A Thesis Submitted for the Degree of PhD at the University of Warwick

Using Virtual Reality Tools To Improve Social Cognitive Training In First Episode Psychosis

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A thesis submitted in partial fulfilment of the requirements
for the degree of Doctor of Philosophy in Health Sciences

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Acknowledgements

This doctoral thesis is dedicated to my late Dada (paternal grandfather) and late Dadi (paternal grandmother). Thank you for all the sacrifices you made, in the hope that we would have a better life. I think about you both every day and I know you would be so proud of me.

I began this journey in 2016; although my life has changed considerably since then, the thesis has been a consistent commitment and passion for the last five years. Undertaking it was a challenging experience; nevertheless, it would not have happened without the help and support of many people.

Working with those with psychosis has been a great privilege and humbling experience for me. I learned so much about a condition which is complex, commonly misunderstood, and stigmatised. People with psychosis live in a society that has not always given them the understanding and help they need. I hope to continue learning more and providing support for those with psychosis, whether in a research, voluntary or healthcare capacity.

First, I would like to thank each participant for taking part in this research. I've thoroughly enjoyed meeting and working with every single one of you and I hope you all enjoyed the experience.

Second, I would like to thank my family and friends for supporting me each step of the way. Thank you to my parents, who instilled the importance of education and knowledge in me. Special thank you goes to my sister Maaha, who is also my best friend. Although you are seven years younger than me, you have a lot of wisdom beyond your years. The countless hours of support you've provided me during this thesis has not been ignored (and I know you won't let me forget it).

Third, I would like to thank my supervisors for their support and guidance. Thank you Professor Andrew Thompson for choosing me to complete this PhD thesis. Thank you to Dr Jennifer Martin and Dr E. Bethan Davies for joining the supervisory team in my second year; I have appreciated your expertise and practical support. Dr Deborah Biggerstaff: thank you for joining the team in the final year. I know we haven't been working together for long, but I have valued your passion, advice and support.

Fourth, thank you to my funders, the Economics and Social Research Council. I have received so much support from my local ESRC Doctoral Training Centre; the staff were always friendly and available to give advice.

Fifth, I would like to thank those colleagues who played a significant part in this research; it was a pleasure to work with the co-investigators of the VEEP trial; I learnt so much from you all. Thank you to those colleagues at Orygen and Infinite Pixel. who provided support for the Phase 3 section of my doctoral thesis. Thank you to Dr Muna Dubad for providing me with additional support.

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Finally, thank you to my fellow doctoral thesis colleagues (you know who you are). We have shared so many experiences together and I hope these friendships last a lifetime. Special thank you goes to Latoya Clarke who was there for me from the beginning until the very end.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or institute of learning.

Published work and authorship

Phase 2 of this PhD thesis was part of a larger trial funded by Mental Health and Quality of Life (MQ): Transforming Mental Health, under the PsyIMPACT award and sponsored by the University of Warwick. The trial was called 'Virtual Reality as a Method of Delivering Social Cognitive Therapy in Early Psychosis' (VEEP) (short title: Social Cognitive Therapy in Virtual Reality in Early Psychosis). The candidate's supervisor Dr Andrew Thompson was the local principal investigator.

As a result, there are two peer reviewed publications from this trial; the candidate is second author on both papers (these are referenced in the publications section). Some of the data for studies 2,3 and 4b were published in these articles: this is elaborated on further in chapter 1 and at the beginning of chapters 5,6 and 8.

The candidate also presented the findings from her PhD thesis studies, at a number of UK and international conferences. These are outlined in the publication section.

Collaborator contributions

The VEEP trial co-investigators and local principal investigator wrote the grant application and contributed to the overall design of the VEEP trial.

With regards to phase 3, Infinite Pixel (UK) contributed to the filming and editing of the 1st 360° video and colleagues at Orygen (in Australia), contributed to the filming and editing of the 2nd 360°. Further details about their roles and contributions are provided in chapter 3.

Data collection, analysis and write up

The candidate collected all of the data reported in this PhD thesis, apart from the social cognition, social functioning, behaviour change, quality of life, neurocognition and psychopathology outcome measures collected during the VEEP trial (phase 2 of this thesis). The candidate analysed all of the data reported in this PhD thesis. The candidate's supervisors, Dr Andrew Thompson, Dr Deborah Biggerstaff, Dr Jennifer Martin and Dr Eleanor Bethan Davies, have overseen design, conduct and write up of all the studies presented in this PhD thesis.

Funding

The candidate's PhD was funded by a four year full time Economics and Social Research Council Doctoral Training Centre (ESRC DTC) joint studentship between Warwick Medical School, University of Warwick and NIHR MindTech MedTech Co-operative, University of Nottingham. The findings expressed are those of the candidate and do not represent the views of the ESRC.

Abstract

Background: Social cognitive interventions have not been thoroughly assessed in the beginning stages of psychosis. Digital interventions can help to engage with young individuals who are less likely to access psychological interventions.

Objectives: The aim was to assess the feasibility and acceptability of using virtual reality (VR) technologies to deliver social cognitive therapy in those with first episode psychosis (FEP).

Methods: This doctoral thesis adopted a mixed methods approach. Phase 1 involved undertaking a systematic review to evaluate the feasibility, acceptability, and efficacy of VR interventions for those diagnosed with psychosis. Phase 2 involved delivering the social cognition and interaction training via a virtual world, to those with FEP. Phase 3 involved a patient and public involvement (PPI) study to gather feedback on two 360° prototypes to deliver social cognitive therapy.

Results: The results from phase 1 showed that it was feasible and acceptable to deliver VR therapy to those with psychosis. During phase 2, the beta testing study showed that delivering VR social cognitive therapy was feasible and usable. A series of self-reported outcome measures, feedback forms and post-intervention interviews showed that it was feasible and acceptable. The findings from phase 2 informed the development of phase 3; to develop a more immersive personalised VR social cognitive therapy. PPI workshops were conducted with those with lived experience; findings indicated that whilst it could be a feasible and acceptable concept, further research is required to assess who would benefit the most from VR therapy and the importance of implementing it into services.

Conclusions: These are some of the first studies to use VR technologies to deliver social cognitive therapy in those with FEP, and so therefore further research is recommended.

Publications, conference presentations and academic prizes

PEER REVIEWED PUBLICATIONS

Thompson, A., **Elahi, F.**, Realpe, A., Birchwood, M., Taylor, D., Vlaev, I., Leahy, F., & Bucci, S. (2020). A feasibility and acceptability trial of social cognitive therapy in early psychosis delivered through a virtual world. *Frontiers in Psychiatry*, 11: 219.

Realpe, A., **Elahi, F.**, Bucci, S., Birchwood, M., Vlaev, I., Taylor, D., & Thompson, A. (2019). Co-designing a virtual world with young people to deliver social cognition therapy in early psychosis. *Early Intervention in Psychiatry,* 14: 37-43.

OTHER PUBLICATIONS

Elahi, F., Thompson, A., Biggerstaff, D., Martin, J., & Davies, B. (2020). A systematic review of the feasibility, acceptability and efficacy of virtual reality interventions for psychosis. *PROSPERO PROTOCOL*.

Elahi, F. (2019). Virtual reality and mental health: Does it work? *Ignite: Warwick Medical School Magazine*, 12-13.

CONFERENCE ABSTRACT PUBLICATIONS

Elahi, F., Birchwood, M., Bucci, S., Vlaev, I., Taylor, D., Realpe, A., Leahy, F., Martin, J., Davies, B., & Thompson, A. (2018). A qualitative study into using virtual reality to deliver social cognitive training in those diagnosed with first episode psychosis (VEEP Trial). *Early Intervention In Psychiatry*, 12(1): 136. [Conference Abstract].

Elahi, F., Thompson, A., Martin, J., Davies, B., Clarke, L., & Hollis, C. (2018). A systematic review of the effectiveness of virtual reality therapy in treating psychotic disorders. *Early Intervention In Psychiatry*, 12(1): 167. [Conference Abstract].

CONFERENCE RESENTATIONS

2020

Elahi, F. (2020) Using virtual reality tools to improve social cognitive training in first episode psychosis. *GIANT HEALTH 2020*, UK. [Online oral presentation].

2019

Elahi, F., Realpe, A., Bucci, S., Vlaev, I., Taylor, D., Birchwood, M., Leahy, F., & Thompson, A. (2019). A qualitative study into using virtual reality to deliver social cognition training to those diagnosed with early psychosis (VEEP trial). *International Association of Youth Mental Health Conference 2019*, Brisbane. [Oral presentation].

Elahi, F., Realpe, A., Bucci, S., Vlaev, I., Taylor, D., Birchwood, M., Leahy, F., & Thompson, A. (2019). Clinicians' perspectives of using virtual reality to deliver social cognition training to those diagnosed with early psychosis (VEEP trial). *International Association of Youth Mental Health Conference 2019*, Brisbane. [Oral presentation].

Elahi, F. (2019). Using virtual reality tools to improve social cognitive training in first episode psychosis. *Warwick Medical School Postgraduate Research Symposium*, University of Warwick, UK. [Oral presentation].

Elahi, F., Realpe, A., Bucci, S., Taylor, D., Vlaev, I., Leahy, F., Birchwood, M., De Valliere, N., Falconer, C., & Thompson, A. (2019). Virtual reality as a method of delivering social cognitive therapy in early psychosis (VEEP Study). *MQ Mental Health Science Meeting 2019*, UK. [Poster presentation].

2018

Elahi, F., Birchwood, M., Bucci, S., Vlaev, I., Taylor, D., Realpe, A., Leahy, F., Martin, J., Davies, B., & Thompson, A. (2018). A qualitative study into using virtual reality to deliver social cognitive training in those diagnosed with first episode psychosis (VEEP Trial). *IEPA 11th International Conference*, Boston, USA. [Poster presentation].

Elahi, F., Thompson, A., Martin, J., Davies, B., Clarke, L., & Hollis, C. (2018). A systematic review of the effectiveness of virtual reality therapy in treating psychotic disorders. *IEPA 11th International Conference*, Boston, USA. [Poster presentation].

Elahi, F. (2018). Using virtual reality tools to improve social cognitive training in first episode psychosis. *Postgraduate Research Showcase*, University of Warwick, UK. [Poster presentation].

Elahi, F. (2018). Using virtual reality tools to improve social cognitive training in first episode psychosis. *The 6th ESRC Midlands Graduate School Student Conference*, University of Warwick, UK. [Oral presentation].

Elahi, F. (2018). Using virtual reality tools to improve social cognitive training in first episode psychosis. *Warwick Medical School Postgraduate Research Symposium*, University of Warwick, UK. [Poster presentation].

Elahi, F. (2018). Using virtual reality tools to improve social cognitive training in first episode psychosis. *Digital Health & Care and Safety of Connected Health: Improvements & Applications Conference (DICOH) 2018*, UK. [Oral presentation].

Elahi, F., Thompson, A., Hollis, C., Martin, J., & Davies, B. (2018). Using virtual reality tools to improve social cognitive training in first episode psychosis. *MQ Mental Health Science Meeting 2018*, UK. [Poster presentation].

2017

Elahi, F. (2017). Using virtual reality tools to improve social cognitive training in first episode psychosis. *The 5th Midlands ESRC Student* Conference, University of Birmingham, UK. [Oral presentation].

Elahi, F., Thompson, A., Falconer, C., & Hollis, C. (2017). Using virtual reality tools to improve social cognitive training in first episode psychosis. *ESRC Funded Seminar "Interventions to tackle stigma and discrimination in relation to youth mental health" University of Greenwich*, UK. [Poster presentation].

Elahi, F., Thompson, A., Falconer, C., & Hollis, C. (2017). Using virtual reality tools to improve social cognitive training in first episode psychosis. *MQ Annual Science Meeting 2017*, UK. [Poster presentation].

DOCTORAL THESIS ACADEMIC PRIZES

- UKRI Policy Internship at the Behavioural Insights Team, Public Health England. (January - April 2020).
- Warwick Medical School Postgraduate Research Symposium Faculty Prize Winner for Best Oral Presentation – received £300. (May 2019).
- 3 Minute Thesis (3MT®) Competition University of Warwick Winner 2018. Received a £500 research grant and was entered into the UK National Semi Finals. (June 2018).
- 3 Minute Thesis (3MT®) Competition University of Warwick 'Popular Choice Award' 2018 – received a £50 Amazon Voucher. (June 2018).

Research training

QUALIFICATIONS

- Postgraduate Award in Teaching and Learning in Higher Education: Pass. University of Warwick. (2018 - 2019).
- Associate Fellow of the Higher Education Academy (2018).
- PGCert in Social Science Research: Pass. University of Warwick (2016 - 2017).

TRAINING COURSES

- ‘Standing up for Science’ workshop by Sense about Science. University of Warwick (14.06.19).
- 'Understanding Parliament' by Industry and Parliament Trust (IPT). London (25.03.19).
- Introduction to Systematic Reviews and Critical Appraisal Course. University of York, Centre for Reviews and Dissemination (20.11.17-22.11.17).
- ESRC Advanced Training: Communication Skills in Projects involving Direct Contact between Researchers and Participants. University of Warwick (31.05.17).
- ESRC Advanced Training: Introduction to Health Economics. University of Warwick (16.05.17).
- Diversity in the Workplace Training. University of Warwick (01.05.17).
- ESRC Advanced Training: Making a Difference – Research Impact and Engagement. University of Warwick (28.04.17).
- ESRC Advanced Training: Mixing It Up – An Advanced Level Introduction to Mixed Methods Research in Health and Social Sciences. University of Warwick (27.02.17-28.02.17).
- Digital Tool for Researchers (Online Module). University of Warwick (09.01.17-30.03.17).

MPHIL/PHD Upgrade Document

Some paragraphs of the candidate’s MPhil/PhD Upgrade document submitted and accepted in August 2017, have been used in this PhD thesis.

These are the following sections:

- 1.1 The incidence and prevalence of psychosis: paragraph 1 (lines 5-9).
- 1.3 Rationale for this PhD thesis: paragraphs 1, 2 (lines 1-12) and 3
- 2.2.1.2 Cognitive behavioural therapy: paragraphs 1-3, paragraph 4 (lines 1-5, 8-10).
- 2.2.3.1 Quality of life: paragraph 1 (lines 1-4), paragraph 3 (lines 1-3).
- 2.2.3.3 Functional outcomes: paragraph 2, paragraph 3.
- 2.3.3.3 Social cognition and interaction training: paragraphs 1 (including the three bullet points), paragraph 2 (lines 1-9).
- 2.3.4 Social cognition and social functioning: paragraph 1 (lines 1-4), paragraph 2, paragraph 3 (lines 1-6).
- 2.5.1.1 Introduction.
- 2.5.1.3.4 Realism factors: paragraph 2 (lines 4-7), paragraph 3.

List of abbreviations

AI: Assertion Inventory

ANOVA: Analysis of Variance

APA: American Psychological Association

App: Application

AVH: Auditory and Visual Hallucinations

BAVQ-R: The Revised Beliefs About Voices-Questionnaire

BLERT: Bell Lysaker Emotion Recognition Task

BNCE: Brief Neuropsychological Cognitive Examination

BPD: Borderline Personality Disorder

BPRS: Brief Psychiatric Rating Scale

BSREC: Biomedical and Scientific Research Ethics Committee at the University of Warwick

CAVE: Cave Automatic Virtual Environment

CBT: Cognitive Behavioural Therapy

CBTp: Psychosis Focused Cognitive Behavioural Therapy

CDS: Calgary Depression Scale

CENTRAL: Cochrane Central Register of Controlled Trials

CINAHL: Cumulative Index to Nursing and Allied Health Literature

CG: Control Group

COREQ: The Consolidated Criteria for Reporting Qualitative Research

COVID-19: The COVID-19 Pandemic

CSQ-SF: Cognitive Style Questionnaire

CWPT: Coventry and Warwickshire Partnership NHS Trust

CVD: Cardiovascular Disease

DHI: Digital Health Interventions

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, 5th Edition

DVT: Digital Vigilance Test

EIP: Early Intervention in Psychosis

EuroQol 5-D: 5 level EuroQol Quality of Life Outcome

EG: Experimental Group

FEP: First Episode Psychosis

FoV: Freedom of View

F-SCIT: Family Assisted Social Cognition and Interaction Training

GDPR: General Data Protection Regulation

GRIPP2: The Guidance for Reporting Involvement of Patients and the Public 2nd Checklist

HMD: Head Mounted Display

iCBT: Internet Based Cognitive Behavioural Therapy

ICD: International Classification of Diseases

ISRCTN: International Standard Randomised Controlled Trial

ITQ: Immersive Tendencies Questionnaire

KMO: Kaiser-Meyer-Olkin

MMAT: Mixed Methods Appraisal Tool

MMSE: Mini Mental State Examination

MOOI: Massive Online Open Intervention

MQ: Mental Health and Quality of Life

NART: National Adult Reading Test

NHS: National Health Service

NICE: National Institute for Health and Care Excellence

NIHR: National Institute for Health Research

OPUS: Intensive Early-Intervention Program for First Episode Psychotic Patients

PANSS: The Positive and Negative Syndrome Scale

PICO: Participant Intervention Comparator and Outcome

PPI: Patient and Public Involvement

PQ: Presence Questionnaire

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-analyses

PSP: Personal and Social Performance Scale

PSYRATS: Psychotic Symptom Rating Scales

QOL: Quality of Life

RA: Research Associate

RBMT: Rivermead Behavioural Memory Test

RVP: Rapid Visual Processing

RCFT: Rey-Osterrieth Complex Figure Test

RCT: Randomised Controlled Trial

REC: Research Ethics Committee

RF: Research Fellow

SADS: Social Avoidance and Distress Scale

SBS: Social Behaviour Scale

SCIT: Social Cognition and Interaction Training

SCSQ: Social Cognition Screening Questionnaire

SCST: Social Cognitive Skills Training

SFS: Social Functioning Scale

SMI: Severe Mental Illness

SPSS: Statistical Package for the Social Sciences

SSIT: Simulated Social Interaction Test

SSQ: Simulation Sickness Questionnaire

TAU: Treatment as Usual

TDF: Theoretical Domains Framework

TEQ: Training Experience Questionnaire

3D: Three Dimensional

2D: Two Dimensional

ToM: Theory of Mind

TRAS: Trower's Rathus Assertiveness Schedule

UK: United Kingdom

VPDS: Voice Power Differential Scale

VEEP: **V**irtual Reality as a M**e**thod of Delivering Social Cognitive Therapy in **E**arly **P**sychosis

VE: Virtual Environment

VR: Virtual Reality

VR-360°: Virtual Reality 360° Social Cognition Treatment

WCST: Wisconsin Card Sorting Test

WMS: Warwick Medical School

WHO: World Health Organization

Appendices

Glossary terms

Table 1: Key definitions

Acceptability	A multi-faceted construct that represents the extent to which individuals delivering or receiving a healthcare intervention consider it to be appropriate. This is based on anticipated or experienced emotional and cognitive responses to the intervention (Sekhon, Cartwright, and Francis, 2017).
Augmented reality	Augmented reality (AR) is a live direct or indirect view of a real world physical environment, where its stimuli have been 'augmented' by a computer-generated input. This can include sound, graphics, and videos (Hilty et al., 2019). Put simply, AR combines both the virtual and real world elements together, which also includes visuals, sight, sound and even smell (Juan et al., 2005).
Avatar	Avatars are users of the virtual world who can connect and interact with others around them. Avatars provide users with a body by which they can experience the 3D virtual world (Girvan, 2018).
Efficacy	The capacity for a therapeutic effect or beneficial change to occur, because of an intervention (Burches and Burches, 2020).
Feasibility	The extent to which those who develop and implement a research intervention or study, can do so within an appropriate and authentic environment. Here a researcher can understand the intervention further and consider aspects relating to

	management, resources and procedures (Gagnon and Barber, 2018).
Immersion	Immersion can be defined as the level of sensory realism and the authenticity of an experience that a VR environment provides (Slater, 2009).
Negative symptoms	This is when individuals experience social withdrawal, self-neglect, lack of drive, emotional apathy and reduction in speech. Individuals may also appear emotionless (NICE, 2014).
Presence	Presence refers to a sense of existing in a particular space, time and/or location (Sheridan, 1992; Usoh et al., 2000). It provides a world where an individual is exposed to a specific lived experience (Banos et al., 2005; Riva et al., 2003). Social presence can be described as the ability for a user to believe they are in the presence of, and engaging with other individuals within a VR environment (Blascovich et al., 2002).
Personalisation	A procedure which alters the interface, information, access, content, functionality or distinctiveness of a systems to enhance its relevance to an individual or groups of individuals (Fan and Poole, 2006).
Positive symptoms	These include hallucinations and delusions (NICE, 2014).
Psychosis	Psychosis can be defined as a condition characterised by hallucinations (when an individual sees or hear things that are not there), delusions (when an individual displays strong beliefs which are

	not shared by others around them) and disordered thought processes (Reed, 2008).
Social cognition	Social cognition is a combination of neurocognitive mechanisms associated with recognising, understanding and responding to social cues in the environment (Healey, Bartholomeusz and Penn, 2016). More specifically, this refers to one's ability to recognise, relate to and monitor the emotions of others.
Usability	This refers to how pleasant and easy user interfaces are to use. It can be defined by 1) learnability (behaviour of the system and ease of learning the functionality 2) efficiency (the user's level of productivity in using the interface 3) memorability (ability to remember the system functionality 4) errors (the ability of the system in supporting users in making less errors) 5) satisfaction (how pleasant the design is to use) (Nielson, 1993; Sousa and Lopez, 2017).
Virtual reality	Virtual reality (VR) can be defined as a computer-generated simulation of a natural or artificial environment. Visual and auditory output devices allow individuals to experience and interact with this virtual environment (VE) in real time (Mantovani et al., 2003; Pratt, Zyda and Kelleher, 1995).
Virtual World	Virtual worlds are developed from VR technologies and can be defined as open ended, computer simulated environments that users design and create the world, behaviours and objects (Delwiche, 2006).

1. Introduction

1.1 The incidence and prevalence of psychosis

Prior research states that the age of onset of psychotic experiences is late teens to early 20s (Kessler et al., 2007; Solmi et al., 2021). McGrath et al. (2016) stated that the median age of onset of psychotic experiences was 26 years. According to Public Health England (2021), the new cases of psychosis in England between the ages of 16-64 is 18.1 per 100,000. According to a general population survey ‘Psychoses in Finland’, the lifetime prevalence of psychotic disorders is 3.06%, with schizophrenia varying between 0.12% to 1.6%. This is followed by 0.32% for schizoaffective disorders, 0.24% for bipolar disorder I, and 0.18% for delusional disorders (Perala et al., 2008). Moreno-Küstner, Martin and Pastor (2018) found that the median lifetime prevalence of psychosis was 7.49 per 1000.

