracking apps. Therefore, the aspect of potentially using gamified interventions remains open. It would be interesting to see whether the staff would feel any different towards using gamified interventions when compared to non-gaming tools. Our qualitative review suggests a positive outcome, but more studies are needed to explore this avenue.

2. Use of theoretical background should not be ignored.

Previous research into the development of digital interventions for healthcare – including self-management – highlights the importance of incorporating an appropriate theoretical background in the interventions (e.g., CBT, mindfulness etc.). Most of the existing mental health interventions seem to focus only on theoretical models and theories that underpin and inform the content of a digital intervention/tools, while seemingly ignoring the HCI element of the equation. In general, the design process of many existing apps and SVGs for mental health is poorly reported, and when there is a description of the design and ideation process, not much thought is given to how exactly digital tools will be effective and engaging from the UX point of view. Research into how exactly digital interventions seem to operate, and how different components and systems are affecting the end user, is ongoing. In order for digital tools for self-management to be engaging, we do need to get a better understanding of the various processes involved in the promotion of intrinsic motivation, how to empower individuals with the tools, and help people to exert more control over their wellbeing.

The SVGs for diabetes that we have reviewed in Chapter 5 build upon SDT and SCT, which aim to explain potential processes by which self-management tools exert their effect on HBC

and facilitate engagement in health-promoting behaviours. Digital tools like apps and SVGs must draw ideas from the digital self-management interventions for physical healthcare.

Finally, digital interventions should focus more on existing psychological mediators of change, such as self-efficacy, and more research is needed to understand what processes may help to promote it (mediators of change) in the digital medium.

3. The need to develop other ways to test and report the efficacy of SVGs.

Synthesising the current literature is challenging because of the heterogeneity of the outcomes of the interventions. In addition, studies appear to be underpowered, without control groups, randomised and administered for a short period of time. Therefore, the full potential of SVGs in mental healthcare – especially self-management – is under-explored.

We must encourage scientifically rigorous research to understand better the influence of SVG on mental health, HBC and whether there are any adverse effects. One of the reasons why healthcare providers appear to be dismissive of novel digital interventions, such as SVGs, is due to the lack of rigorous scientific research.

Conversely, we also must consider existing methodological challenges that digital interventions face, namely the use of randomised controlled trials (RCTs) as the ‘gold standard’ to examine the efficacy of the interventions in healthcare. Usually, RCTs are time-consuming, expensive and answer yes/no questions like “Is X effective in improving Y?”. They do not answer what part of the intervention is the most effective (basically, what makes a difference). In addition, RCTs are traditionally fixed interventions and once the protocol has been approved, no changes to the interventions are allowed; this is rather problematic for digital interventions and tools that rely on continuous iterations dependent on feedback from users and overall performance. Also, due to their time-consuming nature, digital technologies tested via RCTs tend to be outdated by the end of the trial.

There are new adaptive interventions, designs and approaches that specifically use digital tools as a medium for delivery of interventions. These new approaches focus on the provision of the right amount or type of support needed at the right time. So, the interaction with the system is user-triggered. Examples include interventions that prompt users to complete an assessment at specific times during the day; based on the response, users get tailored self-management support. The two most researched design methodologies are “just-in-time adaptive interventions” (JITAI) (Nahum-Shani et al., 2018) and the multiphase optimisation

strategy (MOST) (Collins et al., 2007; Wilbur et al., 2016). Both methodologies focus on contextual, in-the-moment support for service users and enable more efficient investigation of what parts/components of an intervention do and do not work. These new design methodologies can be used in the earlier stages of an intervention design, to maximise the potential of a digital interventions and then be tested in the RCT (Collins, 2018).

4. Co-production with end users and the experts.

As mentioned previously, co-operation with the end users is paramount in the design of a digital interventions (Baranowski et al., 2013; Beentjes et al., 2015). Other important people to consider involving in the design and development process of a digital intervention are experts, such as game designers, artists and clinical psychologists. Experts are determined by the digital medium that the researcher wants to use and the health domain in which it will be implemented.

Nevertheless, developing ‘theoretically’ sound digital intervention is half the job done. The researcher should involve experts from HCI to maximise the engaging potential of the intervention. The design and development processes are iterative, meaning that input from all the stakeholders is needed constantly to feed into progress. Therefore collaboration, rather than consultation, is required. Of course, this means involving service users too.

It is important to know service users’ needs, however, it is equally important to involve this group into the design, since they will be the ones to use the end product. Such co-production is likely to optimise acceptability and facilitate implementation of digital interventions into mental healthcare.

5. Need to measure cost-effectiveness of digital interventions.

Research has suggested for a long time that one of the benefits of digital interventions is their cost-effectiveness compared to traditional face-to-face treatments. Although initially possible, we need to assess this matter further. Designing digital interventions and then deploying them is not the end of costs; the upkeep can be rather expensive too. There has to be a designated team who will constantly develop updates and new content for the app/videogame based on the needs of the user.

The actual digital market has all moved online, meaning that developers of digital products keep in constant contact with the users, perfecting their product and fixing bugs.

Research in the US indicated that such “online” reality is the future of digital interventions in healthcare. However, the cost has to be calculated and evaluated (Torous et al., 2019).

7. Guidelines for game development.

This point applies solely to SVG, since there are multiple guidelines for app development and other digital tools.

Due to their novelty, SVGs for health have been overlooked. Although there are now emerging attempts at providing frameworks, none were rigorously tested or researched (Baranowski et al., 2016). In addition, little is currently known about principles for effective and engaging SVG design for HBC and self-management. There are some design principles, but they were almost exclusively used in SVG design for physical health.

Also, in order to be effective, SVGs must be fun and enjoyable to play. Current SVGs for any health condition are more “serious” than “fun” (Baranowski et al., 2016). It is important that the game focuses on the health goal, such as learning, behavioural changes or empowering the player; however, they should still be fun to play.

Developing guidelines for SVG design for self-management will also allow future research to systematically evaluate components of the SVG, and determine what works and what does not.

8.6 Conclusion

SVGs do have the potential to engage people with self-management routines, as well as educate and motivate them to look after themselves. There is also a significant potential for SVGs to be implemented in mental healthcare, especially for people with psychosis. Our interview study indicated a positive attitude towards the use of SVG among both MHPs and service users.

It is too early to say whether our SVG can enhance self-efficacy, however, we have used the existing guidelines for SVGs and HBC, and researched the literature extensively for examples of effective SVGs.

There is a noticeable lack of guidelines concerned with SVGs’ development for mental health conditions and self-management, which makes it tricky for anyone to develop a scientifically rigorous digital intervention. Nevertheless, the field is advancing and an increasing number of games emerge every year.

From the literature reviews, we have learnt that SVGs have the potential to enhance self-efficacy and intrinsically motivate people. In addition, we have learnt that people with psychosis play videogames as often as other people and use technology in the same way as others do.

Therefore, it is possible to argue that SVGs do have a place within existing mental healthcare, have the potential to make a positive change in mental health-related outcomes, and can tackle the motivational issues experienced by people with mental health problems.

To take this research further, we propose to:

(a) Follow the proposed plan to test the effectiveness and playability of the suggested SVG that seeks to encourage self-management in people with psychosis.

(b) Follow the principles outlined in section 8.2 to improve the quality of the research. We believe there is a potential for SVGs within the NHS, but it is important to consider different approaches, methods and potential collaborations with different stakeholders to develop an effective tool that can be implemented within practice.