A systematic review and meta-analysis found that all clinical psychotic disorders have an annual incidence rate of 32 per 100,000 people in England. For all clinically relevant psychoses, schizophrenia and non-affective psychoses, studies have shown that incidence declines with age for both men and women. Where data was available for those with affective psychosis, there were no significant differences between men and women prior to the age of 45 years. However, rates were higher after the age of 45 in women (Kirkbride et al., 2012). An updated systematic review and meta-analysis reported similar results; incidence of all psychotic disorders was found to be 26.6 per 100,000 people. However, with regards to affective psychotic disorders, women were found to be at higher risk than men (Jongsma et al., 2019). Previous studies have found that the incidence rates peak in two age groups; 18-24 years and 45-54 years (Amminger et al., 2006; Cheng et al., 2011; Saha, Whiteford and McGrath, 2014).

1.2 Living with psychosis

Psychosis can often lead to decades of severe psychological distress, disability, substance abuse, unemployment, and homelessness (Bennett and Rosenheck, 2021). Some of these factors are outlined below in more detail.

1.2.1 Migrant status and ethnicity

Previous studies have consistently found raised rates of psychotic symptoms in immigrant groups (Kirkbride et al., 2008). The stress vulnerability model (Nuechterlein and Dawson, 1984) can be used to explain the raised rates of psychosis in immigrant populations. Isolation and potential abandonment that accompanies immigrants in unfamiliar surroundings can lead to stressful experiences. This illustrates that environment and individual risk factors may interact with and compound each other (Shah, Mizrahi, and McKenzie, 2011). However, further research is required to replicate these findings. Nevertheless racism embedded into the social environment may limit BAME individuals from receiving the relevant resources and care required (Morgan et al., 2010). It is important to note that raised rates of psychosis remain after controlling for socio-economic status (Kirkbride et al., 2008). However, socioeconomic status should be viewed as a cofounder in the relationship between psychosis risk and ethnic group (Morgan et al., 2007).

1.2.2 Comorbidity of psychosis

Previous studies have indicated that there are high prevalence rates of psychiatric comorbidity in those diagnosed with psychotic conditions. Such patients are less likely to recover from their symptoms, which have a detrimental impact on clinical outcomes (Sim et al., 2006). Berman et al. (1995) found that approximately 30.6% of patients diagnosed with schizophrenia also experienced a lifetime prevalence of obsessive-compulsive features, whilst Sim et al. (2003) found that of those diagnosed with FEP, psychiatric comorbidity was found in approximately 36.7%.

Of those diagnosed with psychotic illnesses, the leading cause of death is cardiovascular disease (CVD). Conditions such as diabetes, metabolic syndrome and obesity are more likely to result in worse outcomes for those diagnosed with psychosis. This may be due to the fact that patients with mental illnesses are vulnerable to inadequate levels of care and lead an unhealthy lifestyle (Kozumplik, Uzun, and Jakovljevic, 2009). Another challenge is determining whether somatic symptoms are independent illnesses, or a by-product of the psychotic condition and antipsychotic medication (Sim et al., 2003).

1.2.3 Socioeconomic factors

Socioeconomic disadvantages can apply to both populations and individuals who live in low-income circumstances. Higher prevalence and higher mortality are associated with socioeconomic disadvantage. These circumstances can take multiple forms such as poverty, limited job security, poor social networks, and low self-esteem (Brunner, 1997). The relationship between social disadvantage, poverty and poor health outcomes has been firmly established in research (Burns and Esterhuizen, 2008). Furthermore, research has confirmed that poverty and social disadvantage are more strongly correlated to psychosis and schizophrenia, compared to other mental health conditions (Read et al., 2008). Due to stigma, challenges in day to day functioning, low income and a fluctuation in symptoms, many people with psychosis are forced to live in substandard accommodation. This can result in lower quality of life and rising unmet needs, when compared to those in high support housing (Lambri et al., 2012).

1.3 Rationale for this doctoral thesis

The mainstay of treatment in psychotic disorders is invariably long-term pharmacological and psychological treatments. However, compliance with effective treatments is challenging. Bartholomeusz et al. (2013) found that young individuals struggled to attend and adhere to traditional face-to-face treatments. Reasons for this may be because social functioning impairments hinder their ability to engage with their social environments (Addington, Saeedi and Addington, 2006; Bartholomeusz and Allott, 2012).

Social cognition (our ability to process and apply social information) is associated with poor functional outcomes in those diagnosed with first episode psychosis (FEP). Social cognition is a stronger predictor of functional outcomes (social skills and community functioning) than neurocognition (people's mental abilities such as memory, language processing and executive functions), which suggests that it is an important mechanism to target for functional recovery (Bartholomeusz and Allott, 2012). Previous research has indicated that social cognitive interventions positively affect social cognition and subsequently social functioning in those diagnosed with psychosis (Addington et al., 2006). However, social cognition interventions have not been as thoroughly assessed in the early phase of psychosis, when the opportunity to improve outcomes is the greatest. Therefore, social cognitive interventions are likely to result in benefits when implemented during the early phase of psychosis (Healey et al., 2016).

Developments in technology mean that there are potentially more beneficial methods of providing psychological interventions to those who find it challenging to adhere to face-to-face treatments (Andersson, 2018; Batra et al., 2017). Virtual reality (VR) is one such technology that enables individuals to interact with three-dimensional (3D) social environments (Bombari et al., 2015). Over the last few decades, VR interventions have been implemented in the treatment and understanding of clinical populations with psychosis and have been used to treat social cognitive problems in other clinical populations, such as those with intellectual disabilities (Freeman et al., 2017; Valmaggia, Day and Rus-Calafell, 2016). Its benefit lies in providing participants with a sense of presence and immersion whilst enabling clinicians to manipulate and control the environments. These trigger physiological and psychological responses in patients, which are similar to the real world, thereby increasing the ecological validity (Gregg and Tarrier, 2007).

1.4 Aims and objectives

Considering the above, this doctoral thesis will examine whether VR is a feasible and acceptable method to deliver therapy to improve social cognition impairments in those diagnosed with psychosis. This will be achieved via three phases:

i) A systematic review will be conducted to evaluate the feasibility, acceptability, and efficacy of VR interventions for those diagnosed with psychosis.

ii) A VR therapy will be delivered to those with FEP to target social cognition deficits. Here, an existing social cognitive treatment entitled ‘social cognition and interaction training’ (SCIT) will be refined and delivered via an existing online virtual world called Second Life® (2017).

This section of the doctoral thesis is part of a wider trial called ‘Virtual Reality as a Method of Delivering Social Cognitive Therapy in Early Psychosis’ (VEEP). This is funded by a charity called Mental Health and Quality of Life

(MQ): Transforming Mental Health. Figure 1 provides more information on the structure of this trial and the sections that are presented in this doctoral thesis.

iii) Two 360° videos will be developed, as part of a novel social cognitive treatment. 360° videos are filmed using an omnidirectional camera. These videos can be viewed on a screen or through an immersive head-set (Blascovich et al., 2002). This is called VR-360° social cognition treatment (VR-360°). The potential application of 360° videos in mental health is particularly novel and has yet to be assessed.

The implications of this research could be far-reaching, not least for the improvement of social cognition in psychosis but for other conditions where social interactions, avoidance and exposure to social scenarios are issues (Sullivan et al., 2013).

1.5 The importance of feasibility and acceptability

1.5.1 Feasibility

Feasibility is used to assess whether an intervention is appropriate for further testing. This research may identify what changes need to occur if any. Feasibility studies focus on the process of creating and implementing a therapy, resulting in a preliminary understanding of participants' responses to the intervention (Orsmond and Cohn, 2015).

Thus, a feasibility study may take place when (Bowen et al., 2010):

- There are few previously published studies or data using a particular intervention mechanism.

- Previous interventions have had positive outcomes, but in different settings to the one about to take place.

In this doctoral thesis, feasibility will be assessed using recruitment, attendance and completion data.

1.5.2 Acceptability

Sekhon, Cartwright and Francis (2017) conducted an overview of reviews into the acceptability of healthcare interventions and developed the following definition of acceptability:

> “A multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention” (Sekhon et al., 2017; pg.4).

Therefore, this doctoral thesis will measure acceptability via the following:

- Reasons for dropping out
- Opinions and perceptions about the VR interventions
- Willingness to take part in the VR interventions
- Participant experiences
- Any associated side effects from taking part in the VR interventions

1.6 Summary of phases, studies and research aims

PHASE 1, study 1 - a systematic review will be conducted to evaluate the feasibility, acceptability, and efficacy of VR interventions for those diagnosed with psychosis.

PHASE 2

Studies 2, 3, 4, 5, and 6 aim to evaluate a VR intervention to target social cognition deficits in those people diagnosed with FEP. A feasibility and acceptability proof of concept mixed methods trial will be conducted. The therapy called the SCIT (Roberts and Penn, 2009) will be altered and implemented into a virtual world called Second Life®. Service users diagnosed with FEP will be recruited to take part in this trial. This phase is comprised of multiple studies:

Study 2 is a beta testing evaluation of the VEEP intervention. This involves recruiting PhD students to take part in two beta testing sessions. After this is completed, the findings will be used to refine the intervention before those diagnosed with FEP are recruited.

Study 3 is a quantitative analysis of the SCIT delivered via a virtual world in those with FEP (the VEEP trial). Outcome measures will be collected at pre and post intervention. This will involve a comparison between completers and non-completers scores at post-intervention. A measure of participants' presence will be analysed at post-intervention, as well as their end-of-session feedback forms.

Study 4a is a Patient and Public Involvement (PPI) study to assist with the design of the interview schedules for the VEEP trial. PPI advisors who assist with the codesign of the VEEP trial, will also be recruited to review the interview schedules for service users. The findings will be used to refine the interview schedules for VEEP participants.

Study 4b is a qualitative investigation of the SCIT delivered via Second Life® for those with FEP (the VEEP trial). Both completers and non-completers will be interviewed post intervention to provide their feedback on their experiences of taking part in the intervention.

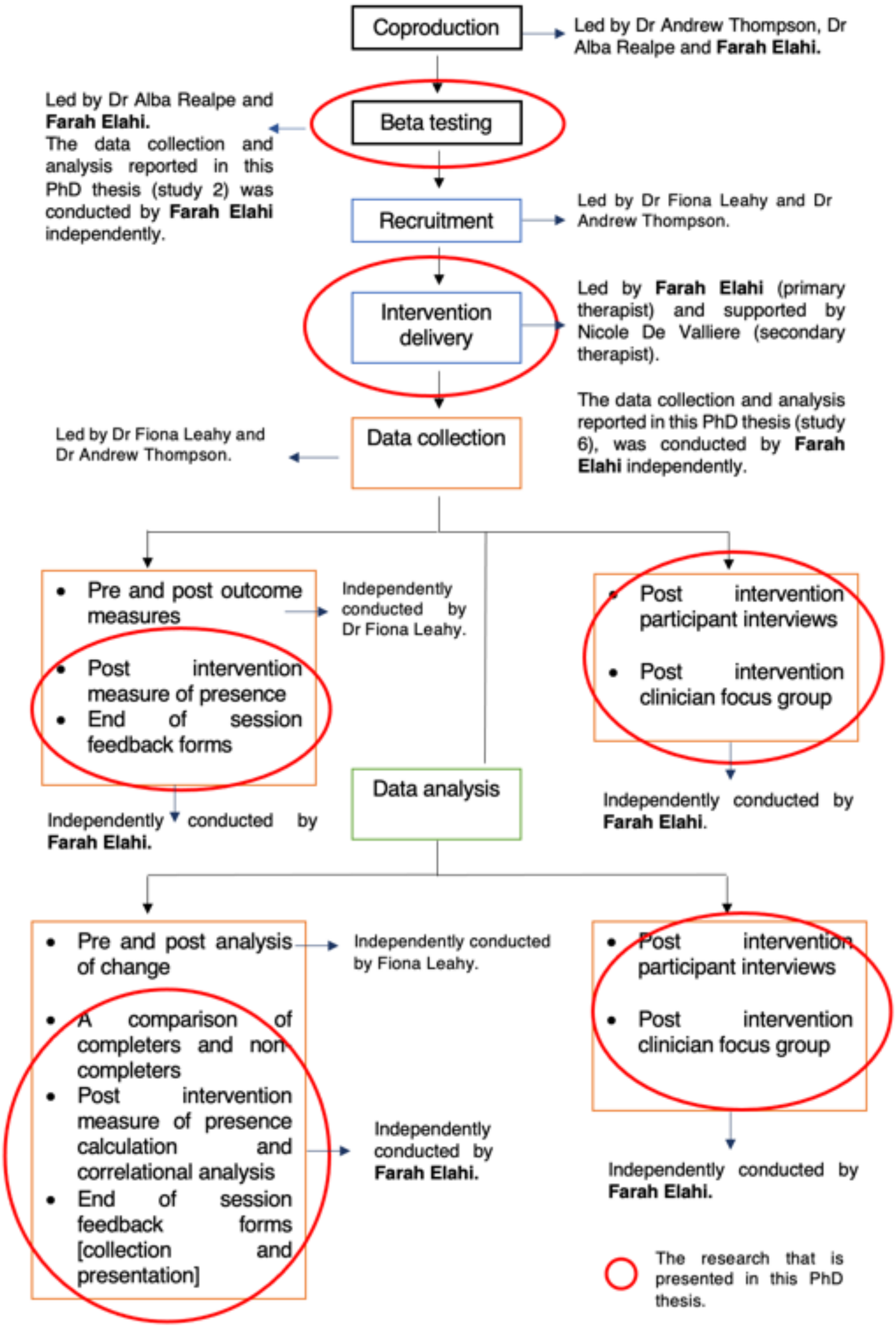
Study 5 is a qualitative investigation into the SCIT delivered via Second Life® from clinicians' perspective (the VEEP trial). Here, clinicians (care coordinators) from an Early Intervention In Psychosis (EIP) team, whose service users will be taking part in the VEEP trial, will take part in a focus group. They will be asked to provide feedback on the VEEP trial.

Study 6 is an autoethnography of a therapist's experience of delivering the SCIT via Second Life® for those diagnosed with FEP (the VEEP trial). This will be written from a first-person perspective, as the candidate will be the primary therapist delivering the SCIT.

PHASE 3, study 7 involved developing a VR intervention to target social cognition deficits in those people diagnosed with FEP. In this VR therapy, two videos will be scripted and filmed in a 360° format. The scripts of these videos will be based on the SCIT. After this, PPI workshops will be conducted with advisors. These advisors will be young people with lived experience of mental health issues.

The below figures outline the following:

- Figure 1 – VEEP trial structure
- Figure 2 – VR-360° development structure
- Figure 3 – Overview of the doctoral thesis chapters
- Figure 4 – Doctoral thesis timeline



Led by Dr Andrew Thompson, Dr Alba Realpe and **Farah Elahi.**

Led by Dr Alba Realpe and **Farah Elahi.** The data collection and analysis reported in this PhD thesis (study 2) was conducted by **Farah Elahi** independently.

Led by Dr Fiona Leahy and Dr Andrew Thompson.

Led by **Farah Elahi** (primary therapist) and supported by Nicole De Valliere (secondary therapist).

The data collection and analysis reported in this PhD thesis (study 6), was conducted by **Farah Elahi** independently.

Led by Dr Fiona Leahy and Dr Andrew Thompson.

Independently conducted by Dr Fiona Leahy.

Independently conducted by **Farah Elahi.**

Independently conducted by **Farah Elahi.**

Independently conducted by Fiona Leahy.

Independently conducted by **Farah Elahi.**

Independently conducted by **Farah Elahi.**

○ The research that is presented in this PhD thesis.

Figure 1: VEEP trial structure

More information about the VEEP trial is provided in Chapter 3: Methods and Methodologies.

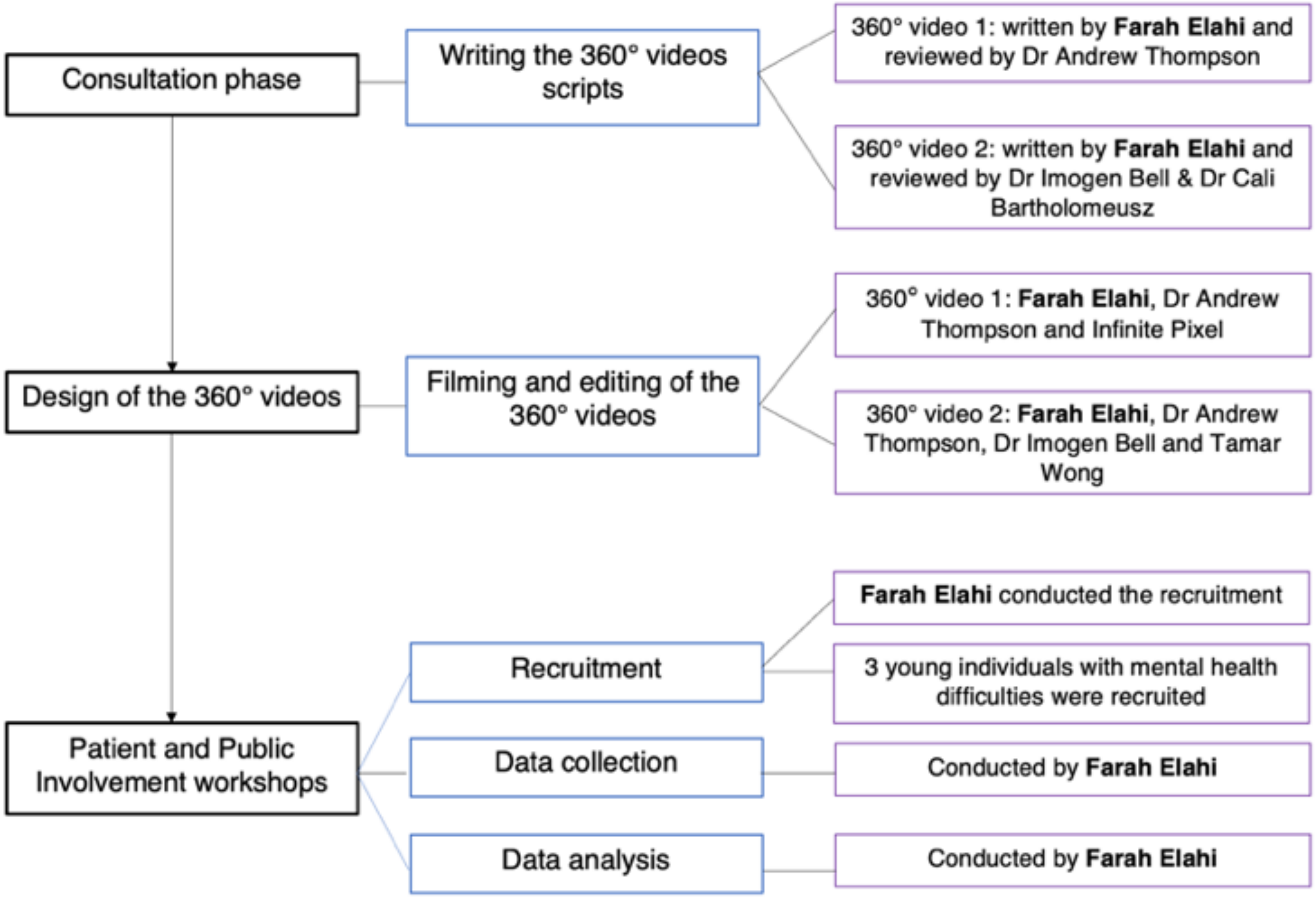


Figure 2: VR-360° development structure

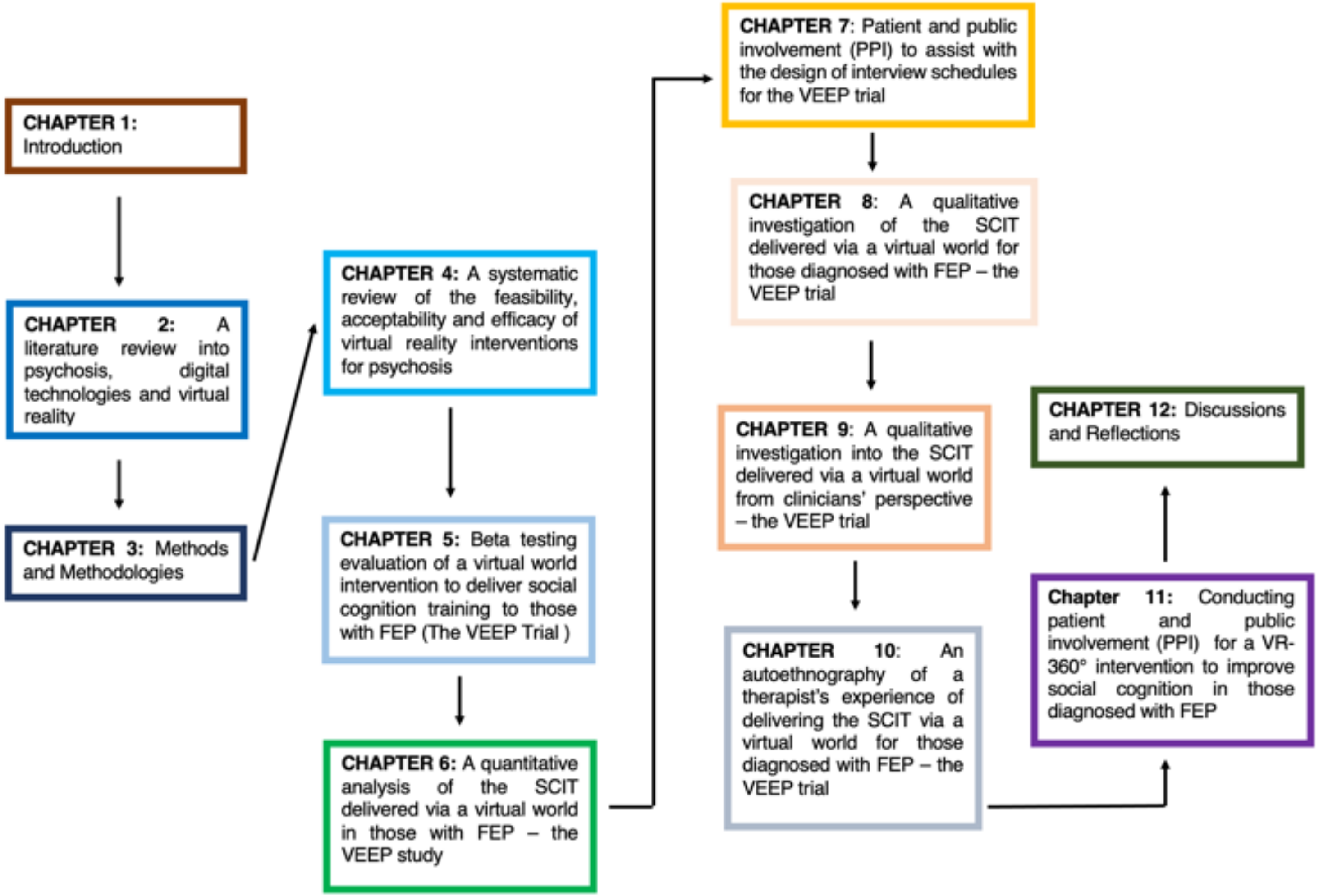


Figure 3: Overview of the doctoral thesis chapters

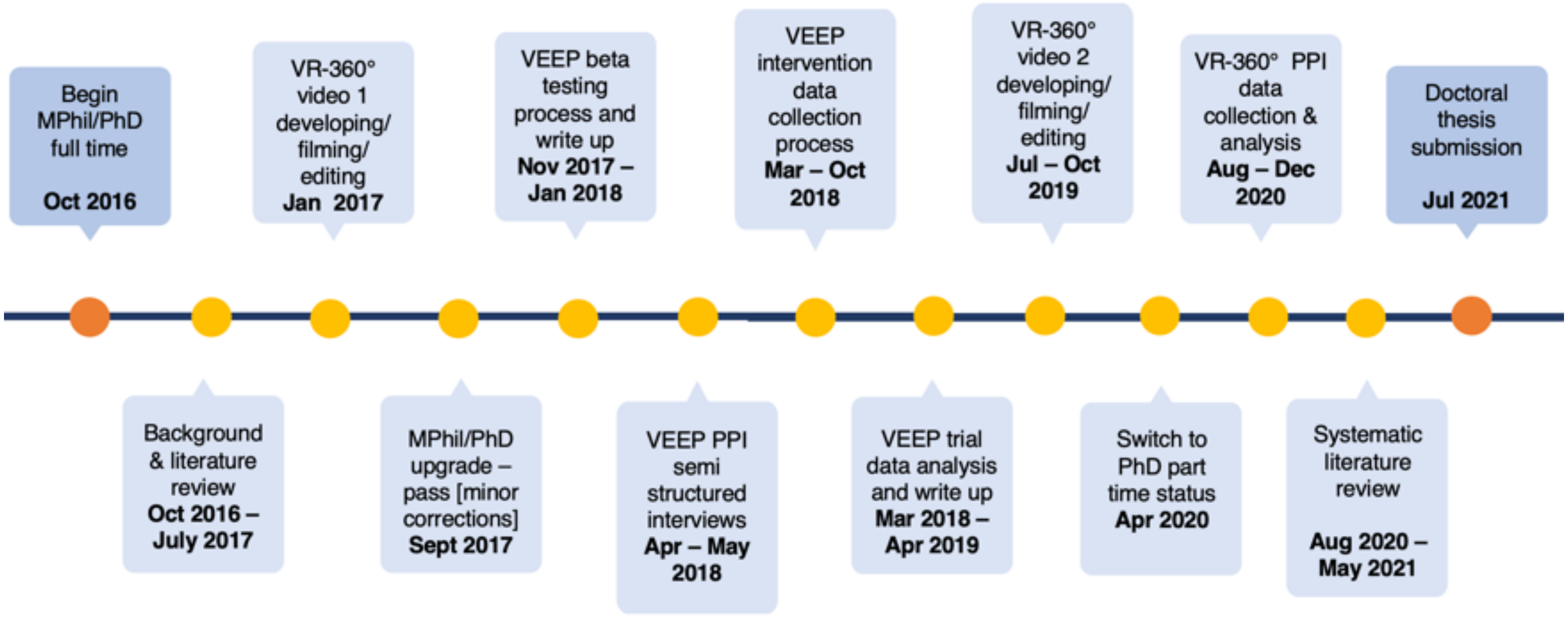


Figure 4: Doctoral thesis timeline

2. A literature review into psychosis, digital technologies and virtual reality

2.1 Introduction to the chapter

This literature review provides an introduction into psychosis, social cognition, digital health interventions and VR. Firstly, the treatments available for those with psychosis is discussed, followed by the impact psychosis has on quality of life (QoL) and functioning outcomes. Secondly, social cognition is then discussed in detail; the components of social cognition are introduced, followed by various interventions available for those with psychosis. Thirdly, digital health interventions that are available to target those diagnosed with psychosis are reviewed. Fourthly, VR is introduced and expanded upon in detail. This includes explaining what VR is, the components that define VR and the VR treatments that are available for those with mental health conditions.

2.2 Background into psychosis

2.2.1 Treatment in psychosis

According to the World Health Organization (WHO) (2009), antipsychotic medication should be used to improve debilitating psychotic symptoms in individuals. The National Institute for Health and Care Excellence (NICE) guidelines for those with FEP are the following: individuals diagnosed with FEP should be offered oral antipsychotic medication alongside psychological interventions; individual cognitive behavioural therapy (CBT) and family interventions (Kendall et al., 2013; NICE, 2015a).

If an individual wants to try psychological interventions alone, they should be offered the following (NICE, 2015b):

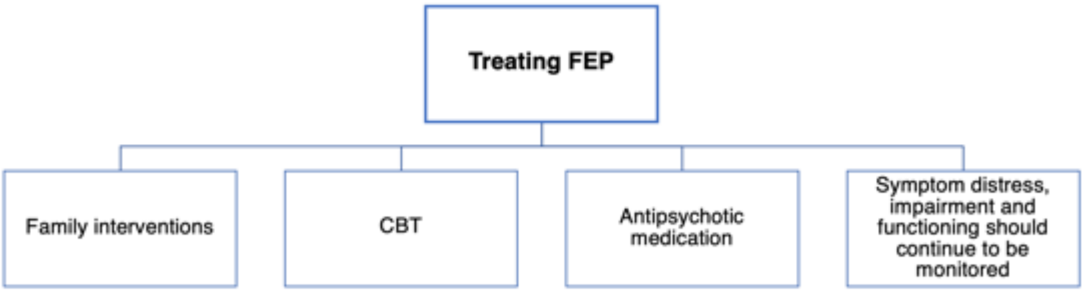


Figure 5: NICE guidelines for treating first episode psychosis

CBT for psychosis should be offered on an individual basis for at least 16 sessions and can be provided during any phase: at-risk, FEP, acute phase or during recovery (Naeem et al., 2016; NICE, 2015b).

2.2.1.1 Pharmacological treatment

Antipsychotic medication can be classified into first (atypical) or second-generation antipsychotics. Both forms have similar effects on patients' psychotic symptoms but vary in side effects. Clinicians regularly monitor treatment, with effects re-evaluated approximately six to eight weeks after the initial dose. It is suggested that patients begin with low doses and titrate up when required. Patients should continue with their pharmacological treatment approximately a year after their acute episode to avoid a possible relapse. Side effects to treatment can either be categorised into anticholinergic (convulsions, parkinsonian effects, increased blood pressure, chronic dystonias) or neurological (seizures) (WHO, 2009).

2.2.1.2 Cognitive behavioural therapy

CBT aims to help individuals formulate connections between their life events and their thoughts, emotions, and behaviours (Turner et al., 2014). This may help those with psychosis to make sense of relevant phenomena and subsequently, reduce distressing psychotic episodes. Psychosis focused CBT (CBTp) was developed primarily in the UK and aims to improve symptoms of psychosis, reduce distress and improving functioning. As a result of this, forming comparisons between trials is challenging (Tarrier, 2014).

CBTp has been found to alleviate both hallucinations and delusions (Mehl, Werner and Lincoln, 2015; Thomas et al., 2014; Van der Gaag, Valmaggia and Smit, 2014). A review examining the efficacy of CBTp concluded that CBTp is a practical, evidence-based treatment with robust outcomes (Bird et al., 2010; Turkington et al., 2013). Bird et al. (2010) also found that previous research has consistently illustrated long term benefits of CBTp in alleviating the severity of symptoms in early psychosis. Fowler, Hodgekins and French (2019) reported on data collected from a two year follow up of participants taking part in the ‘social recovery and early psychosis’ trial. Social recovery therapy is a form of CBT, which targets those individuals with psychosis who experience complex difficulties. Results showed that 25% of the individuals with non-affective psychosis in the intervention group, had taken part in paid work within a year of the treatment (Fowler et al., 2019).

Nevertheless, widespread dissemination and implementation of CBTp remains a crucial difficulty. Only 10% of patients are offered CBTp, with 16% of patients choosing to stop receiving treatment (Hazell et al., 2016; Lincoln et al., 2014). There are many potential explanations for this, including that CBTp knowledge, awareness and training are limited and heterogeneous. This means that there is limited consistency in the way in which interventions are delivered and implemented. The lack of therapists may also have a detrimental effect on the quality of treatment provided; according to the British Psychological Society in 2021, the Migration Advisory Committee had added psychologists onto the shortage occupation list in the UK (British Psychological Society, 2021). There is a motivation to use the cheapest opportunities to train individuals, leading to the low-quality implementation of treatment in the UK (Tarrier, 2014).

Low intensity CBTp is defined as treatment that provides less than the 16 sessions recommended by NICE, with sessions ranging from six to 15 sessions. A recent review concluded that low intensity CBTp offers significant benefits in improving psychotic symptoms and widening access to treatment (Hazell et al., 2016). The review found that there were significant between-group effects at post-intervention for the primary outcome ($d = -0.46$) and at follow-up ($d = -0.40$). These effect sizes favoured low intensity CBTp over the control conditions. Mediating factors such as intervention frequency did not significantly predict outcomes in psychosis (Haddock et al., 2014; Fusar-Poli, McGorry and Kane, 2017). Turner et al. (2020) provided an update on their prior meta-analysis into the evidence on case formulation-driven CBT for psychosis and its effects on hallucinations and delusions. Results demonstrated the efficacy for CBTp on both auditory hallucinations and delusions, thereby concluding that the evidence base is sufficient and consistent.

A narrative review into the barriers of implementation of CBTp found that there were multiple barriers those with psychosis face (Switzer and Harper, 2019). Key barriers included the prioritisation of the biological model in providing treatment; the biological model states that mental health conditions are brain diseases and therefore should be treated with pharmacological treatment (Deacon, 2013). Other barriers included low levels of confidence and knowledge in staff and the stigma associated with psychosis. Therefore, funding combined with high quality staff training is vital for successful implementation (Switzer and Harper, 2019).

With regards to non-psychotic symptoms, CBT was found to improve distress more effectively than other treatment routes. However, due to the heterogeneity in the quality of studies, these findings may not apply to all of those with psychosis (Soneson et al., 2020).

When mental health funding is limited particularly in the UK, cost effectiveness and efficacy of interventions are important, so that services are investing in therapies that will be effective with long lasting effects. The specific benefits of CBTp therapy still need to be explored in more depth; for example, considering whether a more focused approach and targeting a specific symptom (i.e. persecutory delusions) is more beneficial than traditional CBTp (Hazell et al., 2016). Furthermore, Tarrier (2014) also concluded that technologies could be used to individualise treatment and monitor individuals' symptoms, especially during critical periods in the UK.

2.2.2 Early intervention in psychosis

EIP services are multidisciplinary community-based teams that aim to diagnose emerging symptoms, reduce untreated psychosis, and improve individuals' access to relevant treatment (Tsiachristas et al., 2016). These multidisciplinary teams implement pharmacological interventions alongside supporting individuals' interpersonal skills, social skills, education, economic situation, and functional recovery (Csillag et al., 2016). The number of services has steadily increased in recent years, particularly within the UK (Bird et al., 2010).

NICE in the UK, recommends EIP services for adults with psychosis. Furthermore, according to the 'Access and Waiting Time Standard for Early

Intervention in Psychosis,' EIP services are required to provide more than 50% of people with FEP with a NICE approved care package within two weeks of referral (NICE, 2015a). Drake et al. (2020) conducted a longitudinal analysis and modelling study in the UK and found that delayed treatment in the first few weeks of psychosis was associated with impaired recovery in all symptoms. Therefore, the implication is that rapid access to comprehensive treatment is required.

Within the last decade, there has been growing evidence to support the beneficial effects of EIP on patients' clinical and psychosocial outcomes compared to standard care. The 'Lambeth Early Onset' trial (n=144) found that those with early psychosis who received care from EIP were more likely to maintain contact with psychiatric services when compared to those in standard care. Furthermore, they were more likely to have fewer admissions to a hospital (Craig et al., 2004). This study was replicated again with a sample of 166 participants and found that those that received care from EIP reported significant improvements at 18 months in social and vocational functioning, quality of life (QOL), medication adherence and satisfaction (Garety et al., 2006).

The intensive early-intervention program for first episode psychotic patients (OPUS) trial was the first and largest Randomised Controlled Trial (RCT), which compared EIP to treatment as usual (TAU) for those young individuals with FEP (n=547). Two years post-intervention, EIP produced significant positive effects on psychotic and negative symptoms and treatment adherence, a reduction in dosage in medication and treatment satisfaction. During a ten year follow up study, the OPUS trial found that the short-term significant effects of EIP reduced over time. Overall, those in EIP were significantly less likely to use supported housing and use psychiatric bed stays when compared to their counterparts in TAU (Secher et al., 2015).

2.2.3 Focus on outcomes

2.2.3.1 Quality of life

WHO defines QoL as:

> “individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (WHO, 2012; pg. 11).

QoL aims to assess whether a physical and/or mental condition impairs an individuals’ functioning and overall wellbeing (Carr et al., 2001). For individuals and their families, QoL, and social and occupational functioning, are critical to consider during psychosis (Malla and Payne, 2005). Kwong et al. (2017) found that functioning, affective, and positive symptoms and treatment-related variables are important determinants of subjective QoL in FEP.

Baseline social functioning may determine QoL over a one year follow up period in those with FEP (Ortega et al., 2020). A longitudinal study showed significant improvements in subjective QoL over one year, in those with FEP (Tan et al., 2019).

Factors that significantly correlate with QoL domains include self-esteem levels, social skills, coping styles, autonomy, and social support network (Law et al., 2005). As well as this, QoL was significantly related to depressive symptoms in those with FEP (Ohmuro et al., 2017). A 10 year follow up study found that measures aimed at improving daily activities and treating depressive symptoms are essential in improving subjective QoL in those with psychosis. Being in a better financial situation and having more contact with family at baseline have a long-standing impact on subjective QoL development in those with FEP (Gardsjord et al., 2016). A meta-analysis concluded that a longer duration of untreated psychosis was associated with a reduction in QoL. Furthermore, severity of psychiatric symptoms was negatively associated with QoL; this was strongest between QoL and negative symptoms (Watson et al., 2018).

A review found that those diagnosed with psychosis experience a significant improvement in QoL between one-four years after receiving treatment (Malla and Payne, 2005). Therefore, treatment which focuses on enhancing QoL in patients with psychosis is vital to consider (Law et al., 2005).

2.2.3.2 Functional outcomes

Functional and symptomatic recovery is a vital focus of research in psychosis (Andreasen et al., 2005; Harvey and Bellack, 2009). Compared to earlier studies, more recent studies have demonstrated favourable outcomes after long term follow up periods in FEP and schizophrenia (Harrison et al., 2001; Harrow et al., 2005; Henry et al., 2010; Robinson et al., 2004; Wunderink et al., 2009). Recent research has analysed recovery models, including stability, empowerment, a perspective of recovery and QoL (Andresen et al., 2003; Leamy et al., 2011; Sheridan et al., 2012). These models consider recovery as both a process and outcome (Ramon et al., 2009).

Despite advances in psychological interventions and research, some outcomes remain poor. Functional outcomes such as impaired social functioning are an early marker for psychosis (Addington et al., 2008; Lin et al., 2011). In addition, severe deficits in community functioning are commonplace, such as impaired interpersonal relationships and occupational and vocational functioning (Fett et al., 2011).

A meta-analysis conducted by Green, Kern and Heaton (2004) found that performance in neurocognition is associated with functional outcomes in those diagnosed with psychosis. Furthermore, Addington et al. (2006) concluded that social cognition mediates the relationship between neurocognition and functional outcomes. Other reviews have concluded strong associations between social cognitive domains and outcomes such as community functioning and social problems. Therefore, treatments should target functional outcomes in those diagnosed with psychosis (Couture, Penn and Roberts, 2006; Fett et al., 2011).

However, neurocognition and social cognition can only explain a certain percentage of variance in functional outcomes. Factors such as meta-cognition or motivation may influence the associations between social cognition and outcomes. Thus, there is a need to identify other factors which can provide an insight into this unexplained variance (Fett et al., 2011). Furthermore, there are various inconsistencies in reports due to different definitions of outcomes and measures used. Future studies will need to focus on the definition of outcomes used and assess the mediating factors between predictors and directions of various outcomes (Malla and Payne, 2005).

2.3 Social cognition in psychosis

2.3.1 What is social cognition?

Social cognition refers to a complex number of mental abilities, which underly social stimulus processing, perception, interpretation, and response. These abilities can be involved in social interactions on a one-to-one basis and/or a group level (Beaudoin and Beauchamp, 2020; Frith and Blakemore, 2006). Social cognition can be separated into the following categories.

Emotion processing This is the ability to use and recognise emotions. Emotional intelligence involves individuals' ability to identify, manage, understand, and facilitate emotions in themselves and others. Measures of emotion processing vary, where individuals are asked to recognise and rate emotions using facial expressions, voices, and even brief vignettes of social scenarios. These are scenarios depicting social situations that people may commonly find themselves in. Here, viewers are asked to observe these videos and answer questions about the interactions (Healey et al., 2016).

Social perception This is the potential to form assumptions about social scenarios and respond to person-centred cues. Social perception tests assess individuals' ability to recognise social roles, rules, and the social context around the situation. During these tests, individuals should analyse the verbal and non-verbal cues around them to form judgments on potentially ambiguous situations. Individuals may also be required to recognise interpersonal factors in scenarios such as mood states, intimacy, and status. Previous research has shown that individuals' social knowledge can influence community functioning. Therefore, future interventions should be designed to actively target this particular domain (Healey et al., 2016).

Social knowledge This domain refers to one's awareness of rules and goals, guiding and defining social situations. This area overlaps with social perception. This is because social knowledge involves an awareness of cues, which occur in social situations. This can be measured using a series of tests that ask individuals what is expected in various social situations (Healey et al., 2016).

Theory of mind (ToM) This is the ability to interpret mental states in oneself and others around them (Javed and Charles, 2018). These 'mentalising' characteristics create a fundamental and essential role in many communicative and social interactions, thereby allow mutual and successful exchanges of information between individuals (Ahmed and Miller, 2011; Bradford, Jentzsch and Gomez, 2015). Further research is required to understand the mechanisms underlying the ToM. Past evidence has suggested a particular modular structure underlying the ToM abilities, with separate components involved in different mentalisation processes (Bodden et al., 2010; Harari et al., 2010).

Attributional style/bias This can be defined by understanding and processing social scenarios and events. Therefore, this reflects on how individuals analyse the causes of specific positive and adverse events. These can be measured using various questionnaires through observations and transcriptions of interactions. During these measures, key distinctions are formed between internal attributions (i.e., causes due to their actions), external personal attributions (i.e., causes due to other individuals' actions) and external situational attributions (i.e., causes due to situational factors). Previous research has indicated that individuals with psychotic disorders are more likely to attribute negative outcomes to other individuals than a non-clinical sample. This is known as attributional bias. This can have detrimental implications in their ability to interact with others (Healey et al., 2016).

2.3.2 Social cognition deficits

Impairments in social cognition are one of the defining characteristics of psychotic disorders (Penn et al., 2007). An in-depth review of social cognition deficits in FEP individuals, found that individuals experience long-term deficits in emotion processing, social perception, and attributional bias. Therefore social cognitive impairments may either be one of the first skills to deteriorate during the early stages of psychosis or may pre-date the condition as trait vulnerability characteristics (Combs et al., 2007).

2.3.3 Social cognition interventions

A systematic review focusing on social cognition interventions for people with schizophrenia found that those who took part, experienced significant improvements in ToM and affect recognition, compared to both passive and active control conditions (Grant et al., 2017). Although social cognition interventions have the same aims, there is variability in the implementation, format, and therapy modalities. Whilst some interventions target multiple domains; others target only one domain (Grant et al., 2017; Yamada et al., 2019).

2.3.3.1 Single domain interventions

Table 2 below outlines the single domain interventions for social cognition in more detail.

Table 2: Social cognition single domain interventions

Domain	**Intervention Name**	**Examples of evidence**
EMOTION PERCEPTION	Emotional management therapy	1. A group study with outpatients diagnosed with schizophrenia found improvements in emotion perception, psychopathology, and social adjustment (Hodel, Kern and Brenner, 2004). 2. In a study with those diagnosed with FEP, there was no treatment related improvements in social functioning or emotion perception post-intervention or at an eight month follow up (Hodel et al., 1998).
SOCIAL PERCEPTION AND KNOWLEDGE	Integrated Psychological Therapy	1. Garcia et al. (2003) found that those randomised to the intervention improved their social perception. 2. These findings were replicated in a RCT, with findings being maintained at a six month follow up (Fuentes et al., 2007).
	Social Cognitive Enhancement Training	An RCT conducted by Choi and Kwon (2006) found that some social cognitive abilities improved post intervention.
THEORY OF MIND AND/OR	Cognitive-emotional rehabilitation	Those in the intervention group provided significantly better performances in first order ToM (Veltro, 2011).

ATTRIBUTIONAL BIAS	Emotion and ToM Imitation Training	Mazza et al. (2010) found an increased performance in false belief understanding, as well as emotion and attention attributing, compared to problem solving skills training.
	ToM skills training	The intervention group showed significant improvement in the inference of mental states of others post intervention Kayser et al. (2006).
	Understanding social situations	Fiszdon et al. (2017) conducted a proof-of-concept intervention targeting ToM and attributional bias in those with psychosis. Contrary to the hypothesis, there was no effect on the two primary ToM measures: The Hinting Task (Corcoran, Mercer and Frith, 1995; Greig, Bryson and Bell, 2004) and the Reading the Mind in the Eyes Task (Baron-Cohen et al., 2001).
	ToM training	A feasibility and acceptability study found a significant improvement of ToM abilities in those in the ToM training group, compared to the CG (Bechi et al., 2013).

2.3.3.2 Multidomain interventions

Social cognition training interventions have been found to have a positive impact on psychotic patients' positive and negative symptoms as well as QoL. Previous interventions have specifically targeted factors such as ToM, with few interventions focusing on other social cognition factors, i.e. attributional style/bias and facial emotion recognition (Combs et al., 2007). Fiszdon and Reddy's (2012) review into social cognitive treatments for psychosis concluded that further interventions need to be refined to provide long lasting effects on higher-order social cognitive factors (i.e. ToM and attributional bias). One of the reasons for this may be the lack of opportunity to practice the knowledge and skills obtained. Therefore, participants should be provided with opportunities to practice these newly acquired skills until they become thoroughly integrated into their everyday life (Fiszdon and Reddy, 2012).

Nijman et al. (2020) conducted a meta-analysis to assess the efficacy of social cognitive training for those with psychosis. It was concluded that broad-based social cognitive therapy without cognitive remediation therapy, is the most appropriate approach to improve social functioning and social cognition. Further, methodologically rigorous studies with longer follow up periods are required. Additionally, those interventions tailored to the individual's needs and are relevant to their daily life are more likely to produce long lasting functioning outcomes (Nijman et al., 2020).