9. References

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10. Appendices

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Appendix A: Search terms

Video Games/	5303
2	Mobile Applications/
3	(app or apps or "mobile application*" or sms or "smart phone*" or smartphone* or text?messag* or digital or "mobile device*" or m?health).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
4	(pokemon or tetris or grand theft auto or GTA or "video gam*" or videogam* or "computer gam*" or "online gam*" or "game system*" or "gaming system*" or "arcade gam*" or Nintendo or xbox or playstation* or MMORPG* or "interactive gam*" or gamer* or gaming or "game console*" or "gaming console*" or "digital gam*" or console gam* or multiplayer* or gameplay* or "game boy*" or "game cube*" or pc or laptop*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
5	1 or 2 or 3 or 4
6	treatment outcome/
7	(interven* or therap* or treat* or adheren* or efficac* or effectiveness* or improv*).mp. [mp=title, abstract, heading word, table of

	contents, key concepts, original title, tests & measures]
8	6 or 7
9	exp Psychotic Disorders/
10	exp Schizophrenia/
11	exp Mental Disorders/
12	(psychosis or psychoses or psychotic or schizo* or depress* or anxi* or anxiety or wellbeing).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
13	gamification*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
14	1 or 4 or 13
15	9 or 10 or 11 or 12
16	8 and 14 and 15

Appendix B: Description of the game intervention's purpose in terms on mental health-related outcomes (Table 9)

Study	Diagnosis	Game Intervention's Purpose
Playmancer (Fernando Fernandez-Aranda, 2015)	Bulimia Nervosa	To examine whether the SVG group (condition known as CBT+CVG) is more effective in reducing short-term impulsivity, emotional expression, and levels of anxiety than the condition with CBT only.
MindLight (Schoneveld, 2016)	Elevated anxiety	To reduce symptoms of anxiety at post-intervention and 3-month follow-up.
SocialVille (Nahum, 2014)	SCZ	To improve social cognition deficits in schizophrenia, namely facial memory, emotional prosody identification, emotion and social perception, functioning, social functioning, quality of life and motivation levels.
Let's Face It! (Tanaka, 2010)	ASD	To improve facial identity and object processing in children with ASD.
Poki-Poki (Cunhg,2016)	ASD	To improve social cognition, which includes social communication, facial recognition, and emotional words in ASD adolescents.
X-Cog (Saleem,2014)	FEP	To improve cognitive functioning (namely executive functioning), positive and negative symptoms.
X-Cog (Trapp, 2013)	SCZ	Same as in Saleem (2014)
SPARX (Poppelaars, 2016)	Depression	To reduce depressive symptoms as much or more than treatment as usual. As well as improve self-rated measures of depression, anxiety and hopelessness, and quality of life and on a clinician.
SPARX (Merry, 2012)	Depression	Same as in Poppelaars (2016)

SPRAX (Fleming, 2012)	Depression	Same as in Poppelaars (2016)
Playmancer (Fagundo, 2013)	Bulimia Nervosa	To examine whether the SVG is effective in reducing short-term impulsivity and emotional expression.
Playmancer (Tarrega, 2015)	Gambling Disorder	To examine whether SVG can enhance self-control and reduce general impulsive behaviours and improve emotional skills (control over stress, anxiety, anger).
Dojo (Scholten, 2016)	Subclinical Anxiety	To examine whether SVG can to reduce anxiety and improve emotion regulation in adolescents
Flowy (Pham, 2015)	CMHDs	To examine whether SVG is effective in reducing anxiety, panic, and self-report hyperventilation scores and improving quality of life scores.
FaceMaze (Gordon, 2014)	ASD	To improve emotion recognition in children with ASD.
BrainGame Brian (Dovis, 2015)	ADHD	To examine whether SVG can improve executive functions (working memory, inhibition, or cognitive-flexibility).and alleviate ADHD-symptoms.
BrainGame Brian (van der Oord et al., 2014)	ADHD	Same as Dovis (2015)
BrainGame Brian (De Vries, 2015)	ASD	Same as Dovis (2015)
Journey of the Wild Divine (Knox, 2011)	Depression and Anxiety	To examine whether SVG can reduce overall anxiety symptoms, somatic/autonomic symptoms and depression symptoms in adolescents.
CogoLand (Lim, 2012)	ADHD	To examine whether SVG can improve ADHD symptoms.
gNats (Coyle, 2011)	Depression and Anxiety	To examine whether SVG can decrease symptoms of depression and anxiety in adolescents.

Navigation Game (Amado, 2016)	SCZ	To examine whether SVG can improve patients' cognitive abilities, mainly in prospective memory and planning, with a clinical benefit and a benefit in social functioning, quality of life and self-esteem.
The Journey (Stasiak, 2014)	Depression	To examine whether SVG can reduce symptoms of depression in adolescents.
Junior Detective Program (Beaumont, 2008)	ASD	To determine whether SVG is effective in enhancing the social skills and emotional understanding of children with ASD.
Guardian Angel (Verduin, 2013)	Alcohol Use Disorder	To examine whether SVG can reduce incidents of relapse, prolong time to relapse, reduce alcohol craving, and improve self-efficacy with respect to relapse prevention.
Kitchen and Cooking (Manera, 2015)	MCI and Alz	To examine whether SVG can improve executive functioning and increase motivation levels.
Supermecha (Prins, 2011)	ADHD	To examine whether SVG will improve motivation, training performance, and working memory in children with ADHD and whether it can reduce ADHD-related symptoms.

Appendix C: Game Characteristics and User Experience Evaluation (Table 10)

Game Name	Game Objective	Game Story	User Experience Evaluation
Playmancer	To improve emotional regulation and achieve a sense of self-control by completing 3 minigames.	Player is presented with an Island that forms part of several islands in an archipelago. Player uses a customizable avatar to explore each island where different activities are available in a form of 3 minigames (i.e. diving, climbing, learning and training intensive relaxation tasks).	Patients feel comfortable using <i>Playmancer</i> a videogame (usability over 85%)
MindLight	To help little Arty to save his grandmother from evil forces that have possessed her and the house.	<i>MindLight</i> is an adventure biofeedback game. Game story is that little Arty left at the doorstep of a scary mansion faced with the task of saving his grandmother from the evil forces that have possessed her and the house. There he finds a glowing headset that teaches him (and the player) to overcome his fears by changing his state of mind.	Participants rated <i>MindLight</i> as more anxiety-inducing than a control commercial videogame. This means <i>Mindlight</i> had it intended emotion-inducing effect. However, control commercial videogame was more likely than <i>MindLight</i> to induce feeling of flow in children.
SocialVille	To complete exercises at various locations around the city.	SocialVille has 19 different exercises which are gradually introduced in the course of training, and which collectively target the various social cognition domains. SocialVille uses a layout of a town as context for the social cognitive training exercises. Various locations around the city contain exercises that have to be completed by the player.	Participants were largely satisfied with the training. The exercise instructions were clear and easy to understand. It was also easy to navigate in the game and has a potential to be used daily. Users has little concern about security issues. Graphics was somewhat attractive.
Let's Face It!	Is to correctly identify facial subsets presented in the picture	The Let's Face It! intervention is composed of 7 computer games targeting various face processing skills. Players could select mode and level of play. Game has 24 levels of varying degree of difficulty.	Not available

		In the game, players are presented with a series of pictures, based on the task, players have to attend to faces, recognize facial identity and expression and interpret facial cues in a social context.	
Poki-Poki	The aim is to engage in social activity by chatting, presenting virtual gifts, and imitating the other players to improve own avatar and become friends with other avatars	Players had to explore a virtual online world with the help of a clinician.	Not available
X-Cog	To successfully complete 16 tasks within the game.	Game consists of 16 visuomotor, memory, problem-solving and attention tasks. Participants had to control characters that face several adventurous challenges, such as rescuing a princess which has been captured inside of a maze, protecting salads from hungry snails etc. Each task can be administered in five different levels of difficulty from 'beginner' to 'superprofessional'.	Not available
SPARX	to restore the balance in a fantasy world dominated by defeating GNATs (Gloomy Negative Automated Thoughts) Gather SPARX and collect gems via tasks.	<i>SPARX</i> is an interactive fantasy game designed to deliver CBT. It utilises both first person instruction and a three-dimensional interactive game in which the young person chooses an avatar and undertakes a series of challenges to restore the balance in a fantasy world.	From study by Merry et al (2012): 71 (95%) of participants in the <i>SPARX</i> group believed that the type of support they received would appeal to other teenagers, and 64 (80.5%) of participants in the <i>SPARX</i> group would recommend the treatment to their friend. Of those who completed <i>SPARX</i> and returned satisfaction questionnaires (n=80), 53.2% (n=43) would have liked the sessions to stay the length they were.

Dojo	to help high-risk youths learn to manage their negative emotions by mastering relaxation techniques.	<p><i>Dojo</i> is a biofeedback game that has three rooms (fear, frustration, and anger), each with one or two relaxation tutorials and a challenging game that is designed to trigger the emotion in question and offers the opportunity to practice the acquired techniques.</p>	<p>Schuermans et al (2015): Satisfaction with <i>Dojo</i> was high. It was noted that participants enjoyed playing <i>Dojo</i> and liked the use of a videogame as a form of therapy. Four participants commented on the limited number of rooms in the game (they would have preferred more).</p>
Flowy	<p>To engage users in a series of minigames where they use breathing retraining exercises and perform diaphragmatic breathing to alleviate anxiety.</p>	<p>The minigames in <i>Flowy</i> range in theme, from sailing a boat down a river to flying balloons into the sky. Users touch the screen with their finger as they inhale and remove their finger from the screen as they exhale to control the gaming mechanics.</p> <p>The goal of each minigame is to correctly follow the breathing indicator while advancing in the game narrative; users progress through levels and achieve goals by breathing correctly and staying calm.</p>	<p>Overall, received positive ratings. Participants stated that “Flowy is a useful intervention”, easy to use and simple. However, the majority of the participants felt like <i>Flowy</i> won’t eliminate the root of their anxiety problem.</p>
FaceMaze	<p>To strengthen the link between the conceptual and motor representation of “happy” and “angry” emotions via overcoming obstacles in the maze.</p>	<p>In a game, player navigates a pac-man-like figure through a series of corridors, and removes face obstacles by producing the appropriate happy or angry expressions. Facial expressions as measured by the computer recognition emotion toolbox (CERT).</p>	Not available
BrainGame Brian	<p>To improve executive functioning by helping Brian, a young inventor who, throughout the game, to befriend the game-</p>	<p>This game is made of extensive 3D world with multiple areas and characters. All the characters have problems which the player character, Brian, helps to solve by playing minigames and inventing clever machines.</p>	Not available

	worlds inhabitants by creating increasingly elaborate inventions.	After each minigame the difficulty level of the game is adjusted to match the player's level of performance.	
Journey of the Wild Divine	The objective is to Learn breathing relaxation techniques by building bridges across a valley.	Biofeedback game, where a player has to perform an assortment of experiences (e.g. making a fire, building a wall and shooting a bow and arrow) in a fantasy land. The user has a goal of building a bridge across a valley. As the person's breathing slows and tension decreases, the bridge is built. If the user experiences frustration or anxiety, the bridge disappears. After a continuous amount of relaxation, the bridge is completed and the user may 'cross' to the next activity.	Not available
CogoLand	Different levels in the game have different objectives. The core component is to learn to move avatar effectively via attention training paradigm embedded in the game.	Biofeedback training game using an EEG headband. It is a 3D world which the player can explore using their avatar, whose movement speed is controlled by the intensity of the players' concentration. Players would complete three minigames involving speed, control and memory, which took 30 minutes including breaks.	Not available
gNats	The objective is to travel through a tropical island and meet a team of wild life explorers. Another objective is to learn strategies and challenge negative thoughts through interactions with NPCs.	In the game, players navigate through a 3D world in which they meet a series of characters. These characters introduce mental health concepts using spoken conversation, embedded animations, videos and questions regarding the player's own situation. Inhabitants of the island (NPCs) are influenced by gNats (negative automated thoughts) that are presented as little creatures.	Clinicians: All five clinicians reported positive overall impressions of gNats Island. They commented positively both on the impact of the overall intervention and on specific issues e.g. "the game changed the dynamics of the therapeutic interaction". Users: The majority found the game very enjoyable e.g. "It was a game and it

			was more fun than just talking.”
Navigation Game	To successfully navigate through a virtual city	It is a VR 3D game. Players have to navigate in the VR town, sharing a joystick. While one of the members in the group navigates, the others are helping him, in an interactive and collective effort. Participants should find their way (involving, therefore, attention and visuospatial organization), to memorize their itinerary (which involves memory for details and topographic memory abilities), to plan different actions (encouraging planning ability, flexibility, executive functions, as well as prospective memory), depending on the instruction they have to follow.	Not available
The Journey	To earn points and progress to the next module	It is a fantasy game-like environment i.e. the user selects and names an avatar, follows a narrative of a quest through magical lands where the content is linked to a theme (e.g. cognitive restructuring techniques), earns points for completing modules and is rewarded with a simple minigame at the end of each module.	The participants identified the following five features of the program as their favourite: “it was computer-based”; “showed me things I didn’t know about”; “I could use it at school”; “it was made for adolescents” and “it talked about mental health”. The main identified weaknesses of the program were technical glitches, excessive amounts of reading and perceived developmental inappropriateness (game was perceived as more appropriate for younger adolescents).
Junior Detective Training Program	To graduate from the academy and successfully complete missions.	The game was set in the year 2030, where postnatal genetic screening indicated that the central character in the game (the ‘junior detective’) was best suited to a career as a secret agent, specializing in the field of controlled remote	Not Available.

		viewing. Player has to advance through levels in order to graduate from a detective academy. Game is completed through effectively applying social skills to game missions.	
Guardian Angel	To assist individuals in recognizing and coping with relapse risk factors by acting as a “guardian angel” to a character in recovery.	In this simulation, players serve as a “guardian angel” that essentially guides a character in early recovery to make daily decisions in support of recovery and continued abstinence.	Not available
Kitchen and Cooking	To successfully cook dishes by following recipes.	Player has to cook four different recipes (4 minigames). Each dish has to be completed within certain time frame. Player has to choose correct cooking-actions, ingredients in order to make dish successfully. Each of the recipes is harder to cook than the last.	Participants rated the game experience as interesting, reported to be highly satisfied and motivated by the game, to experience more positive emotions than negative emotions, and not to be fatigued both at the beginning and at the end of the training. A few participants played almost only with the clinician, some others played up to 70 scenarios per week, thus suggesting that the game most probably met their interest.
Supermecha	To successfully conquer villages and fight evil robots via working memory training.	The player has to save the world from an evil group of robots, named Mechas, which have taken control and invaded villages. The player must take control of a “good” robot, the Supermecha, fight the evil robots. The game consists of three levels and in each level several villages could be “reconquered.” Once a village has been entered by the Supermecha, the evil robots can be shot: but the shot’s success is determined by the player’s performance in a WM task.	Children reported that they liked the task, would like to have the task at home, would like to do the task at home, and would often use the task at home.

Appendix D: Study outcomes and scales/measures used – full version (Table 4)

№	Game Name/Author	Outcome	Findings
1	<p>Playmancer</p> <p>Fernando Fernandez-Aranda, 2015</p>	<p>Clinical symptoms:</p> <ol style="list-style-type: none"> 1. To measure state of anxiety: State-Trait Anxiety Index (STAI) 2. To measure the experience and expression of anger: State-Trait Anger Expression Inventory-2 (STAXI) 3. To assess different cognitive and behavioural characteristics, which are typical in ED: Eating Disorder Inventory-2 (EDI-2) 4. To evaluate a broad range of psychological problems and symptoms of psychopathology: Symptom Checklist-Revised-90 (SCL-90), which divided into (a) GSI, designed to measure overall psychological distress; (b) PSD, designed to measure the intensity of symptoms, (c) PST, measures self-reported symptoms. <p>Therapy outcome:</p> <ol style="list-style-type: none"> 1. To measure rate of dropout 2. To measure rate of partial and total remission 	<p>Clinical symptoms: Statistical differences only appeared in the SCL-90-PST scores (lower mean for the CBT+ SVG condition, 55.1 versus 72.1; $p=0.046$).</p> <p>Not sig: EDI-2, SCL-90-GSI/PSDI total scores, STAI or STAXI scores</p> <p>Therapy outcome: No statistical difference emerged in the global test ($p = 0.22$). However, a moderate effect size was found in the comparison of the risk of dropout during the treatment, being higher for CBT - SVG compared with CBT +SVG (44.1 percent versus 20.0 percent, $d = 0.54$).</p> <p>Survival analyses showed that the rate of dropout during the therapy was higher for CBT- SVG compared with CBT + SVG.</p>
2	<p>MindLight</p> <p>Schoneveld, 2016</p>	<p>Subclinical symptoms:</p> <ol style="list-style-type: none"> 1. To measure anxiety symptoms in children: Spence Children’s Anxiety Scale (SCAS-C) and parents (SCAS-P) 	<p>Subclinical symptoms:</p> <ol style="list-style-type: none"> 1. No significant effect of game condition on any of the anxiety outcomes
3	<p>SocialVille</p> <p>Nahum, 2014</p>	<p>Social Cognition</p> <p>A) <i>Learning:</i></p> <ol style="list-style-type: none"> 1. Facial Memory, the performance-based Penn Facial Memory Test 2. Emotional prosody identification, the performance-based Prosody Identification Test 3. Emotion and social perception, performance-based Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT). <p>B) <i>Functioning</i></p>	<p>Social Cognition</p> <p>A) <i>Learning:</i></p> <ol style="list-style-type: none"> 1. Facial Memory, the median RT for correct responses of the Penn Facial Memory test significantly decreased for both immediate and delayed recall ($p < .007$ and $p < 0.03$). 2. Not sig: emotional prosody identification; emotion and social perception,