2.3.3.3 Social cognition and interaction training

The SCIT was developed to enhance individuals' ToM, attributional abilities and emotion perception in those diagnosed with schizophrenia (Roberts and Penn, 2009). The SCIT provides a range of techniques, including metacognitive training, therapeutic exposure techniques and role playing. SCIT is a group-based intervention and comprises of 20 sessions, with each lasting approximately 50 minutes. The sessions are divided into three phases (Penn et al., 2007);

- Emotion training: this is where individuals are taught about defining and understanding emotions, its associations with the social environment and understanding paranoia.
- Figuring out situations: this is an opportunity for participants to learn about jumping to conclusion bias and enhance their cognitive understanding through social scenarios.
- Integration: individuals are required to implement the knowledge they have gained via a series of tasks involving challenging interpersonal situations.

Roberts and Penn (2009) found that patients diagnosed with schizophrenia showed significant enhancements in their emotion perception levels and social skills after completing the SCIT intervention combined with TAU when compared to stand alone TAU (this compromised of several available services which included psychotherapy, medication management support and occupational therapy). This provides support for the theory underpinning the SCIT intervention. Furthermore, Penn et al. (2005) observed statistically significant improvements in patients' ToM abilities when they had completed the SCIT. Similarly, Hasson-Ohayon et al. (2015) found improvements in participants' ToM abilities post-intervention in those with severe mental illness (schizophrenia, schizoaffective disorder, bipolar disorder, and depression).

Combs et al. (2007) found that when compared with a coping skills group treatment (this focused on improving individual's problem solving, relapse prevention and symptom management), forensic inpatients diagnosed with schizophrenia spectrum disorders that completed the SCIT showed improvements in all domains of social cognition. They also reported that they felt their relationships with others had improved and had reduced their aggressive behaviour on the wards. A randomised feasibility trial found that it was feasible to deliver the SCIT to those with schizophrenia in a forensic ward setting. Furthermore, the SCIT group showed significant improvement in their facial affect recognition, when compared to TAU (Taylor et al., 2017).

During a six month follow up, participants' emotion perception and social functioning significantly improved compared to baseline, for those who completed the SCIT. Thus, the results provide modest support for the feasibility and acceptability of the SCIT on a schizophrenic population over six months. These findings can be supported by Wang et al. (2013). This study found significant improvements in participants' social cognitive domains when compared to a TAU group. These effects were maintained at a six month follow up.

Robust RCTs need to be developed to assess whether the SCIT can be considered an evidence-based treatment for those diagnosed with schizophrenia. Similarly, a RCT was conducted to assess the impact of the SCIT on those recently diagnosed with schizophrenia. Results showed that the SCIT could improve functional outcomes and attributional biases (Rocha et al., 2020).

Tas et al. (2012) built on the SCIT and developed their own 'Family assisted Social Cognition and Interaction Training' (F-SCIT). Here, family members and/or selected friends were trained in social cognition techniques by completing four structured 60-minute sessions. The benefits of this are that these selected individuals could support participants in achieving their social cognitive training goals. Compared to the social simulation group (this was when participants completed a series of interactive social activities), participants diagnosed with schizophrenia in the F-SCIT group showed significant improvements in social cognition and social functioning (Tas et al., 2012).

However, a recent study that aimed to implement the SCIT for those diagnosed with FEP, found that attendance and retention rates were low (Bartholomeusz et al., 2013). Therefore, considering the evidence of the theoretical and clinical support for SCIT, strategies aimed at improving engagement and adherence to the therapy should be explored in a FEP population. Furthermore, there are some limitations to the SCIT's effectiveness on those diagnosed with schizophrenia. An RCT conducted by Dark et al., (2020) found that there were no clinically significant differences between the SCIT group and the befriending therapy group for outcomes relating to social cognition and social functioning.

2.3.3.4 Social cognitive skill training

Social Cognitive Skills Training (SCST) was developed by Horan et al. (2009). This treatment involves reviewing content from the previous session, an introduction to new social cognitive skills and role play activities. The steps of social skills training is outlined below:

Figure 6: Steps in social skills training

Horan et al. (2009) conducted an RCT for a social cognitive intervention for individuals with psychosis, to improve their social perception, attributional style, facial affect perception and theory of mind. This intervention combined elements from the SCIT and a remediation training programme developed by Frommann, Streit and Wolwer (2003). Results showed that it is feasible and efficacious to deliver a SCST programme for outpatients with psychosis. The intervention group showed significant improvements in facial affect perception when compared to the control group and provided positive feedback on the intervention.

In a second evaluation of the SCST (Horan et al., 2011), it was found that the SCST showed some impact on affect perception. The SCST has been replicated in further trials:

- Gohar et al. (2013) randomised participants to a culturally adapted version of the SCST or an active control. When compared to control, the SCST was associated with a significant improvement in participants' emotional intelligence.
- In a recent trial, Horan et al. (2018) randomised participants to either the SCST intervention with in-vivo training, SCST with additional clinical based training or a control condition. Findings showed that the SCST conditions showed significant improvements in affect perception, when compared with the control condition. These findings were also maintained at three months.
- An intervention was conducted to assess the effectiveness of a social skills training program on the severity of symptoms and social functioning of those with schizophrenia. Results showed that the program reduced the severity of symptoms and effectively improved social functioning (El Aziz, El Aziz Rady, and El Din, 2017).

2.3.4 Social cognition and social functioning

Individuals diagnosed with psychosis experience social functioning deficits (i.e. completing self-care tasks, maintaining relationships), which are considered risk factors for relapse and markers of symptom severity (Lenior et al., 2001). Furthermore, various studies have found correlations between social functioning and particular domains of social cognition such as emotion recognition (Henry et al., 2015; Hooker and Park, 2002), ToM (Sprong et al., 2007), emotion perception (Irani et al., 2012) and attribution bias (Lahera et al., 2015).

According to Fett et al. (2011), social cognition deficits have been consistently found to contribute to social functioning abilities in those with psychosis, with Addington et al. (2006) concluding that social cognition mediates the association between cognitive and social functioning. As a result, several social cognition interventions have been developed, which improve social functioning.

Kurtz and Richardson (2012) found that social cognitive training contributed to improvements in social cognition and social functioning in those diagnosed with schizophrenia. This is because social cognitive training helps individuals to interact with their social environment, thereby reducing social functioning impairments (i.e. developing and maintaining friendships) (Woolverton et al., 2017). With regards to social cognitive measures, weighted effect-size analyses showed that effects on attributional style and social cue perception were not significant. However, there were moderate to large effects of social cognitive training procedures on facial affect recognition (discrimination d = 1.01 and identification d = 0.71), and small-moderate effects of training on ToM (d = 0.46) (Kurtz and Richardson, 2012).

2.3.5 Clinical implications and future research

2.3.5.1 Identification of risk factors

According to Grossman et al. (2019), there needs to be further understanding of factors that influence the early and persistent social withdrawal in psychosis. These include not only just the objective characteristics of social scenarios but also subjective experiences as well. Compared to healthy controls, individuals diagnosed with early and established psychosis illustrated a compromised ability to experience and expect pleasure from social interactions (Engel et al., 2016). This could lead to the development of targeted interventions in order to improve functioning in FEP. Previous research found that the duration of untreated psychosis, cognitive variables and remission of positive and negative symptoms was independently associated with functional recovery (Santesteban-Echarri et al., 2017).

Minimising social punishments/rejection and increasing social pleasure/rewards are essential considerations to improve the satisfaction originating from social interactions (Fulford, Campellone and Gard, 2018). Sundermann et al. (2013) highlighted the importance of targeting the psychological processes of those diagnosed with psychosis instead of the frequency of contact and size of their social networks. Therefore, interventions that target self-stigma, particularly in the early stages of the illness, may help to alter negative cognitions, which influence the fear of social rejection (Best et al., 2018). Furthermore, providing social skills training, which prioritises the communication challenges experienced by individuals with psychosis in face-to-face and digital scenarios, may be beneficial (Grossman et al., 2019).

2.4 Digital health interventions

There is extensive evidence to support psychological interventions in the treatment of various mental disorders. NICE have recommended that CBTp should be delivered to those with first episode psychosis (NICE, 2015a). Nevertheless, there is evidence to indicate a large treatment gap, as most individuals with mental disorders do not receive treatment (Ebert et al., 2019). Practical shortfalls such as long waiting times and lack of clinical support are not the sole reason for low treatment rates (Ebert et al., 2019). Psychological barriers to treatment may also play a vital role. This is because some individuals may be afraid of the stigma associated with receiving or seeking mental health treatment (Clement et al., 2015).

Digital technologies can be utilised to help people find information to improve their mental health. This is because the internet provides a pathway for young individuals to access help and support (Pretorius, Chambers and Coyle, 2019). Young individuals use the internet for many of their daily needs. For example, recent survey conducted in the UK found that 76% of 18-24 year olds felt that technology and the internet helps in all areas of their life (Nominet, 2019). Various online services are available as well as informal resources such as forums and social media. These sources can help facilitate help seeking procedures and attitudes due to the anonymity, user control and access (Collin et al., 2011).

2.4.1 What are digital health technologies and interventions?

Due to the rapid increased use of technology on an international scale, many mental health interventions are now being implemented using digital technologies (also known as e-health), such as the Internet, computers, mobile phones and software applications. Although technology is not viewed as a replacement for direct clinical care, the opportunity to provide 24/7 clinical support and collect data in innovative ways offers a unique view into the individuals' psychological, social, and functional wellbeing (Batra et al., 2017; Ben-Zeev et al., 2019).

NICE developed an evidence standards framework for digital health technologies. These standards are designed to be used by technology developers to influence their evidence development plans (NICE, 2021). These technologies may also assist clinicians in monitoring users' mental health and providing support on a population level. Digital health interventions (DHI) are expanding significantly, and there are currently more than 10,000 mental health applications available for individuals to download. More research must be undertaken to investigate the effectiveness of such treatments to improve mental health difficulties, and the implications they may have on healthcare (Tal and Torous, 2017).

These interventions vary in the following ways:

Mode of Delivery Digital health interventions can be used to prevent, promote and treat mental health disorders. They can be used to increase the accessibility of evidence-based psychological support to the public (Buntrock et al., 2014).

Stand-alone digital health interventions A prominent characteristic of these interventions is that they can be accessed via a smartphone app or the internet at any time. Therefore, it can facilitate access to evidence-based interventions to individuals who are unable to access face-to-face treatment. Furthermore, these approaches can overcome psychological challenges by helping individuals express themselves (Lal and Adair, 2014). These can also be circulated as massive open online interventions (MOOI) to provide free services on an international scale at minimal cost (Munoz et al., 2016).

Blended Care Here, face-to-face interventions are combined with digital health interventions. The dosages of both components can vary depending on the interventions (Erbe et al., 2017). For example, in some blended care interventions, digital interventions may replace aspects of face-to-face treatment, which do not require mediation by a clinician. Face-to-face sessions can then be used more efficiently (Ebert et al., 2019).

Nevertheless, interventions can be augmented through the application of digital technology to improve its effectiveness. Digital interventions can be used in such contexts to provide tasks for individuals to complete between sessions and support the implementation of behaviour changes (Ebert et al., 2016; Nobis et al., 2015; Sander et al., 2017).

Format Digital health interventions vary in terms of their format. Some interventions adhere to the traditional face-to-face treatment format, and therefore provide regular sessions at a specific day and time. Other interventions choose to maintain similarities to how technology is used and therefore provide shorter, briefer and more frequent sessions than traditional face-to-face treatment. These interventions also vary in their structure, with some allowing users to access treatment in a fixed chronological order, whilst others allow users to access the content in whatever way they choose. There may also be a degree of personalisation, which is implemented into these interventions. For example, some interventions use specific algorithms to provide specific content, which matches the user's psychopathology (Hariman, Ventriglio and Bhugra, 2019; Kolasa and Kozinski, 2020).

Human Support Digital health interventions vary in the degree of face-to-face support. Self-help approaches are prevalent, where individuals can perform tasks and techniques independently. A clinician can then provide support within regular intervals (Ebert et al., 2019). A primary aim of clinical support in stand-alone digital health interventions is to foster adherence to the interventions (Ebert et al., 2014; Schueller, Tomasino and Mohr, 2016; Zarski et al., 2016). Communication can occur either synchronously or asynchronously (Ebert et al., 2019). Figure 7 below illustrates the key aspects of DHIs.

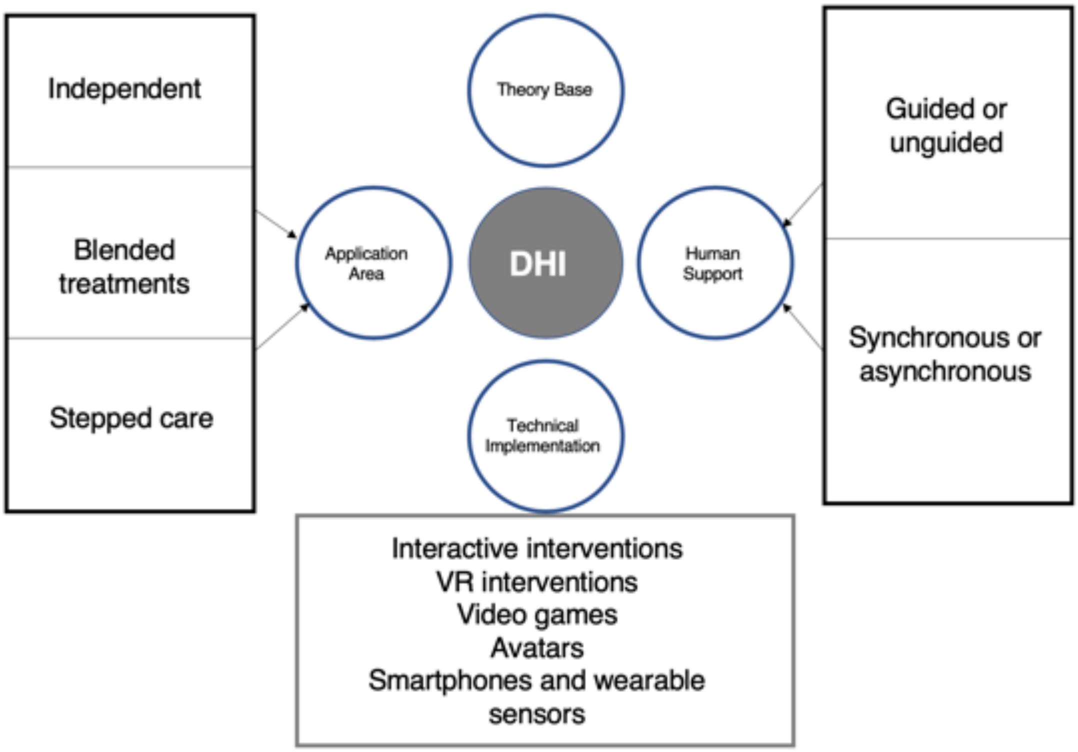


Figure 7: Key aspects of digital health interventions (Ebert et al., 2019)

2.4.2 Digital health interventions and psychosis

2.4.2.1 Digital usage in those with psychosis

Approximately 81% of individuals diagnosed with established psychotic disorders own a mobile phone (Firth et al., 2016; Lal, Dell'Elce, and Malla, 2015). Lal et al. (2015) found that individuals with FEP had access to a mobile phone and frequently used social media platforms such as skype (45%) and Facebook (75%). Only 8% of those with FEP did not have access to the internet in the USA (Torous and Keshavan, 2016). In schizophrenia spectrum samples, 58% of individuals stated that they communicate via text message daily, with 48% stated the same regarding email communication. 27% of individuals stated that they accessed social media websites such as Facebook daily (Miller et al., 2015).

In a recent study, participants aged between 15-35 years were asked to complete a Pathways to Care for Psychosis Questionnaire; this is designed to explore online activity during the emergence of symptoms. 76% of responders favoured the option of receiving online social support. 90% stated that they used the internet and social media daily (Birnbaum et al., 2018).

Of the few studies that analysed the perceptions of digital engagement, those with psychosis were found to respond similarly to control groups (CG) regarding positive opinions of digital technologies (Gay et al., 2016). Miller et al. (2015) found that those with psychosis found online communications valuable in supporting their communication. This allows them to meet new people and take part in peer support (Highton-Williamson, Priebe and Giacco, 2014).

Grossman et al. (2019) assessed the patterns and perceptions of face-to-face and digital communication in those at early stages of psychosis. Results showed that both face-to-face and digital communications were more frequently reported in controls than both FEP and clinical high-risk groups. CGs took part in digital communications approximately twice as many days per week compared to FEP groups. These findings can be supported with previous research, which showed that FEP individuals engage in less social contact (Morgan et al., 2008) and maintain smaller social networks (Gayer-Anderson and Morgan, 2013). Therefore Grossman et al. (2019) stated that some benefits of digital communication might have been overestimated in psychosis, considering the context in which communication occurs to have less of an impact on social frequency in the early stages of the condition.

2.4.2.2 Digital health interventions and psychosis

There has been a rise in the number of digital technology interventions targeting those diagnosed with psychosis.

2.4.2.2.1 Digital interventions using apps

Many digital interventions have focused the use of apps to target various symptoms and outcomes in those with psychosis. Below is a table that summarises this:

Table 3: Digital app interventions for those with psychosis

Authors	App name	Study type	Target	Findings
Bucci et al. (2018)	Actissist	Proof-of-concept trial	Distressing experiences	• Feasible and acceptable • Potential for treatment efficacy
Bonet et al. (2020)	ReMindCare	Usability study	Efficacy	Compared with the TAU group, the app users had: • Fewer relapses • Fewer hospitalisations • Fewer visits to the urgent care unit
Garety et al. (2021)	SlowMo	RCT	Paranoia	• No significant improvements in the main outcome at 24 weeks • However, could have a beneficial effect on paranoia in general
Lewis et al. (2020)	ClinTouch	RCT	Symptom monitoring	• Feasible and acceptable to use at three months • High levels of adherence • App use was associated with improvements in psychotic symptoms in those with recent-onset psychosis

Lim et al. (2020)	+Connect		Deliver positive psychology content	• Feasible and acceptable to use • Preliminary evidence that it: ○ May reduce loneliness ○ Lead to positive mood changes ○ Improve connection with others
Schlosser et al. (2018)	Not recorded	RCT	Improve motivation and QoL	Compared to the waitlist condition, those in the PRIME condition had significantly greater improvements in: • Depression • Defeatist beliefs • Self-efficacy • These were maintained at a three month follow up
Steare et al. (2020)	My Journey 3	Feasibility trial	Self-management	Feasible and acceptable to use

2.4.2.2.2 Qualitative studies

Along with trials, there have been various qualitative studies to explore the opinions and views of digital mental health interventions, in those with psychosis. A qualitative study into users' experience of taking part in a web based psychological intervention, found that those with psychosis experienced challenges in taking part. These included psychosocial stressors, navigation difficulties and mental health difficulties. Thus, web-based interventions should be as flexible as possible and tailored to suit the needs of the individual (Arnold, Williams and Thomas, 2020). Bucci et al.'s qualitative study (2018) collected views of those with psychosis about DHIs. It was found that service users were predominantly positive about the use of DHIs in managing and supporting mental health.

2.4.2.3 Reviews into digital health interventions and psychosis

There have been several reviews to explore the impact of digital mental health interventions in those with psychosis.

Findings from a review focusing on using digital technologies to improve clinical care in those with psychosis, found that studies were feasible and acceptable. (Bell and Alvarez-Jimenez, 2019). A literature review was conducted to review studies published within the last 10 years on digital technological interventions for those with early psychosis. Findings showed that it is feasible to utilise digital technologies to deliver psychological interventions for early psychosis (Rus-Calafell and Schneider, 2019).

D'Arcey et al. (2020) conducted a systematic review into the effects of texting to improve clinical engagement in those with psychosis. It was found that text messaging was a low cost, practical method of enhancing engagement in treatment for those with psychosis. Future studies however should focus on the cost-effectiveness and safety considerations of such processes, as well as the effects of personalising text messages.

Several meta-analyses and systematic reviews also concluded that digital interventions are as effective as face-to-face treatments when accompanied by support. (Andersson et al., 2014; Cuijpers et al., 2010; Richards and Richardson, 2012).

A recent systematic review was conducted to investigate the effects of digital technologies on psychotic symptoms. Whilst this research area is in its infancy, with many interventions being subject to pilot and proof-of-concept studies, there is promising evidence from those web-based CBTp programs as well as avatar-based therapies. Therefore, future studies should focus on recruiting larger sample sizes to establish effectiveness (Clarke et al., 2019).

2.4.2.4 Advantages and challenges

There are many advantages to using DHIs. There is significant research to suggest that DHIs can result in clinical improvements for many conditions when implemented into routine treatment (El Alaoui et al., 2015; Titov et al., 2015; Titov et al., 2017; Williams et al., 2014). Titov et al. (2018) found that online clinics providing internet based cognitive behavioural therapy (iCBT), a form of guided DHIs, has shown to be effective in treating patients undertaking routine treatment. Nevertheless, more research is required to assess how DHIs can be optimally integrated into routine treatment. Currently, there is a large-scale project called 'ImpleMentAll,' which is analysing the implementation of DHIs into routine treatment in 11 European countries (ImpleMentAll, 2019).

According to previous research, some individuals may prefer utilising DHIs compared to face-to-face treatment (Weitz, 2014). This is because they may feel more comfortable remaining anonymous or receiving support online (Fletcher-Tomenius and Vossler, 2009; Suler, 2004). With text-based treatments, both patients and clinicians have additional time to think about their responses. This may encourage patients to implement a reflective stance, enhancing their awareness of their progress (Baker and Ray, 2011). Other advantages include providing therapeutic services to those individuals who cannot or would not engage with traditional face-to-face therapy (Weitz, 2014).

2.4.2.4.1 Patient engagement

There is a lack of evidence as to how the type, mode of delivery (telephone, online or face-to-face), intervention dosage (the number of sessions) or facilitator information (i.e., clinician or researcher) affects the outcomes in those with psychosis. Therefore, future research into digital interventions for those with psychosis, should be undertaken (Musiat and Tarrier, 2014).

2.4.2.4.2 Personalisation

Future research should also assess various patterns of communication across different phases of the illness. Rates of online social networking were consistently higher in schizophrenia spectrum samples when compared to controls (Highton-Williamson et al., 2014). This may be because digital communication use may develop as the illness progresses. Therefore, the clinical characteristics of individuals who are predisposed to using face-to-face or digital communication should also be assessed. These findings could have implications for treatment recommendations (Miller et al., 2015). Furthermore, findings from these digital interventions may not apply to the daily experiences of individuals. Thus, there needs to be further understanding and identification of characteristics of treatment that can be translated to everyday environments (Santesteban-Echarri et al., 2020).

2.4.2.4.3 Engaging the clinician

Despite the increasing implementation, the uptake of digital interventions is still low, with rates ranging from 3-25% (Paul et al., 2017; Woodford et al., 2011). Research has shown that many individuals have limited knowledge about DHIs, including therapists (Hennemann, Beutel and Zwerenz, 2017; Meisel, Drury and Perara-Delcourt, 2018). Therefore, adequate clinical involvement in the development and implementation of DHIs and providing clinicians with appropriate level of training in these technologies is critical (O'Hanlon et al., 2016). One method of achieving this is using 'acceptance facilitating interventions,' such as educational videos. Previous research has shown that they can be efficient in improving the acceptability of DHIs in clinical practice (Baumeister et al., 2015; Cranen et al., 2011; Ebert et al., 2015; Mitchell and Gordon, 2007).