		<p>1. Functioning, the clinician-rated Global Functioning: Social and Role Scales (GFS) assessed social and occupational functioning</p> <p>2. Social Functioning, assessed by self-report Social Functioning (SFS)</p> <p>3. Quality of life, assessed by the clinician-rated Quality of Life Scale—Abbreviated (QLS).</p> <p>Motivation & Reward Sensitivity</p> <p>1. The self-report Behavioural Inhibition Scale / Behavioural Activation Scale (BIS/BAS)</p> <p>2. Reward sensitivity was assessed with the self-report Temporal Experience of Pleasure Scale (TEPS)</p>	<p>B) Functioning</p> <p>1. Functioning Subjects showed a significant increase in GFS's social functioning, and no significant change in role functioning ($p < 0.03$ and $p = 0.41$)</p> <p>2. Not sig: SFS, Quality Life Scale</p> <p>Motivation & Reward Sensitivity</p> <p>1. Significant decrease on the BIS ($p = .04$)</p> <p>Not sig: BAS</p> <p>2. Reward sensitivity: An increase on the TEPS Anticipatory Pleasure subscale ($p < 0.04$) and no significant change on the Consummatory Pleasure subscales ($p = 0.6$)</p>
4	<p>Let's Face It!</p> <p>Tanaka, 2010</p>	<p>Clinical Symptoms</p> <p>1. Facial subsets:</p> <p>Face dimensions</p> <p>Immediate memory for faces</p> <p>Masked features</p> <p>Expression</p> <p>Featural or holistic face recognition</p> <p>2. Objects Subsets</p> <p>House dimensions</p> <p>Immediate memory for cars</p>	<p>Clinical Symptoms</p> <p>1. Facial subsets:</p> <p>No sig: face dimensions, immediate memory for faces, masked features, expression</p> <p>f. Featural or holistic face recognition</p> <p>Relative to the control group, children in the active treatment group demonstrated <u>reliable improvements</u> in their analytic recognition of mouth features ($F(1, 38) = 5.35, p < .05$.) and holistic recognition of a face ($F(1, 38) = 7.69, p < .001$) based on its eyes features.</p> <p>2. Objects Subsets</p> <p>Not sig: house dimensions, immediate memory for cars</p>
5	<p>Poki-Poki</p>	<p>Clinical Symptoms:</p>	<p>Clinical Symptoms:</p>

	Cunhg,2016	<p>1. To identify emotional words and facial emoticons, asessed using Social Communication Questionnaire Current form-Korean version (SCQ-K).</p> <p>2.fMRI scanning: brain activity was assessed in two separate scans, in response to 1) 60 emotional words and 2) 60 facial emoticons.</p>	<p>1. SCQ-total scores were improved in both groups (game-CBT: $p=0.01$; offline-CBT: $p=0.04$). However, there was no significant difference in the degree of improvement between the two groups.</p> <p>2. In the game-CBT group, the changes in mean β values within the left fusiform gyrus were positively correlated with the changes in the correct identification rate of emoticons at a trend level ($r=0.71$, $p=0.02$) and negatively correlated with the changes in SCQ-I scores at a trend level ($r=-0.55$, $p=0.08$). There were no significant correlations between the changes in social communication, correct identification of emotional words and emoticons, and brain activity within other clusters.</p>
6	<p>X-Cog</p> <p>Saleem,2014</p>	<p>Clinical symptoms:</p> <p>1. Cognitive Symptoms: The Cambridge Neuropsychological Test Automated Battery (CANTAB) was used to assess cognitive function</p> <p>The tests used are as follows: Pattern Recognition Memory, Spatial Recognition Memory, Intra/Extra Dimensional Set Shift, Stockings of Cambridge and Choice Reaction Time.</p> <p>2. Negative Symptoms: The severity of symptoms was assessed using the Positive and Negative Syndrome Scale.</p>	<p>Clinical Symptoms:</p> <p>1. Cognitive Symptoms: post treatment there were significant differences found in the domain of executive function between the X-Cog and control group ($F=12.65$, $p < 0.01$)</p> <p>2. Negative symptoms: There was a significant difference in negative symptoms ($F = 3.32$, $p < 0.05$) with the X-Cog group scoring significantly lower than control group.</p>
7	<p>X-Cog</p> <p>Trapp, 2013</p>	<p>Clinical Symptoms:</p> <p>1. Positive Symptoms: used German versions of the Scale for the Assessment of Positive Symptoms (SAPS).</p> <p>2. Negative Symptoms: used the Scale for the Assessment of Negative Symptoms (SANS)</p> <p>3. Cognitive functioning: assessed using the</p> <p>a. Wisconsin Card Sorting Test (WCST) – <i>problem solving</i>.</p>	<p>Clinical symptoms:</p> <p>1. Positive Symptoms: Significant multivariate interaction effects for time x group ($F=4.47$, $p=.003$). Univariate analyses point to stronger decreases in SAPS ‘delusions’ for X-Cog group ($F=16.46$, $p=<.0005$)</p>

		<p>b. The German version of the Wechsler Memory Scale (WMS-R) - <i>memory</i>.</p> <p>c. The Trail Making Test (TMT) Part A und B - <i>processing speed</i></p> <p>d. Two versions of the Continuous Performance Test (CPT) for the assessment of sustained <i>attention</i>: The degraded CPT and the 3–7 CPT</p> <p>4. Other symptoms: self-rating scores of depressive and paranoid symptoms (PD-S subscales).</p> <p>Follow-up:</p> <p>1. Rehospitalisation after 5 years (relapse)</p> <p>2.Total time in psychosis</p>	<p>2. Not sig: negative symptoms</p> <p>3. Cognitive Symptoms: significant multivariate interaction effects (time x group) for attention (F=4.6, p=.003), memory (F=51.2, p<.0005) and problem solving (F=20.4, p<.0005) measures for <i>X-Cog</i> and control from</p> <p>Not sig: pre to posttest changes for processing speed</p> <p>4. Other symptoms:</p> <p>Significant multivariate interaction effects (time x group) (F= 3.40, p=.040). Univariate analyses point to stronger decreases in self-rated ‘paranoid thinking’ and ‘depressive’ symptoms for <i>X-Cog</i> patients (F= 4.16. p=.046 and F= 5.01, p=.029).</p> <p><i>NB: No significant main effect “group” on either measures.</i></p> <p>Follow-up</p> <p>1. No sig: rate of relapse; total time in psychosis</p>
8	<p>SPARX</p> <p>Poppelaars, 2016</p>	<p>Clinical Symptoms:</p> <p>1. Depressive Symptoms: Severity of depressive symptoms assessed via Reynolds Adolescent Depression Scale(RADS-2).</p> <p>2. Suicidal Ideation: using item 9 of the Children’s Depression Inventory (CDI)</p>	<p>Clinical Symptoms:</p> <p>1. Depressive Symptoms: Depressive symptoms decreased significantly in all conditions during the study period with a medium effect size (F=24.31, p < .001, partial η^2= 0.14) The analyses showed no difference in depressive symptoms across conditions, including the monitoring control condition (F=1.13, p =.34, partial η^2 =0.01) indicating that all conditions were equally effective in reducing depressive symptoms.</p>

			2. Suicidal Ideation: no significant differences between conditions in suicidal ideation ($\chi^2(3)=1.66, p=.65$)
9	SPARX Merry, 2012	<p>Clinical Symptoms:</p> <p>1. Depressive Symptoms:</p> <p>a. Children’s Depression Rating Scale-Revised (CRDS-R) - to assess <i>change in severity of depression</i></p> <p>b. Reynolds Adolescent Depression Scale-Second Edition (RADS-II) - to evaluate the <i>severity of depressive symptoms</i> in adolescents</p> <p>c. Mood and Feelings Questionnaire (MFQ) - to <i>detect clinical depression</i> in children and adolescents.</p> <p>2. Other measures:</p> <p>a. Quality of life enjoyment and satisfaction questionnaire (PQ-LES-Q)</p> <p>b. The Spence children’s anxiety scale (SCAS) –to <i>measure child anxiety</i>.</p> <p>c. The Kazdin hopelessness scale for children (Kazdin HPLS)= – to <i>measure suicidality</i>.</p> <p>d. Remission</p>	<p>Clinical Symptoms:</p> <p>1. Depressive Symptoms:</p> <p>a. CDRS-R: mean reduction of 10.32 in SPARX and 7.59 in TAU between group difference (2.73, 95% confidence interval –0.31 to 5.77; p=0.079). Suggests SPARX as effective as TAU in reducing depressive symptoms.</p> <p>b. RADS-II: Per protocol mean difference 3.65 (95% confidence interval -0.15 to 7.45, p=.060)</p> <p>c. MFQ: Per protocol mean difference 3.74 (confidence interval 0.33 to 7.16, p=.032)</p> <p>2. Other measures:</p> <p>a. PQ-LES-Q: Per protocol mean difference 2.23 (95% confidence interval -0.24 to 4.71, p=.077)</p> <p>b. SCAS: Per protocol mean difference 3.09 (95% confidence interval -0.31 to 6.50, p=.075)</p> <p>c. Kazdin HPLS: Per protocol mean difference 2.23 (95% confidence interval 1.22 to 2.35, p=.035). Mean changes were significantly higher in the SPARX group</p> <p>d. Remission: Rates were significantly higher in the SPARX group (43.7%) compared to TAU (26.4%) (p=.030)</p>
10	SPARX	<p>Clinical Symptoms:</p> <p>1. Depressive symptoms:</p>	<p>Clinical Symptoms:</p> <p>1. Depressive symptoms:</p>

	Fleming, 2012	<p>a. Children’s Depression Rating Scale-Revised (CDRS-R) - to assess <i>change in severity of depression</i></p> <p>b. Reynolds Adolescent Depression Scale-Second Edition (RADSI-II) - to evaluate the <i>severity of depressive symptoms</i> in adolescents</p> <p>2. Other measures:</p> <p>a. Remission - defined as a clinically significant change was defined as remission or a reduction of at least 30% in symptoms on the CDRS-R.</p> <p>b. Paediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q)</p> <p>c. Kazdin Hopelessness Scale (HPLS) – to <i>measure suicidality</i></p> <p>d. Children’s Nowicki Strick land Internal-External Control Scale short (20 item) form (CNSIE) - to <i>measure locus of control.</i></p>	<p>a. CDRD-R: Significantly greater reductions in depression for those using <i>SPARX</i> when compared to control(F=18.11, p=.0001)</p> <p>b. RADSI-II: Significantly greater reductions in depression for those using <i>SPARX</i> when compared to control (F=4.13, p=.05)</p> <p>2. Other measures:</p> <p>a. Remission - Remission rates were significantly higher in the <i>SPARX</i> group (78.9%) compared to control (36.4%) (p=.004)</p> <p>Not sig: PQ-LES-Q, HPLS, CNSIE.</p>
11	<p>Playmancer,</p> <p>Fagundo, 2013</p>	<p>Clinical Symptoms:</p> <p>1. Anxiety Symptoms</p> <p>a. State-Trait Anxiety Index (STAXI) – to measure anxiety</p> <p>2. The Symptom Check List-90 items-Revised (SCL-90-R) - only Anxiety subscale used</p> <p>2. Eating Disorder Symptoms:</p> <p>a. Eating Disorder Inventory 2 (EDI-2) - assesses different cognitive and behavioural characteristics, which are typical for ED</p>	<p>Clinical Symptoms:</p> <p>1. Anxiety Symptoms</p> <p>a. Not sig: STAXI</p> <p>b. SCL-90-R: SCL-90-R-anxiety mean scores achieved statistical significance (p=.050)</p> <p>2. Eating Disorder Symptoms:</p> <p>a. EDI-2: The number of binges and vomiting decreased from the time when <i>Playmancer</i> was initiated and finished (from 4.33 to 0.11 (p = .016, 95% CI for mean difference (MD): 1.03 to 7.41). Only subscales bulimia (p=.015) and ascetism(p=.019) achieved statistical significance</p>
12	<p>Playmancer</p> <p>Tarrega, 2015</p>	<p>Clinical Symptoms:</p> <p>1. Gambling Behaviour:</p> <p>a. South Oaks Gambling Screen (SOGS) – to <i>measure gambling behaviour.</i></p> <p>2. Impulsivity, Personality, and Psychopathology Measures</p>	<p>Clinical Symptoms:</p> <p>1. Gambling Behaviour:</p> <p>a. SOGS: Significant decrease in gambling behaviour(M= -3.75, 95% CI [-7.45, 0.05], p=.047)</p>

		<p>a. Barratt Impulsiveness Scale (BIS-11) – to measure impulsivity.</p> <p>b. I7 Impulsiveness Questionnaire (I7) – to measure impulsivity.</p> <p>c. State-Trait Anxiety Inventory (STAI) – to measure anxiety.</p> <p>d. State-Trait Anger Expression Inventory 2 (STAXI-2) – to measure expression of anger.</p> <p>e. Symptom Check List–90 Items-Revised (SCL-90-R) - only depression, anxiety, and hostility subscales and the three global indices global severity index (GSI), positive symptom distress index (PSDI) and positive symptom total (PST) were used.</p> <p>f. Temperament and Character Inventory-Revised (TCI-R) - to measure novelty seeking</p>	<p>2. Impulsivity, Personality, and Psychopathology Measures</p> <p>a. BIS-11: significant decrease in score for BIS: Cognitive impulsiveness (M= -2.50, 95% CI [-4.98, -0.02], p=.048) and BIS: Unplanned Impulsiveness (M= -5.83, 95% CI [-10.7, -0.95], p=.023).</p> <p>Not sig: BIS</p> <p>b. I7: significant decrease in score for I7: Impulsivity (M= -2.92, 95% CI [-5.65, -0.19], p=.038). Not significant results for other I7 scores.</p> <p>c. STAI: significant decrease in score for trait anxiety (M= -5.64, 95% CI [-8.58, -2.69], p=.002), but no significant results for state anxiety (p=.750)</p> <p>d. Not sig: STAXI-2</p> <p>e. SCL-90-R All the scale scores showed significant pre-post changes with a high effect size (from 0.96 to 1.38) except for the SCL PSDI mean scores on which the change was not significant.</p> <p>f. TCI-R: significant decrease in score for novelty seeking (M= -8.85, 95% CI [-16.5, -1.19], p=.027)</p>
13	<p>Dojo</p> <p>Scholten, 2016</p>	<p>Clinical Symptoms</p> <p>1. Anxiety symptoms: assessed via Spence Children Anxiety Scale (SCAS) - to measure level of anxiety</p>	<p>Clinical Symptoms</p> <p>1. Anxiety symptoms:</p> <p>SCAS - anxiety symptoms significantly decreased at follow-up in both conditions: total anxiety symptoms ($\beta = 0.70$, $p < .001$) and personalized anxiety symptoms ($\beta = 0.63$, $p < .001$). No statistical difference was observed between two conditions.</p>

14	<p>Flowy</p> <p>Pham, 2016</p>	<p>Clinical Symptoms</p> <p>1. Anxiety symptoms:</p> <p>a. Generalized Anxiety Disorder Scale (GAD-7)</p> <p>b. Overall Anxiety Severity and Impairment Scale (OASIS).</p> <p>c. Anxiety Sensitivity Index-3 (ASI-3)</p> <p>2. Panic Symptoms:</p> <p>Panic Disorder Severity Scale-Self Report (PDSS-SR).</p> <p>3. Hyperventilation symptoms:</p> <p>Nijmegen Questionnaire</p> <p>Other measures:</p> <p>1. Quality of life, enjoyment, and satisfaction were via Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form (QLES-Q-SF).</p>	<p>Clinical Symptoms:</p> <p>1. Not sig: GAD-7, OASIS, ASI-3</p> <p>2. No sig: PDSS-SR, however there was a significant decrease in panic for <i>Flowy</i> condition when results are compared pre/post test (p=0.011).</p> <p>3. Not sig: hyperventilation symptoms, however there was a significant decrease in hyperventilation for <i>Flowy</i> condition when results are compared pre/post test (p=0.016).</p> <p>Other measures:</p> <p>1. QLES-Q-SF: Flowy condition rated higher on quality of life questionnaire after the intervention comparing to control (p= 0.034).</p>
15	<p>FaceMaze</p> <p>Gordon, 2014</p>	<p>Clinical Symptoms</p> <p>1. Facial Expression: happy, angry and surprise expressions were measured via the computer recognition emotion toolbox (CERT) for each condition..</p>	<p>Clinical Symptoms</p> <p>1. Facial Expression:</p> <p>a. Happy - a significant increase in expression quality ratings of emotion “happy” post-<i>FaceMaze</i> (<i>happy version</i>) than pre-<i>FaceMaze</i> (<i>happy version</i>) (t = -5.39, p=0.001) for experimental condition.</p> <p>b. Angry - significant increase in expression quality ratings of angry post-<i>FaceMaze</i> (<i>angry version</i>)when compared to pre-<i>FaceMaze</i> (<i>angry version</i>)(t = - 5.41, p=0.001) for experimental condition.</p> <p>Nos sig: surprise recognition</p>
16	<p>BrainGame Brian</p> <p>Dovis, 2015</p>	<p>Clinical Symptoms</p> <p>1. ADHD Behaviour: The Disruptive Behavior Disorders Rating Scale (DBDRS) - <i>to measure levels of impulsivity and hyperactivity.</i></p> <p>Parent-rated EF- and motivational behaviour</p>	<p>Clinical Symptoms</p> <p>1. ADHD Behaviour: Both parents and teachers reported a significant decrease in ADHD symptoms at the post-test and at</p>