2.4.2.4.4 Barriers to access

Patients with psychosis must have access to the technologies that are required to complete the interventions. Previous research has highlighted that access to technology is reduced in those with psychosis when compared to the general population. For example, in a meta-analysis conducted by Firth et al. (2016), smartphone ownership was 35% in those with psychosis. However, this may be attributable to economic factors, and so therefore socioeconomic, ethnicity, and educational factors should be considered when developing future digital interventions.

2.4.2.4.5 Building an evidence base

There is substantial evidence from feasibility studies and surveys that individuals with psychosis, use and are interested in DHIs developed to suit their needs (Aref-Adib et al., 2016; Bucci et al., 2018). However, with the development of technology far outpacing the implementation of RCTs to assess these interventions, there is a risk that these technologies will become outdated. Therefore, researchers and technology developers should aim to utilise emerging technologies into novel interventions and trialing them in RCTs, to be able to disseminate their findings as soon as possible (O'Hanlon et al., 2016).

It is important not to view digital mental health technologies as simply products. This leads to assuming that interventions are the primary focus of change. It is vital to consider the ecosystem of support around the intervention, such as human support. Therefore, whilst creating a digital intervention, it is helpful to reflect on how it can fit in the context of mental health services (Mohr et al., 2017).

2.4.2.5 Decision making

A specific formulation and assessment should influence whether digital interventions should be involved in the treatment of psychosis. Patients' own needs and capabilities should be considered (Bell, Lim, and Thomas, 2020).

According to a narrative review published by Trusty et al. (2019) into shared decision making in mental and behavioural health interventions, there are several recommendations that should be implemented.

1. Clinicians should create decision aids and have formal decisions with service users to help facilitate discussions.
2. Clinicians should tailor their approach to shared decision making. For example, service users should be provided with choices and decisions to make, based on factors such as age, disability, ethnicity, culture and impairment.
3. Clinicians should frequently seek feedback from service users, particularly during the beginning of the treatment process. This may

involve asking service users to complete patient self-reports and following up on the feedback.

2.4.2.6 Ethical issues

As digital technologies continue to be implemented and developed, ethical guidelines are altered to take these into account. For example, the American Psychological Association (APA, 2013) and the Online Therapy Institute have developed ethical guidelines for utilising digital technologies to provide therapeutic treatment (Anthony and Nagel, 2009). These guidelines can be implemented for face-to-face and digital technological interventions and are required to reflect the fast-paced development of new digital technological interventions (Goss and Anthony, 2006).

Therefore, ethical guidelines are required to distinguish between face-to-face therapy and digital therapy, acknowledge the differences between the process and the therapeutic relationships, recognise cultural differences and ensure patients are provided with the same ethical considerations. These include receiving informed consent, confidentiality, and privacy (APA 2013; Anthony and Nagel, 2009).

Thus, therapists who provide digital technological treatments must understand their patients' privacy and confidentiality and are aware of how their data will be used (General Data Protection Regulation, 2018). Therefore, therapists must utilise adequate encryption and password protection and understand firewalls and virus protection (Anthony and Nagel, 2009). Furthermore, therapists should provide specific training to ensure they are providing efficient digital technological treatments.

2.4.2.7 Recommendations

According to a recent review, the following recommendation should be considered when implementing DHIs for those with psychosis (Aref-Adib et al., 2019; Clarke et al., 2019):

1. The adaptability and complexity of the intervention should be evaluated to ensure that patients can complete the intervention.
2. Further research should explore which components of the intervention are related to symptom improvement.
3. The compatibility of the intervention with existing systems and practices should be reviewed.
4. There is adequate financial support to implement the intervention effectively long term.
5. Clinicians and patients should have instructions and/or the opportunity to complete relevant training to successfully take part in the intervention.
6. Patients should receive regular monitoring and support when taking part in DHIs. This could include receiving telephone calls and/or online support.
7. Continuous monitoring and evaluating of the intervention are required.

2.5 Virtual reality

2.5.1 What is virtual reality?

2.5.1.1 Introduction

According to Mania and Chalmers (2001), VR can be divided into two categories: realistic virtual worlds or magical virtual worlds. Realistic virtual worlds aim to simulate or resemble reality, whilst magical virtual worlds implement tasks and activities outside of reality. These worlds can be accessed either using a computer desktop or a head mounted display (HMD), contributing to a more immersive experience (Mania and Chalmers, 2001).

2.5.1.2 Hardware

HMDs (please see figure 8 below), cave automatic virtual environment (CAVE) systems, augmented reality systems, desktop screens and projectors can be used to visually display a computer-generated world for individuals to interact with. HMDs create an illusion that users are in a three-dimensional (3D) environment that contains various objects and even representations of people (this can be achieved either through avatars (virtual bodies) or through photographic images of people) (Mania and Chalmers, 2001).

Some VR set-ups allow users to interact with virtual objects within the environment (Mania and Chalmers, 2001). An example of this is the CAVE system.

Figure 8: An example of a HMD

CAVE VR systems involve a user wearing a pair of shutter glasses, which connect with a projector to create a 3D stereovision. The displays update in real time, thereby giving the user an accurate perception of the environment (Cruz-Neira, Sandin and DeFanti, 1993). Unlike HMDs, the CAVE allows the user to see the real world environment through the glasses. Therefore, the user can interact with real world objects. An example of this is a driving simulation, where a user is using a real steering wheel to drive in a VR environment (Pan and Hamilton, 2018).

Below is an image of a standard four wall CAVE configuration:

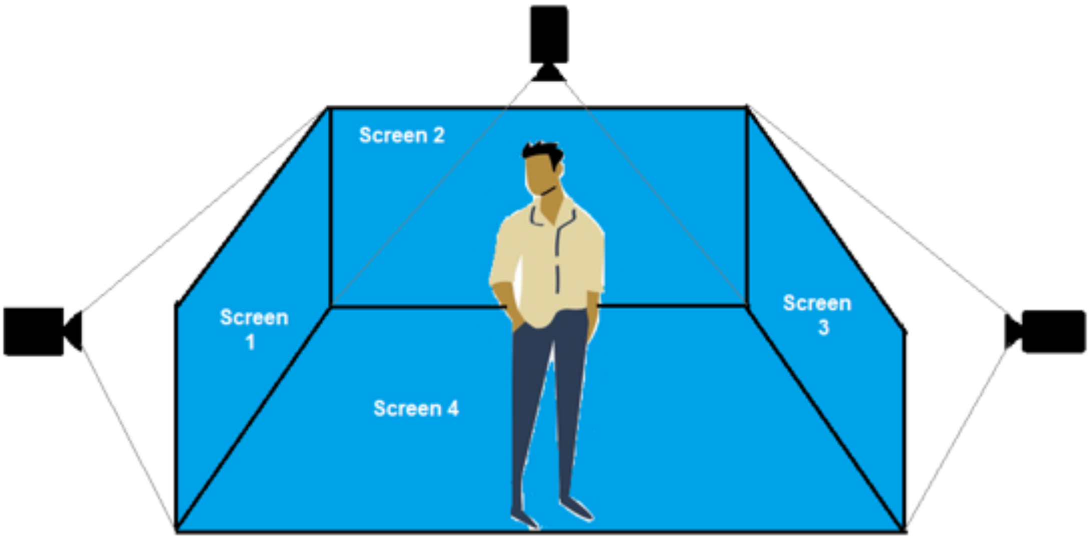


Figure 9: A standard four wall CAVE configuration

The rise of VR in recent years has led to affordable and lightweight HMDs, which provide their users with an immersive experience. According to Slater (2009), the immersive experience is defined by the following:

1. 3D Stereo Vision: two screens in front of each eye.
2. Surround Vision: the real world is blocked from your visual perception.
3. Control of the Viewpoint: the user's head is tracked, so their viewpoint is updated in real time.

These three factors mean that the visual information collected in VR is like that of the real world, allowing the users to respond to these stimuli as if they were real. Nevertheless, there are restrictions to VR. The resolution of some HMD devices is still low when compared to computers. Therefore, it is challenging to utilise VR in studies where high-quality graphics are required, i.e. emotion recognition (Pan and Hamilton, 2018).

2.5.1.3 Presence and immersion

The term ‘place illusion’ is when a user experiences an illusion of being somewhere, even though they know they are not there. Plausibility illusion, however, is when the user believes that the events occurring in VR are real and do relate to the user. Thus, this means that the user can interact with and respond to the VR environment around them instead of simply observing a 3D world (Pan et al., 2012; Slater 2009). Thus, whilst the place illusion is influenced and strengthened by the quality of the VR technology, the plausibility illusion is influenced by the interactivity and animation of the VR characters and environment (Pan and Hamilton, 2018).

VR can lead to total immersion and presence in a VR environment. This can:

> “Intuitively transform their intentions into actions.” (Eichenberg, 2012: pg. 4)

Immersion is one of the main factors, which influence the sense of presence. The range, frequency and number of sensory and motor channels influence the level of immersion experienced. For example, sensory gloves allow individuals to touch virtual objects in a virtual world. Enhancing the sensorimotor realism of the virtual settings, the authenticity of the visual displays and the level of engagement with the VR can increase immersion (Bohil, Alicea and Biocca, 2011; Ke and Im, 2013). Immersion is an essential factor to achieve and maintain, as it predicts adherence, engagement, and motivation with the VR. Furthermore, this engagement may contribute to high retention rates in interventions (Grinberg et al., 2014).

Figure 10 illustrates the relationship between presence and immersion.

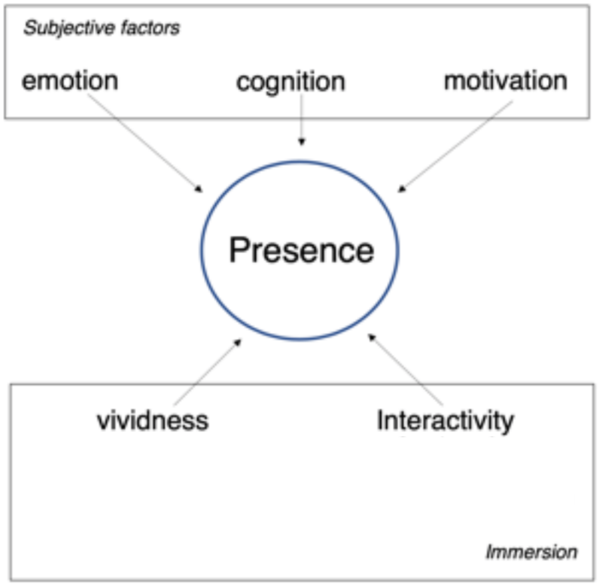


Figure 10: The relationship between presence and immersion (Dengel and Mägdefrau 2019)

2.5.1.3.1 Control factors

Control factors refer to the fact that the more control a user has over the virtual world whilst undertaking tasks, the greater their presence. Control factors can be divided into two factors (Dalgarno and Lee, 2010; Dixson et al., 2016):

1. *Immediacy of control* This is when a user experiences an immediate and appropriate response to his actions. For example, if an individual attempts to open a door in the virtual world, it should open immediately. Delays between the action and feedback could have an impact on the users' sense of presence (Dalgarno and Lee, 2010; Dixson et al., 2016).
2. *Mode of control* It can be argued that users will experience a greater sense of presence if they can predict what will happen next. Therefore presence may be enhanced if users' interactions with the environment are natural and expected in the physical world (Dalgarno and Lee, 2010; Dixson et al., 2016).

2.5.1.3.2 Sensory factors

The more stimulated users' senses are in a VR, the stronger the feeling of presence. These following factors influence this:

1. Visual richness: the information we absorb from the environment around us derives from our visual capabilities. Therefore, it can be argued that visual information strongly influences the presence of individuals' experience (Assländer and Streuber, 2020).
2. Body engagement: the user's experience of body engagement can enhance the sense of presence. This is influenced by the extent to which a user perceives their movements through the environment and how objects around them are relative to the user (Perez-Marcos, 2018; Flavián, Ibáñez-Sánchez and Orús, 2018).

2.5.1.3.3 Isolation factors

Technological devices, which isolate users from the physical environment, are more likely to enhance the presence experienced in the VR. For example, a HMD, which only allows the users to view the VR, may increase their sense of presence compared to a standard screen (Clifton and Palmisano, 2019).

2.5.1.3.4 Realism factors

VR realism can increase the user's sense of presence. The following factors influence this:

1. *Visual realism* The more similarities there are between the information in the physical world and the experiences users have in the VR, the higher the sense of presence (Fan et al., 2018).

2. *Meaningfulness of experience* The more meaningful the experience is to the users, the higher the sense of presence. Meaningfulness is associated with factors such as performance, previous experienced and the saliency of the task (Fan et al., 2018).
3. *Visual body representation* Users who were represented in the virtual world by a body are more likely to experience a sense of presence when compared to being represented by an object (Spanlang et al., 2014).

As presence can be considered a subjective experience, various questionnaires have been developed to measure them. Individual differences in responses, could be because of symptoms such as multisensory integration, prior experience of VR and personality (Haans et al., 2012). The most common method of measuring presence is through self-reported measures such as the 'Immersive Tendencies Questionnaire' (ITQ) and a 'Presence Questionnaire' (PQ) (Witmer and Singer, 1998).

According to a recent review, individuals base their perceptions of presence on their experience of immersion and their level of arousal. Therefore, higher immersion results in the increased presence (Diemer et al., 2015). Most VR research has focused on the effects of presence on anxiety conditions. Price and Anderson (2007) found that presence contributes to individuals' experiences of anxiety in VR exposure therapy and mediates the relationship between pre-treatment anxiety and in-session anxiety.

2.5.1.4 Self-embodiment

When participants immerse themselves in a VR environment, they may lose sight of their own body. Previous research has indicated that a lack of embodiment can lead to worse performance on various tasks (Steed et al., 2016). Therefore, many VR studies must provide participants with a believable virtual body. This can be achieved by either of the following (Pan and Hamilton, 2018):

- Visual-proprioception synchrony: this is when a user has virtual body parts where they expect their body to be.
- Visual-motor synchrony: the virtual body moves in the same way as its actual body.
- Visual-tactile synchrony: this is when a user’s physical body and the virtual body responds to sensation in the same way.

Through embodiment, a user’s sense of the body can be manipulated in various ways. This can allow researchers to further investigate users’ sense of self (Maister et al., 2014).

2.5.2 Virtual worlds

A virtual world can be defined as the following:

> “A synchronous, persistent network of people, represented as avatars, facilitated by networked computers” (Bell, 2008; p. 2)

Virtual worlds are internet based application cyberspaces, where individuals can communicate and develop relationships with one another (Hew and Cheung, 2010; Rheingold, 1993). Prior studies have indicated that common reasons for joining virtual worlds are to develop social relations, receive social support, exchange information, and receive entertainment (Hagel and Armstrong, 1997; Bressler and Grantham, 2000; Jung and Kang, 2010; Ridings and Gefen, 2004; Wellman, 1996). Examples of 3D worlds include Active Worlds (Activeworlds Inc., 2021), Second Life® (Linden Labs, 2021) and Croquet (Croquet Corporation, 2021) (Hew and Cheung, 2010). The millions of users reflect the virtual world’s popularity.

Table 4: Characteristics of virtual worlds

Characteristics	Explanation and evidence
Users	Virtual worlds usually have several users in a shared environment. Their movements and interactions occur during real-time (Blanca Ibanez et al., 2011; Girvan, 2018).
Communication	Depending on the type of virtual world, users can communicate via text or voice in a public or private messaging system (Girvan, 2018; Robbins, 2007). Although users are still required to be 'within range' of each other in the virtual world, the range of audibility is much more comprehensive when compared to the physical world (Kern and Ellermeier, 2020; Rajguru, Obrist and Memoli, 2020).
Consistency	This ensures that developments and creations within the virtual world remain and can be viewed by all users. Therefore, if user A creates an object and stores it in a particular location, user B will view and interact with that object even when user A is logged out (Girvan, 2018).
Interaction and space	Some characteristics of the physical world replicated in the virtual world do not serve to function:

	For example when someone sits down in a chair in the physical world, their view changes. However in a virtual world, if an avatar sits down in a chair, the camera may move from an overhead perspective to a first-person perspective (Berger, Jucker and Locher, 2016; Lucke and Zender, 2011).
Therapist and patient interaction	Via computers/laptops, patients use virtual avatars to attend virtual world therapy. Here they receive therapy from an avatar therapist. Therefore, patients and therapists can select and modify an avatar to interact with each other virtually. Virtual world therapies offer a unique environment for exposure-based treatments; patients can take part in role playing scenarios and exposure based scenarios to develop new skills (Rehm et al., 2016).

2.5.2.1 Characteristics of the virtual world

Some of the characteristics of virtual worlds are expanded on below:

2.5.2.1.1 Avatars

When users are using an avatar, the movements and skills can be controlled and dictated using the relevant device. Virtual worlds also allow their users to experience a third-person view of their avatar. This enables the users to view their avatar and how it interacts with other avatars (Girvan, 2018).

These avatars can influence users' judgments and behaviours. This can influence avatar users' self-disclosure and self-confidence. This is known as the 'proteus effect' (Yee and Bailenson, 2007). This can also be supported by the 'behavioural confirmation theory' (Snyder and Swann, 1978). This states that the expectations of one individual, can cause another individual to alter their beliefs and behaviour. This can subsequently contribute to behavioural and attitudinal shifts (Hershfield et al., 2011; Nowak and Fox, 2018; Peck et al., 2013; Vasalou, Joinson and Pitt, 2007).

However, avatars can alter individuals' attitudes and subsequently behaviours, independent of how others perceive them. If participants choose to incorporate an ideal version of themselves in an avatar, they can observe their distorted self-representations. This can subsequently influence individuals' future behaviours. This can be supported by Behm's self-perception theory (1972), and cognitive dissonance theory (Festinger, 1957), which together hypothesise that public self-representations (i.e. an avatar which represents an individuals' self) can influence individuals' subsequent self-evaluations and, in turn, can influence their behaviour.

Nevertheless, previous research on avatar creation, design and selection has been based on users' self-reports (Dunn and Guadagno, 2012; Vasalou and

Joinson, 2009; Yee, 2006). Therefore, there is limited research to assess the extent to which users' avatars are objectively like them. These similarities between the user and their avatar are partially based on experience (Dunn and Guadagno, 2012).

Users interact with each other through avatars, which are visual representations of their own identity. Three factors that influence the identity construction of an avatar are presence, representation (which involves the avatars' visual appearance and name) and embodiment (Falconer et al., 2014). Therefore these characteristics may elevate immersion and improve user participation (Dalgarno and Lee, 2010).

2.5.2.2 Second Life®

One of the most used and well-known examples of virtual world platforms with approximately 15 million users, is Second Life®, which Linden Lab developed in 2003 (Gallego, Bueno and Noyes, 2016; Linden Lab, 2021). Second Life® provides an effective 3D virtual world format, where multiple users have access to various tools to contribute to 'world-building,' and thereby creating a socially constructed reality (Anstadt, Bradley and Burnette, 2013). The world is formed by 'islands,' which can be rented and built using 3D objects, buildings, and landscapes.

Users access Second Life® using avatars, which are 3D representations of themselves. They can be provided with various physical characteristics, hairstyles, and accessories. The movement of a computer mouse or the arrows of the keyboard can control the avatars. They can run, jump, fly or can be teleported to another location. Second Life® provides a range of interactional affordances for their users to communicate with others. These are the following (Beard et al., 2009; Locher, Jucker and Berger, 2015);

Language-based affordances

- Text based chat: this is where users can communicate with each other through an instant messaging system.
- Voice chat: this is where users can communicate to each other verbally.

The benefits of implementing therapies in Second Life® are the following (Gorini et al., 2008).

- Sense of presence: this is achieved by utilising the virtual world simulations to translate psychoeducation and treatment into the experience.
- Social cohesion within the community: the social interaction within virtual group treatment provides individuals with social support in both reality and the virtual world.
- Utilising real-time feedback between reality and the virtual worlds: researchers and therapists can monitor patients' progress in the virtual world treatment and provide timely and targeted suggestions. This can be viewed as two-fold; 1) behaviour influences the experiences in Second Life® 2) behaviour in Second Life® influences the experiences.
- Providing adequate resources: participants will have access to resources, facilitating a transfer of skills and information into reality.

Table 5: Differences between face-to-face and Second Life®

	Face-to-Face intervention	**Second Life® intervention**
Communication	Individuals can only communicate face-to-face	Individuals can use voice and/or text communication.

		Text communication provides patients with a chance to plan their responses before sending them.
Anonymity	There is a limited sense of anonymity as individuals are face-to-face.	Individuals use avatars to attend treatment.
Location	Individuals will have to attend treatment in a particular geographical location.	Individuals can attend interventions at any location they choose.
Accessibility	Individuals do not require any equipment to attend treatment.	Individuals are required to have a computer/laptop and Wi-Fi to access the treatment.
Skills	Individuals do not require any skills or knowledge to attend treatment.	Individuals require confidence and competency in using the Second Life® programme.

2.5.2.2.1 The pedagogy of Second Life®

Virtual worlds such as Second Life® can be viewed as appropriate examples of providing an environment where facilitators can enhance teaching and learning practices (Ata, 2016). This is because virtual worlds provide ‘transactional learning’ (Barton and Maharg, 2007; White, 2008), where learning is facilitated by the immersive experience combined with completing various tasks and activities.

Therefore, this innovative form of teaching and learning encourages paradigms such as person-centred, immersion, embodiment, and self-direction (Ata, 2016). For example, Wiecha et al. (2010) conducted a pilot postgraduate medical education programme in Second Life®. 14 physicians attended an hour-long session, designed to improve their understanding of insulin therapy. Findings indicated that the pilot was successful, with participants stating that virtual worlds provided an engaging and valuable mechanism to enhance their education.

Nevertheless, there is an idea of a ‘pedagogy of uncertainty’ when considering virtual world interventions. According to Bayne (2008), as virtual worlds are considered ‘uncanny spaces,’ they may trigger potential uncertain learning experiences for some students (Bayne, 2008; White and Le Cornu, 2010). This is discussed further by Falconer (2011), who described the concept of ‘metaxis.’ This represents the concept of belonging to both the virtual and real world simultaneously. Furthermore, Bigger (2009) stated that individuals experience an intertwined state of mind, as they are both embodied in an avatar and can view their avatar from a third person perspective in the physical world. Although there are arguments that this level of complexity in the virtual world can have a detrimental impact on learning (Bayne, 2008; Savin-Baden, 2010), it can also be suggested that this unique learning environment can have significant pedagogical consequences.

However, according to Scopes (2011), there should be three core principles to consider when providing teaching within virtual worlds such as Second Life®:

1. Is using virtual worlds such as Second Life® essential?
2. Are the teachings manageable in the environment?
3. Do the activities provide the required outcomes in a timely cost-effective and efficient manner?

Therefore, adhering to these principles ensures that the virtual world interventions focus on the most efficient and desired value of the pedagogical need.