		<p>1.Executive Functioning and Motivational Behaviour: Behavior Rating Inventory of Executive Function questionnaire (BRIEF).</p> <p>2.Sensitivity to punishment and reward: Sensitivity to Punishment and Sensitivity to Reward Questionnaire for children (SPSRQ-C).</p> <p>General Problem Behaviours:</p> <p>1. Pediatric Quality of Life Inventory (PedsQL; parent and child versions).</p> <p>2. Problematic Behaviour: The Home Situations Questionnaire (HSQ) - <i>to measure impact of the problematic behaviour at home and public situations.</i></p> <p>Performance Measures</p> <p>1. Stop Task - inhibition task</p> <p>2. Stroop</p> <p>3. Corsi Block Tapping Task (CBTT) - to assess capacity of visuospatial VSM and WM.</p> <p>4.Digital Span</p> <p>5. Trail Making Test (TMT) - to measure cognitive flexibility.</p> <p>6. Raven coloured progressive matrices - to measure non-verbal reasoning ability .</p>	<p>the follow-up for all three conditions ($p = .0042$). There was no statistically significant difference between treatment conditions.</p> <p>Parent-rated EF- and motivational behaviour</p> <p>1.After training, parents reported a significant improvement on almost all scales of the BRIEF and on the Impulsivity/Fun Seeking scale of the SPSRQ-C (for both scales: some scales were insignificant after Bonferroni correction). There was no statistically significant difference between treatment conditions.</p> <p>General Problem Behaviours:</p> <p>1. After training, parents reported a significant improvement on all general problem behaviour indices. There was no statistically significant difference between treatment conditions.</p> <p>Performance Measures:</p> <p>1. Only children in the <i>full-active condition</i> showed improvement on measures of visuospatial STM and WM.</p> <p>2.Inhibitory performance and interference control only improved in the <i>full-active condition</i> and the <i>partially-active condition</i>.</p> <p>3. No Treatment-condition \times Time interactions were found for cognitive-flexibility, verbal WM and complex-reasoning.</p>
17	<p>BrainGame Brian</p> <p>van der Oord et al., 2014</p>	<p>Clinical Symptoms</p> <p>1.ADHD Behaviour: The Disruptive Behaviour Disorders Rating Scale (DBDRS) - <i>to measure levels of impulsivity and hyperactivity.</i></p> <p>Parent-rated EF- and motivational behaviour</p>	<p>Clinical Symptoms</p> <p>1.ADHD Behaviour: Children in the training condition showed a greater reduction in ADHD symptom behaviours (inattentive and hyperactive/impulsive</p>

		<p>1.Executive Functioning and Motivational Behaviour: Behaviour Rating Inventory of Executive Function questionnaire (BRIEF).</p>	<p>behaviours) as reported by the parent compared with children in the control condition ($F = 11.95$, $p < .01$ for IA subscale) and ($F = 9.68$, $p < .01$ for H/I subscale).</p> <p>Parent-rated EF- and motivational behaviour</p> <p>1.Executive Functioning and Motivational Behaviour: Children in the executive function training condition showed more improvement in EF (total score) and metacognition than children in the wait-list group ($F = 6.80$, $p < .05$ for metacog) and ($F = 6.84$, $p < .05$ for H/I total EF score).</p> <p>Other subscales of the BRIEF did not show significant effects.</p> <p>Follow up:</p> <p>1. Training condition - significant improvement from pre to follow-up test for the total score, metacognition and the inhibition subscale of the BRIEF and for the DBDRS subscales Inattention and Hyperactivity/ Impulsivity.</p>
18	<p>BrainGame Brian</p> <p>De Vries, 2015</p>	<p>Clinical Symptoms</p> <p>1.ADHD Behaviour: The Disruptive Behavior Disorders Rating Scale (DBDRS) - to measure levels of impulsivity and hyperactivity.</p> <p>2. Social Behaviour: The Children's Social Behavior Questionnaire (CSBQ, Dutch version)</p> <p>3. Pediatric Quality of Life Inventory (PedsQL; parent and child versions).</p> <p>Parent-rated EF- and motivational behaviour</p> <p>1.Executive Functioning and Motivational Behaviour: Behavior Rating Inventory of Executive Function questionnaire (BRIEF).</p> <p>Performance Measures</p> <p>1. Corsi Block Tapping Task (CBTT) - to assess capacity of visuospatial VSM and WM.</p> <p>2. Gender-emotion switch task - adaptation of general switch task (Flexibility).</p>	<p>Clinical Symptoms</p> <p>1.ADHD Behaviour: Children in the WM intervention-condition decreased more in their parent rated ADHD-behavior than children in the other intervention-conditions, and after the post-training this improvement continued only in the WM intervention-condition.</p> <p>2. Social Behaviour: improved equally in all three intervention conditions. No difference between conditions.</p> <p>3. Pediatric Quality of Life: improved equally in all three</p>

		<p>3. N-back task - to measure WM workload.</p> <p>4. Number-gnome switch-task (Flexibility).</p>	<p>intervention conditions. No difference between conditions.</p> <p>Parent-rated EF- and motivational behaviour</p> <p>1.Executive Functioning and Motivational Behaviour: improved equally in all three intervention conditions. No difference between conditions.</p> <p>Performance Measures</p> <p>1. WM: Post hoc analysis revealed a significant increase between pretraining, and post-training scores in all three conditions ($p < .001$), but not between post-training and follow up. scores ($p > .05$).</p> <p>2. Flexibility: Post hoc analysis revealed a significant decrease in RT switch costs between pretraining and post-training ($p < .01$), but not between post-training and FU ($p > .01$) (for all three conditions).</p>
19	<p>Journey of the Wild Divine</p> <p>Knox, 2011</p>	<p>Clinical Symptoms:</p> <p>1. Anxiety Symptoms:</p> <p>a. Multidimensional Anxiety Scale for Children (MASC) - <i>to measure overall anxiety.</i></p> <p>b.State-Trait Anxiety Inventory for Children (STAIC) - <i>to measure anxiety in children.</i></p> <p>2.Depression Symptoms: Children’s Depression Inventory (CDI)</p>	<p>Clinical Symptoms:</p> <p>1.Anxiety Symptoms:</p> <p>Significant improvement in active treatment group comparing on both scales to the control group (MASC:F(2,23)= 12.18, $p = .000$) and (STAIC: F(2,23)= 5.31, $p = 0.014$).</p> <p>2.Depression Symptoms:</p> <p>Significant improvement in active treatment group comparing to the control group (F(2,23)= 9.39, $p = 0.001$).</p>
20	<p>CogoLand</p>	<p>Clinical Symptoms:</p>	<p>Clinical Symptoms:</p>

	Lim, 2012	<p>1. ADHD Symptoms:</p> <p>a. Measured via ADHD Rating Scale, (ADHD-RS)</p> <p>b. EEG - <i>to measure whether change in ADHD symptoms is reflected in EEG recordings.</i></p>	<p>1. ADHD Symptoms:</p> <p>Significant improvement in parent-rated inattentive and hyperactive-impulsive symptoms (mean changes = -5.0 (5.8) and -5.7 (5.1) respectively and $p \leq 0.01$ for both IA and HI). The behavioural improvements were sustained but did not improve further after training sessions.</p> <p>Not sig: EEG</p>
21	<p>gNats</p> <p>Coyle et al., 2011</p>	<p>Clinical Symptoms:</p> <p>a. Child Behaviour Checklist (CBCL) - completed by clinicians.</p> <p>b. Youth Self Report (YSR) - completed by adolescents.</p>	<p>Clinical Symptoms:</p> <p>1. No data reported; narrative discussion states that CBCL indicated improvement.</p> <p>Inconclusive YSR results.</p>
22	<p>Navigation Game</p> <p>Amado et al., 2016</p>	<p>Clinical Symptoms:</p> <p>1. Severity of symptoms:</p> <p>a. Brief Psychiatric Rating Scale-BPRS, <i>provides an overview of the clinical symptomatology.</i></p> <p>b. Global assessment functioning scale (GAF)-<i>provides both a global evaluation of the symptomatology and an overview of the functional level of the participant.</i></p> <p>Other Measures:</p> <p>1. Social Autonomy, assessed via the Social Autonomy Scale (EAS)</p> <p>2. Quality of Life, measures via the Schizophrenia questionnaire for Quality of life (S-QOL).</p> <p>3. Self-esteem, measures via the self-esteem rating scale (SERS).</p> <p>4. Level of insight, assessed via the Insight dimension within a Self-report Insight Scale, the Birchwood Insight questionnaire (BIS).</p> <p>5. Interviews with clinicians.</p> <p>Neuropsychological Measures:</p> <p>1. Attention, visual scanning abilities, and speed processing: D2 cancellation test.</p> <p>2. Verbal and visual working memory: respectively, the digit span subtests of the WAIS-III.</p> <p>3. Verbal learning: Grober and Buschke verbal learning test</p> <p>4. Executive functioning: Battery for assessment of dysexecutive syndrome (BADS).</p> <p>5. Visuo-spatial abilities: Rey-Osterrieth Complex Figure Test (RCFT)</p>	<p>Clinical Symptoms:</p> <p>1. Severity of symptoms:</p> <p>Patients clinically significantly improved at the end of week 12 comparatively to the baseline for BPRS scores ($p < 0.001$), as well as for GAF scores ($p < 0.01$).</p> <p>Other Measures:</p> <p>1. At the end of the program, there was a significant improvement for the EAS-Total score ($p < 0.01$); for the S-QOL questionnaire, as well as the Insight short form questionnaire.</p> <p>Not sig: SERS</p> <p>Neuropsychological Measures:</p> <p>1. Significant improvements on D2 cancellation test ($p < 0.05$), WAIS-III ($p < 0.05$), standard scores of the Digit Span ($p < 0.01$). For retrospective and prospective memory virtual test, some scores were significantly different: "Where" egocentric recognition scores ($p \leq 0.05$), and</p>

		6. Retrospective and prospective memory virtual test	<p>the “When” recognition score ($p < 0.05$).</p> <p>2. No sig: Grober and Buschke test (1987), executive functioning measurements and RCFT. For retrospective and prospective memory virtual.</p>
23	<p>The Journey</p> <p>Stasiak et al., 2014</p>	<p>Clinical Symptoms</p> <p>1. Depression Symptoms</p> <p>a. Children’s Depression Rating Scale-Revised (CRDS-R) - <i>to measure remission and response rate.</i></p> <p>b. Reynolds Adolescent Depression Scale-Second Edition (RADS-II)- <i>to measure depressive symptoms.</i></p> <p>Other measures:</p> <p>1. the Pediatric Quality of Life Inventory (PedsQL)</p> <p>2. the General Short Form of the Adolescent Coping Scale (ACS) - <i>comprises of 18 behaviours that adolescents use to deal with their concerns</i></p>	<p>Clinical Symptoms</p> <p>1. CRDS-R: Significantly greater reductions in depression for those using <i>The Journey</i> ($F(1,27)=20.6$; $p < .001$)</p> <p>2. RADS-II: Greater reductions in depression for those using <i>The Journey</i> but not statistically significantly different from attention placebo group ($F(1,27)=3.39$; $p < .077$)</p> <p>At the end of treatment 88.2% of those who had received an active intervention had a higher response rate compared to control CPE. At 1-month follow-up there was still a difference between groups.</p> <p>Other measures:</p> <p>1. Bot sig: PedsQL</p> <p>2. ACS: There was a significant difference ($F(1,27) = 8.81$, $p = .006$) in the mean change on ACS Problem Solving scale between the treatment groups</p>
24	<p>Junior Detective Program</p> <p>Beaumont et al., 2008</p>	<p>Clinical Symptoms</p> <p>1. Social Skills Measures:</p> <p>a. Social Skills Questionnaire (SSQ) - <i>to evaluate children’s social competence.</i></p> <p>b. Emotion Regulation and Social Skills Questionnaire (ERSSQ) - <i>to examine competency in the skills taught in the program.</i></p>	<p>Clinical Symptoms</p> <p>1. SSQ-P: significant improvement from pre-to post-treatment for the intervention group at $p < .001$ but not for the control group. A similar pattern of results was found for the ERSSQ ($p < .001$) for treatment</p>

			<p>group and ($p > .83$),for the control group.</p> <p>Results showed that for both intervention groups, parent-reported improvements in social skills on the SSQ-P and ERSSQ were maintained at 6-week follow-up and 5-month follow up.</p>
25	<p>Guardian Angel</p> <p>Verduin et al., 2013</p>	<p>Clinical Symptoms</p> <p>1. Relapse:Obsessive Compulsive Drinking Scale (OCDS) - <i>to assess prediction of relapse.</i></p> <p>2. Alcohol craving - Alcohol Urge Questionnaire (AUQ)</p> <p>3.Self-efficacy: Task-Specific Self-Efficacy for Relapse Prevention Questionnaire (TSSE-RP) - <i>to measure self-efficacy to resist drinking.</i></p>	<p>Clinical Symptoms</p> <p>1. OCDS: significant and favoured the game condition over control condition, $p<0.05$ (participants in game condition were reporting to have fewer obsessive thoughts about alcohol).</p> <p>Not sig: rate of relapse</p> <p>2. AUQ: rating reduced in both conditions, reaching statistical significance ($p<0.05$). However, there was no difference between two conditions after treatment.</p> <p>3.TSEE-RP: At week 8 there was a significant difference between conditions ($p<0.001$),favouring game condition. At week 16, differences were no longer significantly different for the game condition.</p>
26	<p>Kitchen and Cooking</p> <p>Manera et al., 2015</p>	<p>Measures of symptom improvement:</p> <p>1. Includes measurement of time for scenario completion, gnosis, executive functions, and praxis.</p>	<p>Measures of symptom improvement:</p> <p>1. After 1 week of practicing on a scenario, participants became faster in both executive functions activity ($p=0.003$) and praxis activity ($p=0.004$). MCI participants improved significantly more in the executive functions activity compared to AD participants.</p>
27	<p>Supermecha</p>	<p>Outcome Measures:</p>	<p>Outcome Measures:</p> <p>1. CBTT: There was a significant interaction effect for conditions</p>

	Prins et al, 2011	<p>1. Corsi Block-Tapping Test. The Corsi Block-Tapping Test (CBTT)- <i>to assess the capacity of visuospatial short-term memory and WM.</i></p> <p>2. Motivation level: This was assessed in both an objective and subjective manner: objectively by assessing the amount of time the child used the training (absence time) and the number of sequences performed during training, and subjectively by asking children questions about the computerized WM task and the WM game.</p>	<p>and time, ($F(1, 49) = 8.30, p < 0.01$). Post hoc analysis showed that memory span in the game training condition significantly increased from pre- to post-test ($t(26) = 3.075, p < 0.01$), while no significant increase was found in the control training condition.</p> <p>2. Motivation level: Children who trained on the game version of a visuospatial WM task were more strongly motivated to do the training (reduced absence time during the training ($F(1, 44) = 81.41, p < 0.001$) and a greater number of trials completed), did better during training (fewer incorrect trials).</p>
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Appendix E: Game elements and characteristics (Table 11)

Game Mechanics	Game Name
<p>Avatar</p> <p>The game gives the player a visible, humanoid character to control</p>	<p>X-Cog, BrainGame Brian, CogoLand , Mindlight, Poki-Poki, SPARX, FaceMaze, The Journey, Supermecha</p>
<p>Biofeedback</p> <p>Biofeedback is used either as a method of control or for player information</p>	<p>Playmancer, Cogoland, Mindlight, Dojo, Flowy, FaceMaze, Journey of the Wild Divine</p>
<p>Non-Playable Characters (NPCs)</p> <p>The game features characters (animals, humans, robots, etc.) which are not controlled by a player</p>	<p>Braingame Brian, Kitchen & Cooking, Mindlight, SocialVille, Poki-Poki, SPARX, Dojo, gNats, Guardian Angel, Junior Detective Training Program, Supermecha</p>
<p>Dynamic Environment</p> <p>As the player plays the game, the virtual world changes permanently in response to their actions</p>	<p>Braingame Brian, Mindlight, Poki-Poki, SPARX, Dojo, Journey of the Wild Divine, gNats, Junior Detective Training Program, Navigation Game, Supermecha</p>
<p>Minigames</p> <p>The game includes/is broken into several different games with substantially different mechanics</p>	<p>Flowy, The Journey, SocialVille, Guardian Angel, Let’s Face It!, Playmancer, X-Cog, Cogoland, Braingame Brian</p>
<p>Leaderboards</p> <p>The game includes comparison of players over time, and ranks them.</p>	<p>Xcog, Poki-Poki,</p>
<p>Levels</p> <p>The game includes levels of differing design which the player must progress through to advance</p>	<p>Kitchen & Cooking, Cogoland, Mindlight, SocialVille, Let’s Face It!, Flowy, FaceMaze, Journey of Wild Divine, Junior Detective Training Program, Supermecha</p>
<p>Feedback</p> <p>Game rewards or punishes player based on player actions and interactions within the game</p>	<p>Playmancer, Xcog, Braingame Brian, Kitchen & Cooking, Mindlight, Let’s Face It!, SPARX, Dojo, Flowy, Poki-Poki, FaceMaze, Journey of the Wild Divine, gNats, Guardian Angel, Junior Detective Training Program, The Journey, Navigation Game, Supermecha</p>
<p>Score</p> <p>The game uses a scoring system to reward player’s actions</p>	<p>Playmancer,Xcog, Braingame Brian, Cogoland, Kitchen & Cooking, SocialVille, Poki-Poki, Guardian Angel, Junior Detective Training Program, The Journey, Supermecha</p>