2.5.3 Challenges of VR implementation

2.5.3.1 Cybersickness

Some users experience nausea when using VR systems, with some applications more at risk of this than others. Cybersickness is related to sensory cure incongruity and occurs when there is a contradiction between perceptions in different senses (visual, auditory, proprioceptive, and vestibular). Alternatively, sensory cue information in the VR environment conflicts with the users' feelings and sensations. This is the opposite of motion sickness commonly felt in a moving vehicle (Pan and Hamilton, 2018; Reason, 1970). It can lead to symptoms such as vomiting, vertigo, eyestrain, disorientation, and ataxia (Kennedy, Drexler, and Berbaum, 1994).

Simulation sickness can be measured using the Simulation Sickness Questionnaire (Kennedy et al., 1993). Prior research has provided varied results as to the percentage of users affected by simulation sickness. According to Hale et al. (2017), 12.5% of participants terminated a task before completing it due to simulation sickness. Another study found that the dropout rate in completing a HMD experience increased significantly as time went on (Stanney et al., 2003).

2.5.3.2 Altered sense of reality

VR has been used to understand and diagnose various mental states. Whilst some individuals can clearly distinguish between real and VR environments, individuals who have impaired judgments may be at a higher risk of distorted thoughts. For example, experiences in VR could lead to misinterpretation of events and paranoid delusions in a vulnerable population (Tart, 1990).

2.5.4 VR and mental health

Within the last twenty years, there has been a development of VR interventions to treat and assess various mental health conditions. There have been several reviews looking into the impact of VR treatment on mental health and wellbeing. Cieślik et al. (2020) conducted a systematic review of reviews and found that VR therapy could positively impact psychiatric disorders. However, there should be caution when considering replacing traditional therapies with VR. Further research should be conducted to evaluate the impact VR therapies have on the healthcare system. Future reviews should also assess the quality of the papers they are appraising (Cieślik et al., 2020). In their review, Kim and Kim (2020) reiterated that due to studies' small sample sizes and lack of controls, it was challenging to verify how effective and safe VR treatments are for various populations. These findings can be supported by reviews conducted by Botella et al. (2017), Freeman et al. (2017), Gregg and Tarrier (2007), Jerdan et al. (2018), van Bennekom, de Koning and Denys (2017) and Valmaggia et al. (2016).

Reviews have also been conducted to look into VR's use in the assessment and/or treatment into specific mental health conditions such as eating disorders (Clus et al., 2018; de Carvalho et al., 2017; Ferrer-Garcia and Gutierrez-Maldonado, 2012), pain and anxiety (Ahmadpour et al., 2020; Eijlers et al. 2019; Oing and Prescott, 2018), anxiety and depression (Fodor et al., 2018; Ioannou et al. 2020), PTSD (Gonçalves et al., 2012; Wenrui et al., 2019), addictive disorders (Segawa et al., 2019), Parkinson's disease (Triegaardt et al., 2020) and neurocognitive disorders (Moreno et al., 2019).

2.6 Summary of chapter

This chapter provided a literature review into the treatment of psychosis. A literature review was provided on social cognition and the associated therapies, followed by DHIs for those with psychosis and ended with an introduction into how virtual environments and VR technologies have been used to provide treatment to those with mental health conditions. Digital treatment, and specifically VR treatment for those with mental health conditions is a broad and rapidly developing area, where there are many pilot, feasibility, and proof-of-concept studies. More research is required to further understand how to implement such interventions successfully into healthcare settings. Furthermore, extensive RCT trials are also required to assess whether VR treatments are just as effective as face-to-face treatment.

3. Methods and methodologies

This chapter provides the rationale and descriptions of the methods and methodologies implemented throughout this thesis, including the strengths and limitations of each. There are three phases in this thesis, comprised of seven studies. This thesis uses a mixed methods approach, thereby drawing on both quantitative and qualitative methods to address the various aims of this thesis.

3.1 Overview of study designs

A mixed methods approach was employed to address the aims of this thesis. A mixed methods design acknowledges the strengths of both quantitative and qualitative methods and compensates for the weaknesses. Thus, it enhances the interpretation and validity of the results (O'Cathain, Murphy and Nicholl, 2007).

Below is a summary of the methods used for each phase and study:

Table 6: Summary of the doctoral thesis structure

Phase	Chapter	Study	Title	Study Type
1	**4**	**1**	A systematic review of the feasibility, acceptability, and efficacy of VR interventions for psychosis	Systematic review
2	**5**	**2**	Beta testing evaluation of a virtual world intervention to	qualitative

			deliver social cognition training to those with FEP (the VEEP trial)	
	6	**3**	A quantitative analysis of the SCIT delivered via a virtual world in those with FEP – the VEEP trial	quantitative
	7	**4a**	Patient and public involvement (PPI) to assist with the design of interview schedules for the VEEP trial	qualitative
	8	**4b**	A qualitative investigation of the SCIT delivered via a virtual world for those diagnosed with FEP (the VEEP trial)	qualitative
	9	**5**	A qualitative investigation into the SCIT delivered via a virtual world from clinician's perspective	qualitative
	10	**6**	An autoethnography of a therapist's experience of delivering the SCIT via a virtual world for those diagnosed with FEP (the VEEP trial)	qualitative
3	**11**	**7**	Conducting Patient and public involvement (PPI) for a VR-360° Intervention to improve social	qualitative

cognition in those diagnosed with FEP

The Consolidated criteria for reporting qualitative research (COREQ) checklist was used to undertake and report each qualitative study (Tong, Sainsbury and Craig, 2007). The 2010 CONSORT checklist was used to report the results from the quantitative study (Equator network, 2020).

3.1.1 Epistemological position

This thesis implemented a mixed methods approach to understand the potential of using VR interventions to improve social cognition deficits in those with FEP. Therefore, identifying an epidemiological stance is complex due to the variation in research methods.

Thus, after considering the aims, topics and research methods in this thesis, the candidate decided to use a critical realist approach. Critical realism is referred to as critical for various reasons. Firstly, critical realists aim to immerse themselves in the critique associated with objective knowledge and research. Secondly, they believe that theoretical knowledge should constantly be analysed and critiqued to improve efficiency (Cruickshank, 2012).

Critical realists distinguish between intransitive and transitive knowledge. The intransitive represents entities of scientific knowledge, which establish the world around us. Transitive involves developing theories, paradigms, and methods of inquiry available to researchers. Therefore, although different theories about various phenomena exist, the world around us remains unchanged (Bergin et al., 2008).

This means that theoretical research is explanatory only, as opposed to predictive as dictated by positivism. Therefore, critical realists are antipositivists and reject the traditional view of scientific development and scientific structure (Parpio et al., 2013). Concerning health research, critical realists accept empirical evidence yet avoid imposing extreme determinism on such interventions to improve mental health (Clark, 1998).

Therefore studies, which aim to assess people's management of psychosis, may take factors such as adherence to treatment into consideration. However, researchers should also consider other socioeconomic and political factors, which also substantially impact patients' mental health (Cruickshank, 2012). The emergence and acceptance of mixed methods within healthcare research represent an acknowledgement that a mixture of methods is required to provide the relevant answers to pertinent questions. For this reason, the foundation of mixed method research is critical realism (Walsh and Evans, 2014).

3.2 Phase 1, study 1: A systematic review of the feasibility, acceptability, and efficacy of virtual reality interventions for psychosis

3.2.1 Rationale for a systematic review

According to Uman (2011), the purpose of a systematic review is to identify, collect, synthesise and appraise evidence about a particular area or topic. Historically there have been systematic reviews in VR and psychosis; however due to the fast-paced nature of publishing in this area, it was necessary and timely to conduct this systematic review.

The last systematic review to assess VR treatments for those diagnosed with psychosis, was published by Rus-Calafell et al. in 2018; this review also included studies that used VR as an assessment tool and included those diagnosed with ultra high risk psychosis. Therefore according to the candidate's knowledge, this is the first systematic review to focus exclusively on VR treatments for those diagnosed with psychosis. The evidence to date suggests that VR can be an effective treatment method for those with psychosis. The protocol for the systematic review was registered on PROSPERO (Elahi et al., 2020).

The definition of VR that was used in this systematic review is as follows: VR can be defined as a computer-generated simulation of a natural or artificial environment. Hardware and software systems create an inclusive sensory illusion, that allow individuals to experience and interact with a virtual environment (VE) in real time (Mantovani et al., 2003; Pratt, Zyda and Kelleher, 1995). VR is characterised by presence, immersion, and interactivity (Radianti et al., 2020).

3.2.2 Aim

The aim of this systematic review is to evaluate the feasibility, acceptability, and efficacy of VR interventions, for those diagnosed with psychosis.

3.2.3 Methods

3.2.3.1 Selection criteria

The methods used in this systematic review were reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) (Moher et al., 2009). PRISMA suggests that Participant Intervention Comparator and Outcome framework (PICO) (Moher et al., 2015) is used. This framework specifies four study components to be considered: participant group, intervention type, comparison group and research outcomes. The use of the PICO in this systematic review is outlined below:

The *participant* group was defined as any individual diagnosed with psychosis. This includes the following conditions: psychosis, schizophrenia, bipolar disorder, schizoaffective disorder, substance/medication induced psychosis, psychotic depression, postpartum (puerperal) psychosis, delusional disorder, organic psychosis, brief psychotic disorder and schizophreniform disorder.

The *intervention* was defined as virtual interventions. Virtual interventions (augmented VR, immersive VR, virtual worlds, CAVE) that aim to treat symptoms or other deficits in those diagnosed with psychotic disorders will be included. Technology based interventions (i.e., mobile applications) with no VR component will be excluded. Those peer-reviewed articles that referred to their intervention as VR were included.

There was no *comparison group* included as a criterion. Therefore, there were no restrictions associated with the type of comparator. Those peer reviewed studies that had a comparator group and those who did not, were included in the systematic review. For example, studies that had a comparator group with psychotic disorder/symptoms and/or non-clinically/healthy CG were included.

The *primary outcomes* were the feasibility, acceptability and efficacy of VR treatments on psychotic symptoms. *Secondary outcomes* were the levels of immersion each VR treatment provides and symptom/functioning outcomes in general, including QoL.

There were no limitations on *study design*. All randomised and non-randomised trials, pilot studies, mixed methods, feasibility studies and case studies were eligible for inclusion.

This review included studies in all *settings* (inpatient, outpatient, and community).

Studies were not excluded based on *year of publication*. It was expected that most studies exploring VR for psychosis would be published within the last 10-15 years. The literature search was conducted in January 2017 and updated in May 2021.

English language studies, published in peer reviewed journals were included. Trials registers were reviewed, to ensure that ongoing studies were identified.

3.2.3.2 Search strategy

Search terms were compiled with the support of the candidate's PhD supervisors. Furthermore, previous systematic reviews in the same field were reviewed to compile a list of search terms. The first set of search terms focused on the type of intervention, and the second set of search terms focused on the condition of the participants. These search terms were searched on the title and abstract level using the following databases: Web of Science, ScienceDirect, PubMed, Embase, PsycINFO, ACM Digital Library, Engineering Village, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Scopus and the Cochrane Central Register of Controlled Trials (CENTRAL). There was no limitation in terms of the year published. Furthermore, trial databases were searched, and the references of the final list of studies were reviewed. 43 studies were included in the review.

Table 7: Overview of search terms

Group 1 and group 2 searches are combined

Virtual” **or** “Augmented Reality” **or** “360 Degree Video” **or** “360 Video” **or** “Virtual Space” **or** “Virtual Environment” **or** “Virtual Community” **or** Cyber **or** “Simulated Environment” **or** “Second Life” **or** Avatar **or** “Inhabited Space” **or** “Active World Inhabited Space” **or** “Active World”	“psychosis” **or** “psychotic” **or** “psychotic disorder” **or** schizophrenia **or** schizophrenic **or** schizoaffective **or** “schizoaffective disorder” **or** “bipolar disorder” **or** “bipolar” **or** “substance induced psychosis” **or** “medication induced psychosis” **or** “substance psychosis” **or** “medication psychosis” **or** “psychotic depression” **or** “postpartum psychosis” **or** “puerperal psychosis” **or** “delusional disorder” **or** “organic psychosis” **or** “brief psychotic disorder” **or** “brief psychosis” **or** “schizophreniform disorder” **or** “schizophreniform”

3.2.3.3 Screening procedure

Following removal of duplicates, the candidate screened 100% of titles, abstracts, and full texts. Dr Muna Dubad (Trainee Clinical Psychologist in the NHS) independently screened 10% of titles and abstracts for full text retrieval. 100% of the full texts were screened by both MD and FE. Therefore the risk of bias was reduced. The candidate assessed full text articles against the inclusion and exclusion criteria and extracted relevant data.

3.2.3.4 Quality assessment

The Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018) was selected to appraise the final set of studies. This is because it is the only validated tool to appraise qualitative, quantitative, and mixed methods studies. No studies were excluded based on their quality assessment. The MMAT contains a methodological rating of 0, 25, 50, 75 and 100 (this is the highest quality) for each study, based on the evaluation of the study design, selection bias, methods of collection, sample size, quality of the intervention and analysis type (Pace et al., 2012).

3.2.3.5 Data synthesis

Both the quantitative and qualitative data were narratively synthesised. A narrative synthesis is an approach that primarily relies on text to explain and summarise the findings of a systematic review synthesis. The ESRC guidance on conducting a narrative synthesis was followed (Popay et al., 2006):

- Creating a preliminary synthesis: developing a description of the results of included studies.

- Exploring and understanding relationships in the data: analysing emerging patterns in the data to find explanations for differences in the size or direction of effect across studies.
- Reviewing the robustness of the synthesis: this involves reviewing the methodological quality of the included studies.

3.2.3.6 Main strengths and limitations

This systematic review's main strengths were its exclusive focus on VR treatment interventions that target those with psychosis; previous systematic reviews have focused on those VR technologies that have been used for assessments in those with psychosis. Furthermore, compared to previous reviews, there was no limitation on the year of publication or type of study. Therefore, qualitative and quantitative studies were appraised. The importance of systematic reviews is that they can help tailor future research questions. One of the key findings of this systematic review was the lack of feedback collated from participants about their experiences in the VR intervention. The transparent and thorough reporting of the systematic review methodology means that future researchers can replicate this review.

Whilst every effort was made to find all the peer reviewed research systematically, some relevant findings may have been missed. Only those publications written in English were included in the review. This is because there were no resources available to translate any literature published in another language accurately. Thus, those findings published in a language other than English may have been missed. Additionally, due to the lengthy publication process, it is possible that those recently published papers were not included in the review. It is advised that at least two individuals should complete the data extraction independently, to reduce the chance of error (Shokraneh and Adams, 2017). However, only the candidate completed the data extraction for the included studies. This was due to time restrictions and difficulties in finding another researcher who had the time to commit to the data extraction. Therefore, this can be seen as a limitation of this systematic review.

3.3 Phase 2: virtual reality as a method of delivering social cognitive therapy in early psychosis (the VEEP Trial)

Below are the list of studies, that are included in phase 2.

Study 2: Beta testing evaluation of a virtual world intervention to deliver social cognition training to those with FEP – the VEEP Trial.

Study 3: A quantitative analysis of the SCIT delivered via a virtual world in those with diagnosed with FEP – the VEEP Trial.

Study 4a: Patient and public involvement (PPI) to assist with the design of interview schedules for the VEEP Trial.

Study 4b: A qualitative investigation of the SCIT delivered via a virtual world for those diagnosed with FEP – the VEEP Trial.

Study 5: A qualitative investigation into the SCIT delivered via a virtual world from clinician's perspective – the VEEP Trial.

Study 6: An autoethnography of a therapist's experience of delivering the SCIT via a virtual world for those diagnosed with FEP – the VEEP Trial.

3.3.1 Development and rationale

Conditions such as FEP are among the most debilitating conditions worldwide, with social cognition a factor that leads to poor functional outcomes. Interventions that target social cognition deficits in those with established psychosis are effective (Kurtz and Richardson, 2012). A limited number of studies have targeted social cognitive deficits in those in the early stages of psychosis. Bartholomeusz et al. (2013) conducted a manualised group intervention using the SCIT; whilst there were significant improvements in some outcomes, some participants struggled with attending face-to-face treatment. Thus, this had an impact on attendance, engagement, and compliance. These findings showed that it is vital to find methods of engaging with those with FEP to improve social cognition and functional outcomes. Advancements in technological interventions mean that there are more novel and engaging interventions. VR can make interventions affordable, accessible, and attractive.

Therefore, a feasibility and acceptability proof-of-concept trial was developed to provide social cognitive therapy to those people with FEP, using a virtual world. This trial was funded by MQ under the PsyIMPACT award, and sponsored by the University of Warwick. The Principal Investigator was the candidate's PhD supervisor Professor Andrew Thompson, and the co-investigators were the following: Professor Max Birchwood, Professor Sandra Bucci, Professor Swaran Singh, Mr. Dave Taylor and Professor Ivo Vlaev. The trial coordinator was Dr Alba Realpe, Research Associate (RA) was Dr Fiona Leahy, and the second therapist was Ms. Keshiaa De Valliere.

3.3.2 Recruitment and participants

The VEEP trial recruited individuals diagnosed with FEP who received treatment at the EIP services in Coventry and Warwickshire Partnership National Health Service (NHS) Trust (CWPT). A purposive sampling strategy was used to recruit participants to take part in the intervention. This is a common non-probability sampling technique used in mixed methods research, where individuals are selected based on their shared experiences (Palinkas et al., 2015).

Inclusion Criteria: service users were eligible if they were attending the EIP for at least three months and had been provided with a care coordinator, diagnosed with a psychotic disorder according to International Classification of Diseases (ICD) 10 (WHO, 2016) and aged between 18 to 45 years.

Exclusion Criteria: service users were excluded if they were limited in spoken and written English. The VEEP recruitment team assessed proficiency in English during the recruitment interview. Those service users diagnosed with a moderate intellectual disability and/or a neurological disorder were excluded. Those service users experiencing an acute psychotic episode at the time of recruitment, were also excluded. This refers to those patients who were either being cared for by an acute (inpatient) service or the crisis team.

Under CWPT, there were three EIP services in the following locations: Nuneaton, Coventry and Warwick, UK. At the time of recruitment, Professor Andrew Thompson was the Consultant Psychiatrist in the EIP located in Nuneaton. Therefore, colleagues in all EIP services, were informed of VEEP trial and asked to review their caseloads to identify eligible service users. Furthermore, the trial coordinator and Research Fellow (RF) Dr Alba Realpe also attended a weekly multi-disciplinary team meeting to introduce and discuss the trial further. The RA Dr Fiona Leahy, and the candidate attended a multi-disciplinary meeting at the EIP services in both Warwick and Coventry to introduce the trial and receive assistance in recruitment.

Once clinicians in EIP services had identified eligible service users, they were asked to approach them and request whether they would be interested in taking part in the VEEP trial. Clinicians were provided with copies of both the consent form and the participant information sheet, which could be given to the eligible service users. If a service user was interested, their contact details were provided to the RA, who then arranged a meeting at the EIP service to discuss the trial further and take consent. The candidate and the RA also recorded the reasons for declining to take part in the VEEP trial.

Participants completed outcome measures at pre and post intervention, with the support of the RA. Outcome measures were collected on social cognition, social functioning, behaviour change, QoL, neurocognition, psychopathology and presence. For this doctoral thesis, the following data was presented, and analyses were conducted: participants' feedback via session feedback forms, a comparison of completers vs non-completers post-intervention, a comparison of completers pre and post-intervention, a comparison of non-completers pre and post-intervention, and a measure of presence post intervention.

Once participants had completed or dropped out of the VEEP trial, they were approached by the candidate and asked whether they would consent to participate in a semi-structured interview. For those participants who agreed, a date and time was scheduled to take consent and record the interview. All interviews were conducted face-to-face at either the participants' homes or at the EIP service.

Clinicians who worked at the EIP services in CWPT, were approached to participate in a focus group to provide feedback on the VEEP trial. The candidate contacted each service via email, to request whether clinicians were available and interested in taking part. One focus group was organised face-to-face at the EIP service in Nuneaton. This focus group took place towards the end of the recruitment period.

3.4 Phase 2, study 2: beta testing evaluation of a virtual world intervention to deliver social cognition training to those with FEP - the VEEP trial

3.4.1 Development and rationale

The process of delivering a beta test is known as a ‘beta release,’ which is usually the first time the intervention is made available to those outside of the development team (Barnum, 2011; Naeem et al., 2016). Beta testing is undertaken to test the feasibility, acceptability and usability of the intervention. Therefore, as a result, the intervention is open to design changes (Upitis et al., 2015). Before delivering the VEEP intervention, a beta testing process was undertaken with a series of volunteers.

3.4.2 Aims

The purpose of this beta test study was to:

1. Determine the feasibility, acceptability and usability of the VEEP intervention.
2. Identify any technical issues prior to undertaking the proof-of-concept trial.

3.4.3 Recruitment and participants

To conduct the beta testing within a short period of time, a purposive sampling approach was used to select a small number of participants.

Eligibility criteria was the following:

1. Aged 18 years and over.

2. Access to either a computer or laptop that could download Second Life®.
3. Able to commit to the entire beta testing process.

Four PhD students based at Warwick Medical School (WMS) were recruited and consented to take part in the beta testing. The demographics were the following:

- One male, three females.
- Aged between 24 to 59 years.

Each participant was provided with a £35 Amazon voucher after the process was complete, in recognition for their time (see appendix 1).

3.4.4 Procedure

Participants were informed that they would be attending social cognition therapy in a virtual world environment. Once participants consented to take part in beta testing, the candidate emailed them with the VEEP participant information sheet (see appendix 2). The therapists (the candidate and the RF) met with participants a week prior to beta testing, to check whether they had access to a computer or laptop.

Once participants confirmed this, the therapists then organised a pre-beta testing session with all participants to introduce and train them in using Second Life®. They provided them with written instructions to install Second Life® on their preferred computer or laptop. The candidate and the RF also created accounts for all participants and provided them with the usernames and passwords to log into Second Life®. Participants were asked to login and choose an avatar. They were shown how to navigate the environment, make use of items in the inventory, and how to activate chat and speak functions.

This included how to use the teleporter; this would allow them to move between rooms in the virtual world. Participants were informed that if they had any questions or queries prior to taking part, they could contact the RA or the therapists.

The therapists conducted the beta testing in the same office at WMS. Three participants decided to take part in the beta testing process at an office together at WMS, whilst another participant chose to take part in their own home.

The purpose of the beta testing was to test that sessions one to six were feasible and acceptable. Due to time constraints, each session was shortened. The beta testing took place over two sessions, which each lasted three hours (session one-four on day one and session five-six on day two). Each session lasted approximately 30 minutes.

At the end of the last session, the therapists held a ‘debrief’ session for 30 minutes in Second Life®, with all four participants to gather their feedback on the VEEP intervention. After this had been collected, the candidate emailed participants with their £35 Amazon voucher.

Figure 11 below illustrates where the beta testing process is positioned in the VEEP trial development process.