3D graphics	Playmancer, Braingame Brian, Kitchen & Cooking, Cogoland, Mindlight, SPARX, Dojo, Poki-Poki, Journey of the Wild Divine, gNats, Navigation Game, Cogoland
2D graphics	Kitchen & Cooking, SocialVille, Let's Face It!, Flowy, FaceMaze, Guardian Angel, The Journey, Supermecha
Platform	Mindlight(Xbox 360), Playmancer (PC), SocialVille(PC), Let's Face It! (PC), Poki-Poki (PC), SPARX (PC), Dojo (PC), Flowy (Mobile), FaceMaze (PC), Journey of the Wild Divine (PC), gNats (PC), Guardian Angel (PC), Junior Detective Training Program(PC), The Journey (PC), Navigation Game (VR), Supermecha (PC), Kitchen and Cooking(Tablet)
<p>Storyline</p> <p>The game hinges around a central storyline, however vague, which the player may work their way through. The storyline can be flexible, but there must be setting of the scene and an explanation for why the player must perform the task</p>	Playmancer, Xcog, Braingame Brian, Kitchen & Cooking, Cogoland, Mindlight, SPARX, Dojo, Poki-Poki, gNats, Guardian Angel, Junior Detective Training Program, The Journey, Navigation Game, Supermecha
<p>Theoretical background</p> <p>Game was designed was guided by existing principles of a psychotherapy or other mental health practice.</p>	<p>Playmancer (CBT), Mindlight(ABM+exposure training),</p> <p>SocialVille(Cognitive enhancement therapy),</p> <p>Poki-Poki (CBT)</p> <p>SPARX (CBT)</p> <p>Dojo (CBT)</p> <p>Flowy (breathing exercises recommended by NICE),</p> <p>Journey of Wild Divine (biofeedback for heart rate variability),</p> <p>gNats (CBT)</p> <p>Guardian Angel (CBT)</p> <p>Junior Detective Training Program (social skills programs for ASD)</p> <p>The Journey (CBT)</p> <p>Supermecha (The WM training of Klingberg et al)</p>
Clinicians were involved in gameplay process	Playmancer, SocialVille, Poki-Poki, gNats

Appendix F: Semi-structured interview questions

(1) Schedule for MHPs

Introductions – introduce self, job title, and role. Explain purpose of the semi-structured interview – to build and a serious videogame.

Explain risk policy and reiterate confidential and exceptions to this.

“Thank you for agreeing to take part in this interview. Your responses will help us to build a videogame that might help patients with psychosis to self-manage their condition, for example by setting and working towards recovery goals, managing stress better, and/or monitoring and responding to early warning signs. The interview will last approximately 30 to 45 minutes and you will be asked questions about three key areas: what area(s) of self-management do people with psychosis struggle with the most, your opinion on existing apps/serious videogames in mental health care/psychosis, ideas for design and implementation, possible ethics considerations. We will also talk about your videogame preferences and habits. You are welcome to have a break at any time you need. Just to remind you that everything we talk about is confidential. Are you familiar with qualitative papers?” (This is how quotes will look like)

Do you have any questions?

Interview questions

1. Before we start, what support do clients (or patients at the Priory) currently get in developing self-management skills? By self-management, I mean...

2. In your view, what do patients with psychosis struggle with the most in terms of self-management

3. From your experience, what strategies have you found the most helpful in managing their condition? Are there strategies or tools you have found helpful in supporting clients to develop self-management skills? (Could prompt to try and make sure they think of stuff and to again make it clear to them what you mean by self-management e.g. – anything used for early warning signs monitoring and relapse prevention? For stress management? For setting and working towards recovering goals? For promoting adherence to medication?)

4. Do you have any experience with digital interventions for mental health problems? In particular for self-management? What do you like/dislike/like about them? Would you use it with your client? (If no prior experience then explore their general opinion and attitude towards using technology in mental health, especially videogames in treatment of psychosis).

5. What is important for you when evaluating digital interventions? (e.g. security, visual aesthetics)

Now, let me show you some examples of apps and games for health, this will give you an idea what we are aiming to build. Show Thrive and Re-mission. Answer any questions they have, explain purpose of the app and game. (Download both OR show youtube videos)

5. What do you think about this game and app?

6. Would you use it (thrive/re-mission) with your patient? If yes/no, please specify why and how (for “yes”)?

Now let’s talk about videogame that we want to design.

7. *In your view how often do clients here use their phones, maybe play games? Do they have access to the consoles/computers?*
8. *What sort of patient do you imagine using this videogame? (interested in age, diagnosis and cultural background of potential user, maybe level of education).*
9. *Would you want to participate in the gameplay? If yes, let's discuss possible ideas.*
10. *When and how often would you want to use this videogame with your patient? (during consultation/prior)*
11. *What do you think about future videogame being an online multiplayer game (where patients can play with each other for example)?*
12. *Do you see any advantages/disadvantages of using videogame as part of self-management intervention?*
13. *Do you have any reservations precautions or something you wouldn't want to see in a future game? Anything game designers should be cautious about?*
14. *Is there anything you would like to see in a game?*

"Thank you for your time". Do you have any questions?

(2) Schedule for service users

Introductions – introduce self, job title, and role. Explain purpose of the semi-structured interview – to build and a serious videogame.

Explain risk policy and reiterate confidential and exceptions to this.

"Thank you for agreeing to take part in this interview. Your responses will help us to build a videogame that will help people like you to do things to stay well.

The interview will last approximately 30 to 40 minutes and you will be asked questions about: what you do to keep yourself well, what bits do you find the most difficult to keep yourself well and how a videogame can help you with these struggles. We will also talk about your videogame likes and dislikes, habits.

You are welcome to have a break at any time you need. Just to remind you that everything we talk about is confidential unless you do say anything that worries me about your safety or the safety of others. Is that okay?

Do you have any questions?"

Interview questions

1. *Can you tell me what sort of things do you do to keep yourself well? (If they don't understand – "When people with a condition like yourself want to keep themselves well, they tend to do a number of different things and it is not the same for one individual, for example: dieting exercising, medication, hobbies, keep a diary. So what do you do?"*
2. *How do you know when things go wrong for you, and when it does happen what do you do? (Maybe notice trigger signals such as sleep too little/too much; stop seeing people).*
3. *Have you worked on a recovery plan with your care coordinator, maybe your own plan? How does it look like? (If don't understand ask "What sort of thing would you like to be doing that you can't do now, for example living independently?"*

4. What do you think about medications? Do you take medication to keep yourself well? Are they helpful? How difficult do you find it to remember to take them every day?

5. From your experience, what strategies have you found the most helpful in managing your condition? (ONLY if feel like not explored this topic enough)

6. How do you get on with your family/friends/ people on the ward? Do you think being with them helps you to stay well? Maybe do you do anything together that helps you to stay well? Do they do anything that makes you feel worth?

7. Do you know how other people with your condition keep themselves well? Can you tell me about this? Did you find anything they have said useful?

8. Have you ever used web-based guides/apps to keep yourself well (give example of mindfulness apps)? Did you find them helpful? What did you like/dislike about them?

9. What bits do you find the most difficult to keep yourself well? (If they don't have ideas diet, exercise).

Let's talk about videogames now

10. What videogames do you like to play? What do you like about these games?

11. How often do you play? Do you play on your own/with other people?

12. In your opinion, are videogames good or bad for you? Why? (Good, for example socializing/having fun).

Thank you, now I will show you an app and a game for health. Show Stress Free and Re-mission. Answer any questions they have, explain purpose of the app and game.

13. What do you think about this game and app?

14. What do you think about the idea of using videogames to help you to keep well OR to do things you need to do to keep yourself well? For example, videogames for exercising, dieting. If answered positively, explore further motivations; if answered negatively, explore reservations and concerns.

15. How would you feel about playing this game with other people (with your condition), family and friends? Would you prefer to play it in a single mode, co-op or multiplayer? Would you use this game with a clinician? What do you think about messaging (method of communication within a game)? If clinician was involved, would you want him/her to see what you are doing in game/ use game as part of the appointment? Or keep it strictly confidential?

16. In your opinion, what would putt you off in a game? / what would you like to see in a game?

17. Last questions, how would you design a game? What are your ideas?

“Thank you for your time”. Do you have any questions?

Appendix G: Digital supplement with game development materials

Anyone with this link can view and download game assets for the SVG that we wanted to create. You can use these assets in any game engine or 3D modelling software (as far as I am aware, I used 3dMax and it worked perfectly fine).

https://www.dropbox.com/sh/18hjqeemaxc2fap/AADjAR_rKCVIEPProhmlgeR9a?dl=0