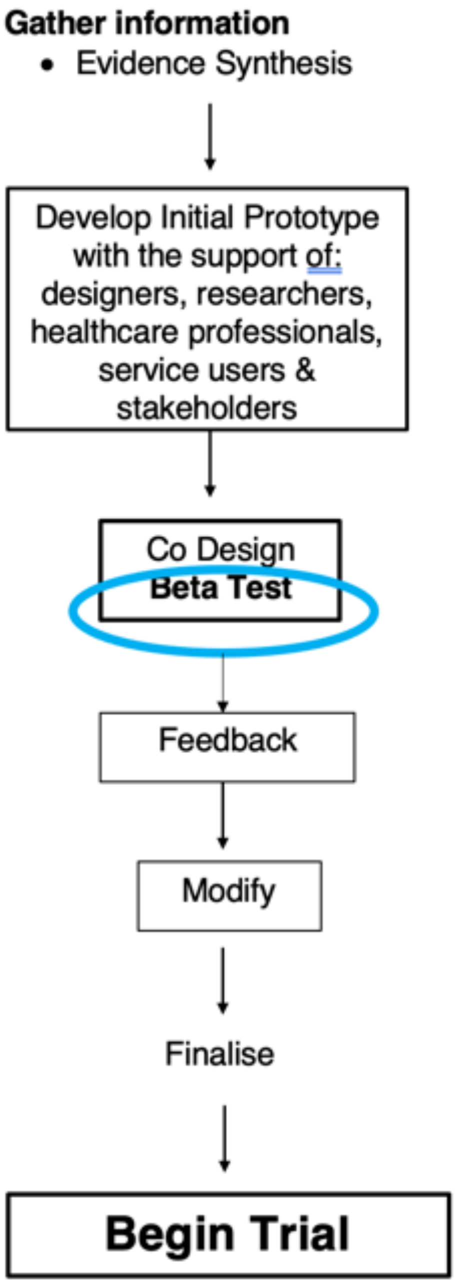


Figure 11: Intervention development outline

3.4.5 Data collection

Data was collected via three methods:

1. Participant log – participants were asked to write down their opinions about the VEEP intervention after each session.

2. Therapist log – The candidate recorded her own thoughts and opinions about facilitating the VEEP sessions.
3. Open ended questions – an open-ended topic guide was used to collect participants' feedback after the beta testing process had ended. Questions focused on the feasibility, usability, and ease of understanding. Participants were also asked what participants would change about the VR intervention, as well as any other feelings they experienced.

3.4.6 Data analysis

Thematic analysis was used to analyse the observations. Full details of how the thematic analysis was conducted can be found in section 3.7.6.

3.5 Phase 2, study 3: a quantitative analysis of the SCIT delivered via a virtual world in those diagnosed with FEP – the VEEP trial

3.5.1 Development and rationale

Choosing to omit the results from those who have dropped out of an intervention may lead to biases in results. Thus, the authors of such studies choose to publish interventions that focus on a sub-group of well-motivated and persistent service users who complete a particular therapy. This means that these findings may not be generalisable to an entire population.

Participants who take part in web-based interventions demonstrate greater variation in how they use interventions regarding frequency of use and session and assessment attendance (Christensen, Griffiths, and Farrer, 2009; Postel et al., 2010; Riper et al., 2008). Nevertheless, less is known about the non-completers who have taken part in these web-based interventions (Eysenbach, 2005). Thus, empirical evidence for the “non-completion” effect requires further investigation.

The quantitative analyses conducted in this doctoral thesis are an extension of the pre to post-intervention analyses conducted by the VEEP trial team (Thompson et al., 2020). Therefore, feasibility was measured using the feedback provided via the session feedback forms. Further analyses were conducted to examine the differences in social cognition, social functioning, behaviour change, QoL, neurocognition and psychopathology between completers and non-completers who took part in the VEEP intervention. Additional analyses between completers at post-intervention were also conducted. Additional analyses between non completers at post-intervention were also conducted. A key characteristic of VR is creating a sense of presence (Schwind et al., 2019). Therefore, to fully understand participants’ interaction in VR, presence was also measured and presented at post-intervention.

This study is one of the quantitative evaluations of this treatment, which provided researchers with information on participants' own unique experiences. This is useful during the pilot stages of treatment before a larger scale trial can be implemented.

3.5.2 Research questions

Below are research questions for this study:

Research question 1: What is the feasibility and acceptability of the VEEP intervention?

Research question 2: Is there a significant difference between VEEP intervention completers and non-completers based on social cognition, social functioning, behaviour change, QoL, neurocognition and psychopathology variables, at post-intervention?

Research question 3: Are there significant improvements between pre and post-intervention, based on social cognition, social functioning, behaviour change, QoL, neurocognition and psychopathology variables, for VEEP completers?

Research question 4: Are there changes between pre and post-intervention, based on social cognition, social functioning, behaviour change, QoL, neurocognition and psychopathology variables, for VEEP non-completers?

Research question 5: What is the impact of the VEEP intervention on participants' sense of presence?

3.5.3 Method

3.5.3.1 Participant information

This study was based on the SCIT trial conducted by Bartholomeusz et al. (2013), who used a 50% completion rate. Therefore, in this trial, completers were identified as those who had attended at least 50% of the VEEP sessions (4/8). This is because they received an adequate dosage of treatment sessions. More information on participants is provided in chapter 6.

3.5.3.2 Procedure

CWPT informed clinicians within the service about the trial and requested that they notify the RA of any eligible participants. Once an eligible participant had been identified, the clinicians then contacted the RA to inform them of this. The RA then arranged an appointment at CWPT with the participant. This appointment involved discussing the trial further with the participant (see appendix 2) and obtaining informed consent (see appendix 3). Once the participant provided consent to participate, the RA then organised an appointment to meet with the participant to complete baseline outcome measures at the participant's home or the EIP service. Below are the following quantitative outcome measures, which were collected at baseline and post-intervention. These measures were self-reported and were completed on paper copies:

Feasibility and Acceptability

Consent rates, completion and follow up – Consent rates of eligible participants, completion rates of those participants who took part in the intervention and outcome measure completions were collected.

VEEP participant feedback forms (see appendix 4) were used to collect information on participants' experiences of the intervention, which highlighted what worked and what improvements are required, and provided the researchers with valuable information on designing future interventions.

Participants were required to complete a feedback form at the end of each session, which aimed to collect their feedback on the following topics:

- Suitable level of content (e.g. easy to understand).
- Relevance and value of the content.
- Guidance from the therapist.
- Encouragement to participate and interact.
- Safety of the VR world.

Participants also had the opportunity to provide some optional written comments at the end of the feedback sheet. The items were scored on a 5-point likert scale (5=excellent, 4=good, 3=fair, 2=poor and 1=very poor).

Social Cognition

- Social Cognition Screening Questionnaire (SCSQ) (Roberts, Fiszdon and Tek, 2011) (see appendix 5) – this aims to measure various domains of social cognition. This also includes subscales measuring on-social domains of schematic inference and verbal memory and ToM, metacognition and attributional bias. Higher score represents a better level for each domain, except for hostility bias. For hostility bias*, a higher score means a larger bias.
- Bell Lysaker Emotion Recognition Task (BLERT) (Pinkham et al., 2016) (see appendix 6) – this aims to measure emotion recognition. Participants are required to watch 21 ten second videos of an individual

expressing one of seven emotions: happiness, sadness, surprise, anger, fear, disgust, and no emotion. After this, participants are required to choose what emotion was expressed. The total score ranges from 0-21 (19-21 is normal, 15-18 is mild impairment, 11-14 is moderate impairment, 7-10 is moderately severe, 0-6 is severe).

- Hinting Task (Corcoran, 2003) (see appendix 7) – this measures participants' understanding of indirect speech requests, which occur during social interactions. This is measured via 10 vignettes. Total scores range from 0 to 20, with higher scores indicating a more positive result.
- Cognitive Style Questionnaire – short form (CSQ-SF) (Meins et al., 2012) (see appendix 8) – this measures negative cognitive style associated with one's vulnerability to depression and anxiety. Total scores range between 72 and 360. Higher total scores reflect a higher negative cognitive style.

Social Functioning

- Personal and Social Performance Scale (PSP) (Patrick et al., 2009) (see appendix 9) – this measures social functioning via four domains; self-care, aggressive behaviour, socially useful activities and personal and social relationships. Total score ranges from 1-100 (1-50 reflect marked to very severe difficulties, 51-70 reflect difficulties and dysfunction and 71-100 reflect 'mild difficulties' or no dysfunction).

Behaviour Change

- Theoretical Domains Framework – Belief about capabilities; domain Four (TDF-4) (Atkins et al., 2017) (see appendix 10). This measures an individual's acceptance of the reality about a talent, ability, or facility, that can then be put to constructive use. Higher scores indicate a more positive result.

- Theoretical Domains Framework– Intentions and goals; domains Eight and Nine (TDF-8; TDF-9) (Atkins et al., 2017) (see appendix 11). Domain eight measures an individual’s conscious decision to act in a certain way or perform a particular behaviour. Domain nine measures an individual’s mental representation of an outcome they would like to achieve. Higher scores indicate a more positive result.

QoL

- 5 level EuroQol Quality of Life outcome (EuroQol 5-D) (Williams, 1990) (see appendix 12) – this requires participants to indicate their health status on five dimensions: self-care, mobility, anxiety/depression, usual activities, and pain/discomfort. Higher scores represent a better health state.

Neurocognition

- National Adult Reading Test (NART) (Nelson, 1982) (see appendix 13) – this is a test of premorbid intellectual functioning. Higher scores and fewer errors indicate higher premorbid cognitive ability.
- Trail Making Test (Arnett and Labovitz, 1995) (see appendix 14) – this is a widely used neuropsychological assessment for identifying mild dementia and mild cognitive impairment. This measures mental flexibility, visual scanning, sequencing, psychomotor speed, and complex attention. Scoring is based on time taken to complete the test with lower scores being more positive.

Psychopathology

- Brief Psychiatric Rating Scale (BPRS) (Overall and Gorham, 1962) (see appendix 15) – this is a standardised method of assessing psychiatric symptoms in participants. The severity and presence of psychiatric symptoms are rated on a likert scale ranging from 1 (not present) to 7 (extremely severe).

Presence

Presence Questionnaire (Witmer and Singer, 1998) (see appendix 16) – this is one of the most prevalent presence questionnaires and has an ordinal scale. Higher scores represent greater reported presence. The presence questionnaire can be divided into four subscales:

- *Control responsiveness*. These items assess participants' judgement of how quickly and how the VR responds to their attempts to interact and control with it.
- *Sensory exploration and adjustment*. These items assess the extent to which VR configuration allows participants to examine VR objects using their senses.
- *Involvement*. These items assess the degree to which participants feel like they are engaged with a VR environment.
- *Interface awareness*. These items assess to what extent the interface is natural and how aware participants are of the control devices used.

The initial appointment between the RA and the participant was also an opportunity to assess whether participants had the appropriate IT equipment to take part in the intervention. Therefore, the RA checked to see that the patient has Wi-Fi access and a computer, which could operate Second Life®. If participants did not have adequate equipment, they were loaned a University of Warwick laptop and/or a portable Wi-Fi hotspot. During this appointment, the RA downloaded Second Life® onto the participants' computer/laptop, provided them with their login details (which was registered in advance and did not have any personal information) and created an avatar for them (see appendix 17).

Once the avatar was created, participants were informed that they could alter the avatar. Participants were also given a headset with a microphone, which was used for voice chat during the intervention. During this appointment, participants also informed the RA of appropriate times by which they could take part in the intervention. Once the RA met with enough participants for a group, the appropriate times were then organised with the therapists (the candidate and Ms. Keshiaa De Valliere). The participants were all informed of the dates and times for the intervention sessions.

Sessions took place twice a week for four weeks, with sessions lasting approximately 60-75 minutes. Two therapists were available to deliver the intervention. The benefits of having two therapists were that one therapist could provide additional support to participants if they required it. For example, if participants were experiencing technical difficulties, such as microphone issues or login issues, the second therapist could contact the participant using the university work phone to rectify this.

Once the intervention was completed, appointments were organised with participants to complete outcome measures. Data collection occurred in participants' homes, with both the candidate and the RA present. All data was stored on a secure database.

3.5.3.3 Data analysis

The overall scores for the feedback form were presented according to each question and each session. Analyses were conducted using statistical package for the social sciences (SPSS) version 22. Paired samples t-tests were conducted for each outcome measure for completers and between Time (T) 1 and T2. An independent samples t-test was conducted to compare the outcome measures of both completers and non-completers at Time (T) 2. The Benjamini-Hochberg procedure was added to these analyses, in order to reduce the chances of Type I errors. Due to the low sample of non-completers, the results for the non-completers were presented descriptively.

3.6 Study 4a: patient and public involvement (PPI) to assist with the design of interview schedules for the VEEP trial

3.6.1 Aims

The PPI workshop was designed to address the following aims:

1. To obtain feedback on the acceptability of the VEEP service user interview schedules.
1. To shape the interview questions based on the feedback before commencing the VEEP intervention.

3.6.2 Methods

3.6.2.1 Design and reporting

A participatory design was used in this PPI study. This is a design to involve all stakeholders in the development process, in order to increase usability. The Guidance for Reporting Involvement of Patients and the Public 2nd checklist (GRIPP2) for reporting PPI in health and social care research was used to report this PPI activity (Staniszewska et al., 2017).

3.6.2.2 Participant information

A purpose sampling strategy was used to recruit PPI consultants. Two participants who had previously taken part in the VEEP trial codesign process were approached via email (see appendix 18). These participants were young people (aged between 18 – 30 years), who had previously used mental health services. The two participants Sophie and Ellie (pseudonym names) had agreed to take part in this PPI study. As they had already taken part in the codesign process, they had already received a copy of the VEEP project plan. They were familiar with the aims and objectives of the intervention. Furthermore, they both had prior experiences of taking part in PPI for other projects.

Due to time limitations of ensuring the PPI study was completed in time before the VEEP recruitment began, it was agreed between the candidate and the VEEP research team that two participants were sufficient. Participants were reimbursed for their travel expenses.

3.6.2.3 Procedure

The PPI workshop took place at WMS. The candidate was the PPI facilitator and met with Sophie and Ellie in separate workshops (one session each), which lasted 45 minutes. The workshops were divided into two phases.

- Phase one (20 minutes) involved providing a presentation on the VEEP treatment and giving individuals an opportunity to view the virtual world environment once again.
- Phase two (25 minutes) involved individuals reviewing the interview schedules and providing feedback.

The workshop discussions broadly focused on five categories:

1. Thorough questions that covered all aspects of the treatment process.
2. Prior experiences to group treatment.
3. Digital expertise and the preconceptions of the VEEP treatment.
4. Experiences of the VEEP treatment.

During phase one, the candidate outlined the scope and plan for the VEEP trial and the role of the PPI workshop within it. The candidate acknowledged the benefit of a bottom-up approach to exploring participants' experiences whilst remaining within the remit of the trial. Therefore, participants were informed that the semi structured interviews had already been submitted and approved by the NHS ethics committee. Thus, this meant that the schedules could not be completely rewritten; however, the language and phrasing of questions could be altered, and some new questions could be added. Each workshop's setup involved only one participant and the PPI facilitator allowed for in depth discussion.

During the second phase, each participant was provided with a copy of the semi structured interview schedules for service users who would participate in the VEEP intervention. They were provided with both the completer and non-completer interview schedules. Participants were given time to read through the interview schedules and asked to provide their thoughts and opinions. They were asked to focus on the language of the questions. After participants had read the interview schedules, they annotated their copies and handed them over to the PPI facilitator. They also discussed with the PPI facilitator about their annotations, as well as their opinions. The PPI facilitator made notes on what each participant fed back.

3.6.2.4 Ethical considerations

As this was a PPI activity to shape a research trial, NHS research ethics approval was not required. This was confirmed by the University of Warwick ethics committee.

3.6.3 Data collection

Participants were aware of the aim of the PPI workshop, had consented to notetaking and for the candidate to use such notes in publications. Both PPI participants annotated interview schedules. An unstructured interview discussion was conducted by the PPI facilitator (the candidate), which involved elaborating upon the reflections captured in the annotations. Conversational data was collected via the candidate’s field notes. These field notes contained the nuances of the discussions and were also coded during the workshops. These codes were checked with both participants during and at the end of the workshops. This was to confirm the validity and clarity.

3.6.4 Data analysis

Thematic analysis was used to analyse the observations. Full details of how the thematic analysis was conducted can be found in section 3.7.6.

3.7 Phase 2, study 4b: a qualitative investigation of the SCIT delivered via a virtual world for those diagnosed with FEP – the VEEP trial

3.7.1 Aims

The aim of this study was to assess the acceptability of the VEEP trial from the participants' perspective. This involved a deep exploration of participants' perceptions and opinions.

The semi-structured interviews aimed to evaluate and refine the treatment, curriculum, and VR environment in terms of content, mode of delivery and practical details (i.e., timing, dosage, resources provided). This information provided useful feedback, which could then be used to make improvements for future studies. Therefore, the interviews aimed to identify:

- Participants' reasons for participating and their expectations of the VEEP treatment.
- Participants' pre-intervention experience with technology and group therapy.
- Participants' experiences of receiving treatment virtually, which includes their opinions of the Second Life® environment.
- Participants' opinions on the content of the treatment itself.
- Participants' opinions on the practical aspects and the impact it had on their daily lives.
- The impact the treatment had on participants' ability to manage their mental health.

3.7.2 Participant information

15 participants consented to take part in the interviews (15/16; 93.8%). In total there were 11 completers and four non-completers.

3.7.3 Procedure

Once the intervention was completed, appointments were organised with those who had verbally consented to participate in the interview's pre-intervention. Participants were provided with the option of either conducting interviews over the phone or face-to-face. For participants who chose the face-to-face option, interviews took place at the individuals' home (N=13). Prior to beginning the interview, participants signed a consent form (see appendix 19) after reading through a participant information sheet (see appendix 20). The interviews were recorded using an encrypted dictaphone and transcribed verbatim by the candidate. The length of the interviews ranged from 10-35 minutes. All data was stored on a secure database at the University of Warwick, which only the research team could access (see appendix 21 for further information on the preliminary interview schedule for those participants who have completed the intervention). The data was collected, stored, and processed according to the Data Protection Act 2018 (GOV.UK, 2018) and the University of Warwick regulations.

Participants who had not completed the intervention were also provided with the opportunity to participate in an exit interview (see appendix 22). Benefits of interviewing participants who have dropped out include collating information about compliance and adherence rates, with the aim of reducing barriers to non-completion for future studies (Lal and Malla, 2015).

3.7.4 Service user interviews

Semi-structured interviews were used to collect qualitative data from this trial. Semi-structured interviews are formulated around a group of pre-designed open-ended questions, with subsequent questions developing from the discussion between the interviewer and interviewee. Therefore, this information contributes to both conceptual and theoretical knowledge.

Below are the key characteristics of semi structured interviews (DeJonckheere and Vaughn, 2019): It involves either group or individual participants. The interview schedule is developed in advance and it provides insight into participants' perspectives.

There are many advantages to using semi-structured interviews. It allows researchers to obtain information from participants regarding their experiences and perceptions relating to the relevant topic in depth. This is particularly useful when there is limited understanding of the domain being investigated. The flexibility with the structure allows researchers to alter the schedule to suit individuals' needs (Braun & Clarke, 2006).

3.7.5 Interview schedules

In a systematic review conducted by McCashin, Coyle and O'Reilly (2019), it was stated that future research should include robust qualitative studies, which focus on the experience of young individuals. Specifically, studies should include the experiences of young individuals who also dropped out of the intervention. This could be useful to determine what adaptations should be made to the technology.

The candidate developed the interview schedules for interviews with service users. The VEEP research team reviewed the initial drafts. Additionally, a PPI study (discussed above) was conducted to gain feedback on the interview schedules. After this, the interview schedules were refined and finalised.

The candidate specifically explored the following:

1. Participants' previous and current uses of technology in their daily lives.
2. Participants' feedback on the virtual world programme.
3. Participants' feedback on the SCIT treatment itself.
4. The impact of VR treatment on participants' mental health and wellbeing, particularly their social cognition.
5. Participants' challenges to using and implementing VR treatments.

Therefore, these questions intended to establish whether it was feasible and acceptable to provide therapy virtually, and what improvements could be made.

Table 8: Example of the questions and prompts used in the semi structured interviews

Grand Tour	This is an introductory question, which is connected to the research question.	This helps to initiate the interview and allow participants to talk about their experiences.	"What are your prior experiences of technology?"
Core Questions	These are questions that are directly relevant to the information	These questions aim to get the relevant responses and encourage participants to talk	"What were your thoughts of the virtual world Second Life®?"

	the researcher is trying to collect.	about the topic in depth. These questions are typically asked to all participants.	
Planned Follow Up Questions	These questions are specifically asked after the core questions, to obtain more information.	This helps to gain greater detail and clarity of the participants' responses.	"What particular aspects of the Second Life® environment did you like the most and why?"
Unplanned Follow Up Questions	These questions arise because of the participants' responses.	These questions are influenced and dependent on the responses participants give.	"You mentioned that you liked the beach hut and environment. Can you please elaborate on why this is?"

Questions were open-ended and broad, to encourage and facilitate a detailed qualitative inquiry. Furthermore, prompts were included to provide detailed responses. The semi-structured nature of the interviews meant that the questions had both structures and the flexibility to allow for additional points to be discussed.

3.7.6 Data analysis

A Thematic Analysis method (Braun & Clarke, 2006) was used to analyse the qualitative data to identify, analyse and discuss the themes found in the semi structured interviews and the focus group. This method was chosen because it can be used to provide in-depth analysis to answer the research questions.

Unlike other types of methods, thematic analysis does not have a pre-existing theoretical foundation and so, therefore, can be utilised using different frameworks.

Thematic analysis can be divided into several stages. Firstly, the candidate transcribed the interviews verbatim, which allowed her to develop a more thorough understanding of participants' thoughts and opinions. She also read the transcriptions in depth, and notes were made to highlight key points. Below are the stages of thematic analysis that the candidate followed:

Phase one - familiarise oneself with the data: firstly, the candidate familiarised herself with the data. This was achieved by transcribing the interviews verbatim and in a format, which is thorough and accurate, considering all verbal and non-verbal cues. After this, the transcriptions were checked against the original audio to ensure accuracy. Whilst reading the transcriptions, the candidate searched for patterns to improve her understanding.

Phase two - developing initial codes: this phase began when the candidate had created a list of the relevant points she found in the transcriptions. From this, the candidate created a set of initial codes. Codes represent aspects of the data and can be analysed in a meaningful way. This involves categorising the data into significant groups. For these studies, the coding was 'data-driven,' which meant that the themes depended on the data. Therefore, to maintain context, the codes were developed for as many patterns as possible.

Phase three - searching for specific themes: this phase began when all the data in the transcriptions had been coded and collected. The candidate then organised the codes into relevant themes by combining similar codes. This was achieved by using a thematic map. At the end of this process, the themes and sub-themes were aligned with the relevant data extractions.

Phase four - reviewing themes: here, the candidate then reviewed these themes. This was achieved in two stages. Stage one involved examining the data extracts for each theme and checking to ensure that they formulate a similar pattern. The second stage involved ensuring that the thematic maps accurately reflected the entire data set to ensure validity and accuracy.

Phase five - providing themes with names: here, the candidate refined the themes to ensure that each one had a clear definition and was represented well with the breadth and depth of data extracts. She then collated the extracts for each and wrote a narrative about the themes. This involved writing about what it meant, what it represents and its reflection on the data. The names of the themes were created to be clear, concise, and easy to understand. To enhance the rigour of the research and reduce bias, two independent researchers reviewed the development of themes and interpretations (Tong et al., 2007). Prof. Andrew Thompson, Dr Muna Dubad, Dr Jennifer Martin, Dr Deborah Biggerstaff and Dr E. Bethan Davies, reviewed the initial codes and themes that were developed for all qualitative studies in this PhD thesis. This was in order to enhance trustworthiness.

3.8 Phase 2, study 5: a qualitative investigation into the SCIT delivered via a virtual world from clinicians' perspective – the VEEP trial

3.8.1 Rationale and aims

Currently, there is limited research, which has assessed clinicians' perspectives and acceptance of technology-based interventions. Furthermore, clinicians' perspectives regarding VR are notably limited. Therefore, research is required to understand the relationship between VR interventions and evidence-based practice.

This study aimed to determine the relationship between the VEEP treatment and patient feasibility and acceptability, through the perception of care coordinators, and whether these findings can be translated to future VR interventions. As patients' access to treatment is influenced by the support of care coordinators', their perceptions, and opinions of using VR treatment are vital in implementing such interventions.

This focus group study aimed to:

- Gather information about clinicians' opinions of the outcome and impacts of VR treatment on their patients' wellbeing.
- Explore whether clinicians believe VR treatment is feasible and acceptable to provide therapy virtually and what improvements could be made.

3.8.2 Participant information and site selection

Purposive sampling was used to recruit care coordinators from EIP at CWPT. Care coordinators belong to community mental health teams in the UK and can be trained as any registered mental healthcare professional (i.e., mental health nurse, occupational therapist, and social worker). Under the care programme approach, care coordinators are responsible for assessing patients' health and social care needs.

Therefore, care coordinators were recruited primarily because they were equipped to monitor patients' progress and were responsible for their wellbeing. This is a common non-probability sampling technique used in mixed methods research, where individuals are selected based on their shared experiences (Palinkas et al., 2015).

Care coordinators who were recruited, were providing care to those diagnosed with FEP. This sampling strategy was used to achieve a heterogeneous sample of care coordinators, who represented a broad selection of experiences and opinions in providing treatment to those with FEP.

3.8.3 Procedure

Care coordinators who assisted with recruiting participants for the VEEP trial were approached via email and asked to participate in a focus group. This was written by Professor Andrew Thompson and sent to the EIP service team manager. For those who agreed to participate, a focus group was organised at the EIP service at CWPT. In total, there were seven care coordinators taking part in one focus group.

The candidate facilitated the focus group. The candidate has significant experience in group facilitation with patients in the NHS and university settings. Care coordinators were required to read a participant information sheet (see appendix 23) and provide informed consent for participating in the trial (see appendix 24).

At the outset, the participants were informed of the purpose of the focus group, the research aims, and what information the therapist was planning to collect during the interview. Participants were informed that they could avoid answering a question if they chose to do so and could withdraw from a trial at any point. The focus group was recorded using a dictaphone, transcribed verbatim and lasted 50 minutes. All data was stored on a secure database (please see appendix 25 for further information on the focus group schedule for those participants who have completed the intervention).

3.8.4 Demonstration of the VEEP intervention

A demonstration of the VEEP virtual world was provided to the three EIP teams in CWPT. This occurred prior to recruitment commencing. This was conducted through a series of PowerPoint slides providing a description of the treatment and screen shots, which provided a display of the virtual world. The RA delivered this. Here, care coordinators were asked to watch a pre-recorded video demonstration of the Second Life® environment. Care coordinators had the opportunity to ask any questions and clarify any details.

Care coordinators were encouraged to assist with the recruitment of patients to take part in the VEEP intervention. Therefore, they were provided with participant information sheets, which could be handed over to those appropriate patients. They would then contact the RA of the trial and provide the contact details of those interested. During the demonstration, the care coordinators were informed that the RA would provide them with a weekly update on their patients’ progress. The RA would record these updates in the NHS patients’ records system.

During the focus group, the group facilitator provided the care coordinators with the same pre-recorded video demonstration of the Second Life® environment.

3.8.5 Data collection

A focus group was used to collect qualitative data from clinicians. A focus group can be defined as an open-ended detailed group discussion, which explores the opinions and perceptions of a predefined set of issues (Robinson, 1999). Focus groups have been consistently used in healthcare research in recent years to explore the perceptions of both patients and healthcare professionals (Tausch and Menold, 2016). The size of the group, the level of participation, the homogeneity of individuals' opinions concerning the topic of discussion and the data analysis process determine the validity of focus groups.

The focus group was facilitated by the candidate, audio recorded and transcribed verbatim. There are many advantages to adopting a focus group approach:

- They can be employed to collect large amounts of information from multiple individuals.
- It can be used to formulate a coherent and detailed understanding of participants' opinions and perceptions. The group function allows for participants to discuss, comment, clarify and share their views. Therefore opinions and perceptions are shared, which is normally an appropriate data collection method for this study (Gill et al., 2008).
- The facilitator can clarify ambiguous statements.
- Group dynamics allow the facilitator to focus on the most important topics and points being addressed. It is easier to observe when there is an agreed consistent view within the group.

3.8.6 Focus group facilitation

According to previous research, there are several factors that should be considered when facilitating a focus group: a) the difference in status between the participants themselves or between the participants and the facilitators b) the size of the focus group, and c) the specificity of the topics of discussion (Tausch and Menold, 2016). The candidate was a facilitator of the focus group and did not work in a healthcare setting. Thus, the facilitator was perceived as a neutral figure who could encourage the goal-orientated discussions. According to Côté-Arsenault and Morrison-Beedy (2005), smaller focus groups in healthcare are more appropriate, as it provides an opportunity for all participants to explain their perceptions and opinions in detail.

3.8.7 Data analysis

Thematic analysis (Braun and Clarke, 2006) was used to analyse the data collected from the workshops. The audio recording from the focus group was transcribed verbatim and analysed according to the thematic analysis framework. More information about thematic analysis can be found in section 3.7.6.

3.9 Phase 2, study 6: an autoethnography of a therapist's experience of delivering the SCIT via a virtual world for those diagnosed with FEP – the VEEP trial

3.9.1 Rationale and aims

Qualitative methods require researchers to collate, organise, interpret, and report participants' experiences and opinions. However, the decisions surrounding the methods used to collect data as well as the analysis and interpretation of the findings, are influenced by the researchers' own experiences and background (Malterud, 2001). Thus, researchers' prior experiences and biases should be explored and highlighted to ensure transparency (Watt, 2007).

Therefore, this study aimed to discuss and review the reflections that the candidate collected during the VEEP Trial.

3.9.2 Method

3.9.2.1 Design

An autoethnography of the primary virtual therapist's (the candidate) own experiences delivering the therapy was undertaken. Autoethnography is qualitative research that uses personal experiences to interpret and describe experiences, beliefs, and practices (Adams, Ellis, & Jones, 2017).

3.9.2.2 Study population

Autoethnography is an autobiography of one's own experiences. The participant in this study is the candidate. When the intervention commenced, the candidate was a second-year full time doctoral researcher in Health

Sciences. She has an education background in Psychology and has had previous clinical experiences in facilitating face-to-face group treatments for those with Severe Mental Illnesses (SMI).

3.9.2.3 Analytical method - autoethnography

Autoethnography comprises of three components (Bright et al., 2012): *Auto* involves consideration and critical reflection of the personal individual as an active agent in a particular situation. *Ethno* requires consideration of the cultural and social environments. *Graphy* is a process of developing a story where personal experiences and reflections are incorporated.

Autoethnography can be defined as a particular form of writing that aims to combine ethnographic and autobiographical intentions (Schwandt, 2007). This is a unique form of methodology because it aims for self-understanding, involving self-exploration, interpretation, and introspection (Anderson, 2006; Starr, 2010; Foster et al., 2006). It allows for exploration of personal perspectives, which leads to a thorough understanding of experience (Sparkes, 1996). This has been used to explore the role of both researchers and clinicians (Hinkley, 2005).

Thus, this autoethnography was written in the form of a personal narrative.

3.9.3 Procedure

The candidate completed a reflective journal during the VEEP recruitment process and after each therapy session. Therefore, a reflective journal (paper version) was completed throughout the trial process to collate the candidate's experiences and views. This journal allowed the candidate to reflect on their own feelings and opinions that emerged.

3.9.3.1 Rigour

Chang (2016) devised five criteria for assessing the quality of autoethnography in healthcare research. The candidate adhered to the below:

1. *Authentic and trustworthy data* – this refers to whether an autoethnography uses trustworthy and authentic data.
2. *Accountable research process* – this refers to whether an autoethnography follows a clear and reliable research process and relates to the researcher's self-reflexivity and transparency. The research procedures must be described and self-critiqued in clear and concise language.
3. *Ethics toward others and self* – this refers to whether the autoethnography follows ethical steps to protect their rights and others in their autoethnography.
4. *Sociocultural analysis and interpretation* – this refers to whether the autoethnography interprets and analyses the sociocultural meaning of the candidate's experiences.
5. *Scholarly contribution* – this refers to whether the autoethnography attempts to provide a scholarly contribution with its engagement with existing literature and conclusions drawn. Researchers must have a long-term commitment to making ethnographic research transferable to the wider community.

Thus, these five standards lead to a credible and defensible ethnography, which the candidate adhered to.

Whilst reflexivity guides praxis and reflection, an autoethnography formalises a reflective outlook and processes it into a research method. Therefore, it improves the rigour of the process (Mcilveen, 2008). Thus, autoethnographers engage in a continuous cycle of discussion, reflection, and practice, which is crucial to make sense of particular experiences:

Figure 12: Triangulation of practice (Moriarty, 2018)

Therefore, this methodology accommodates and acknowledges subjectivity and emotionality.

3.9.4 Data collection

The candidate had multiple roles throughout the VEEP trial:

1. The candidate worked alongside the research team and virtual world developers in developing the virtual world environment in Second Life®.
2. The candidate worked with the RF and principal investigator in conducting the codesign process for this intervention using extensive PPI. This codesign process has already been published and does not form part of this doctoral thesis (Realpe, 2020).
3. The candidate was the primary therapist in delivering the therapy to participants. Therefore, along with the support of a secondary therapist, the candidate delivered the SCIT intervention in each session.
4. The candidate worked with the RA in collecting and analysing the quantitative data from the trial.

5. The candidate collected and analysed the qualitative data from this trial.

Thus, the candidate conducted an autoethnography to discuss and reflect on their experiences of adopting multiple roles in the VEEP trial. The data collection procedures involved keeping a journal of the candidate's personal experiences throughout the VEEP trial. As stated, the research methodology claims that the purpose of the autoethnography should be to better understand the self. Thus, personal experiences of reflections were recorded.

3.9.5 Data analysis

A narrative inquiry is when a researcher asks questions, which will allow them to understand and interpret participants' experiences (Sharp, Bye and Cusick, 2019). It involves functional and structural forms of analyses (Jackson, Drummond and Camara, 2007). Therefore, the candidate conducted a narrative analysis of their journal by employing a thematic analysis. The process of thematic analysis has been explained in more detail in section 3.7.6.

3.10 Phase 2: strengths and limitations

Phase 2 has a number of strengths and limitations. These are outlined below according to study.

There are several strengths and weaknesses for beta testing study (study 2). This beta testing allowed the candidate and the VEEP trial research team to test and evaluate a novel virtual world therapeutic intervention. A one-off usability process was used to elicit feedback and subsequently tailor the intervention to work. This allowed the research team to refine the intervention before recruitment. However, there were limitations. Only four participants were recruited to take part in the beta testing process. Furthermore, these participants did not have a diagnosis of FEP; therefore, the participants' experiences and feedback may differ from those service users the intervention will be recruiting. Due to timing restrictions, the full intervention could not be delivered during the beta testing process.

According to the candidate, study 3 is the first study to assess the comparison between non-completers and completers, in those with FEP completing a VR intervention. However, due to small sample sizes, the findings cannot be generalised to other settings.

Interview schedules enhanced the validity of the trial. Furthermore recruiting advisors in study 4a, who had taken part in the VEEP codesign process, meant that the PPI advisors were aware of the aims and objectives of what the VEEP research team were trying to achieve. Possible limitations include that this was a one off workshop, as opposed to an iterative process. Additionally it would have been beneficial to have had a larger sample size.

The main strengths of studies 4b and 5 were collecting in-depth and rich data via semi structured interviews and a focus group. There are a limited number of qualitative investigations into service users' and clinicians' views of VR interventions. Most of the research in this area often utilises survey-based designs. To assess the feasibility and acceptability of VR interventions, it is important that qualitative research is undertaken to collate the nuances of peoples' thoughts and experiences. As a result of this research, recommendations for future research were collated.

The main limitation of studies 4b and 5 was that a purposive sampling strategy was used. Therefore, it is possible that those service users with particularly strong views towards VR interventions were more likely to participate. Thus, it is possible that views and opinions collated may not be representative. The qualitative nature of studies meant that it is possible that participants' opinions and views may have been influenced by being interviewed by the candidate, who was also the therapist for the intervention. The candidate tried to minimise these potential biases and opinions as much as possible by informing participants, to be honest and open.

There are many strengths in conducting study 6. An autoethnography allowed the candidate to provide a first-person insider account of the research from multiple perspectives (Pavlenko, 2007). Furthermore, this method can be used for a wide range of studies, and the researcher can work at their own pace (Hopper, 2014). Limitations include using a unique communication style, which deviates from traditional academic writing (Tomaselli, 2013). Nevertheless, many critiques overlook the focus of an autoethnography, which is to provide a shared meaning from commonly marginalised experiences (Schmid, 2019).

3.11 Phase 2: reflexivity

As part of qualitative research, the candidate took part in reflexivity. Reflexivity is when researchers are aware of and understand their position during the data collection and analysis process, and the potential impact this may have on the research procedures and results. Interpretation calls for researchers to acknowledge their values, theories and pre-existing thoughts that exist, whilst reflection encourages researchers to understand how their intellectual, theoretical, cultural, textual and ideological thoughts impact on the interpretive process (Haynes, 2012). Thus, the candidate continuously took part in interpretation and reflection during the research process (Haynes, 2012).

One aim of reflexivity is to manage the researchers' involvement in the research process, thereby improving the accuracy and credibility of the data collection and analysis process. It is also an opportunity to monitor the ethics of the researcher-participant relationship, as the researcher is required to be non-exploitative and supportive towards participants (Berger, 2015).

Reflexivity strategies that the candidate implemented into this doctoral thesis, were triangulation, maintaining an audit trail throughout the research process, peer examination and a self-reflective diary.

Triangulation can be used to overcome any issues with reflexivity. Furthermore, the involvement of service users and stakeholders in the development of research can be useful. This can ensure that the research is beneficial and more relevant (Marlett et al., 2015). Therefore, the participant interview schedules were reviewed by PPI participants and refined before interviews took place. This shows that the qualitative research undertaken was iterative in nature: the interviews reviewed by PPI participants and the VEEP trial co-applicants (Busetto, Wick and Gumbinger, 2020).

An audit trail provided a thorough record of the entire research process and thereby allows auditors to follow and replicate the research process (Berger, 2015). Information included in the audit trail, were the research study information (i.e., research aims, rationale and hypotheses), raw data (i.e., interview recordings), data interpretations (i.e. the development of themes), research process notes and instruments (i.e. interview schedules, consent forms and participant information sheets).

During this doctoral thesis, the candidate adopted a peer examination process. This is when researchers liaise and converse with other independent researchers to analyse the research procedures of a particular research project. This may increase the credibility and validity of the research procedures. A self-reflective diary presents researchers with the opportunity to reflect and record their own opinions, emotions, and thoughts about the research procedures. Therefore this encourages researchers to become more aware of their own biases and the subsequent impact it may have on the research process (Haynes, 2012).

3.12 Phase 2: ethical considerations

The VEEP trial received sponsorship from the University of Warwick and ethical approval from West Midlands Solihull Research Ethics Committee (REC) (ref: 17/WM/0340). The IRAS ID is 228308. The study was registered on the International Standard Randomised Controlled Trial Number (ISRCTN) database (ref: ISCRCTN41443166).

3.12.1 Informed consent

Obtaining informed consent from participants is critical. Therefore, participants were provided with a participant information sheet and asked to sign a consent form to ensure they were aware of the implications of taking part. Researchers also sought consent from participants to communicate with individuals' care coordinators from CWPT. Participants were made aware that they could withdraw from the trial at any time and therefore were provided with researchers' contact information.

3.12.2 Privacy and confidentiality

Privacy can be defined as a responsibility to protect a person's body, personal information, decisions and associations from invasion or scrutiny. Confidentiality can be defined as clinical professionals' duty to keep patients' medical information and details private (Lederman et al., 2020). Both concepts are vital in healthcare, and particularly mental health. Loss of privacy can harm individuals by violating their safety and subsequently lead to a breakdown of trust between the patient and the healthcare system. Thus, adhering to the principles of privacy and confidentiality respects patient's autonomy (Beauchamp and Childress, 2001).

During the VEEP intervention, participants disclosed personal and sensitive information in Second Life®. Therefore, during the consent stage, participants were asked to keep all contents of the discussion confidential. The Second Life® Terms of Use and Privacy Policy were used to develop confidential guidelines provided to participants, which included the following.

- The research team bought a piece of 'land' in Second Life® to develop a therapeutic space. This is a private area and not accessible to members of the public. Therefore, only participants and the research team were able to access this space using a username and password.
- No personal information was used to create an account for participants. Therefore, usernames and email addresses were anonymized. These details were developed by the research team and stored on a secure password protected database.

When the candidate completed journal entries in preparation for undertaking an autoethnography, pseudonyms were used to protect participants' identities. Furthermore, no identifiable data was recorded (Tolich, 2010).

3.12.3 Risk to participants

It was anticipated that participants would access the VR treatment at home using their personal computers or laptops. Therefore, the research team checked that participants had the appropriate IT equipment and connectivity. If they did not, they were provided with the appropriate resources. Participants could also opt in to attend the treatment at WMS. Here a private room and a computer would be available for them to use. However, no participant took up this option.

The RA liaised with the participants' care coordinator, to ensure that they were psychologically able to participate in the treatment. Participants were provided with an information sheet before the treatment commencing, which included information on the contact details of emergency services (i.e., Crisis Team, Samaritans or Accident & Emergency). The RA also provided bi-weekly phone calls (before every session) to remind participants of the session times and ensure that they could still take part. If there were any concerns, then the RA could contact the care coordinator, to ensure that appropriate support is provided immediately. Participants were also provided with the RA's phone number, so that they could contact her, in the event of an emergency.

3.12.4 Data protection

Data was stored according to the General Data Protection Regulation (GDPR 2018) and the Caldicott Principles (The UK Caldicott Guardian Council, 2020). Identifiable data was stored in a locked filing cabinet in a lockable room at WMS. The research team were the only individuals who could access this information. All information linking participants' names with their unique identifiable numbers was stored in secure spreadsheets that are password protected on a secure server. All the data was anonymised and contained participants' unique identifiable number.

Below is table 9, which summarises the key ethical issues in conducting VR treatment and how the candidate and her colleagues responded.

Table 9: Summary of ethical issues, principles and responses for VR platforms

Ethical concerns	Ethical principles	VR platforms response
Privacy	Autonomy Nonmaleficence	Only registered participants could access the VR environment. Pseudonyms were used. Participants did not have to provide their names.
Confidentiality	Autonomy Beneficence Nonmaleficence	Therapists completed facilitation training. Two therapists were provided.
Informed Consent	Autonomy Nonmaleficence	Participants signed consent forms to take part in this VR intervention. Participants were provided with VR training session before taking part in the intervention.
Asynchronicity	Nonmaleficence	Research team ensured participants provided informed consent and understood the rules and regulations. Therapy sessions were observed and if participants were found to be distressed, therapists acted. This included checking in on participants and/or contacting their care coordinator (with consent) to inform them of this. RA sent SMS messages and phone calls throughout the week to remind participants to attend their VR therapy session.

		Therapists routinely took part in debriefs after each session.
Miscommunication in Written Medium	Nonmaleficence Autonomy	Information sheets and interview schedules were reviewed by PPI consultants to ensure it was clear, concise, and used simple language. Care coordinators and RA explained the research in detail. Participants were given opportunity to ask any questions they may have had.
Therapist Competency	Nonmaleficence Beneficence	Therapists adhered to NHS professional guidelines. Risk assessment procedure was formulated.
Creating and maintaining a Therapeutic Alliance	Nonmaleficence Beneficence	Therapists organised routine check-ins with participants between sessions.
Efficacy/Effectiveness	Justice Beneficence	Two therapists. Multidisciplinary expertise in designing the intervention, including involving those with lived experience. Beta-testing. Qualitative and quantitative data collected from participants.

3.13 Phase 3, study 7: conducting patient and public involvement (PPI) for a VR-360° intervention to improve social cognition in those diagnosed with FEP

3.13.1 Development and rationale

3.13.1.1 360° videos

360° cameras have existed for many years, but have become more prominent now due to public interest in their use and lower production costs (Neng and Chambel, 2010). A 360° camera contains a camera system with multiple lenses shaped like a sphere. Therefore, it records all aspects of the scene. The film footage is combined via a process called "stitching," which can be viewed from different angles and gives it a 360° effect (Tse et al., 2017).

One convenient and inexpensive method of providing VR treatment, is 360° videos (Depledge, Stone and Murphy, 2011; Smith, 2015). 360° videos are often viewed as VR and can be used interchangeably. 360° videos can be viewed as more user friendly and accessible, because they can be viewed on VR headsets and mobile devices. The viewer can control the perspective. However, there are distinctions between both: 360° videos are dominated by real-world footage, and VR is devised by computer software. Furthermore, 360° videos allow the user to view all aspects of the enclosed sphere, whilst VR provides interaction with a simulated digital world (Snelson and Hsu, 2019). Thus, during playback, users are fully immersed in the scene. 360° videos function as an immersive film, with the user experiencing realistic scenarios but with no ability to actively engage with the scene.

Numerous studies have indicated that the 360° videos have therapeutic benefits (Jerdan et al., 2018; Maples-Keller et al., 2017; White et al., 2018). This is because 360° videos can immerse individuals into a new environment, and thereby increase the sensation of presence. Furthermore, 360° videos allow the participant to understand the environment around them by taking the user's perspective. As a result, this can lead to emotional reactions such as anxiety and empathy, resulting in behaviour change (Riva et al., 2007; Tse et al., 2017). The reporting and storytelling in 360° videos can result in immersion and engagement, more so than text or two-dimensional (2D) videos. As these videos can place individuals into unfamiliar environments, they can understand how individuals react to new information or situations (Bertrand et al., 2018).

3.13.1.2 Patient and public involvement

The past decade has witnessed a growing interest in involving the public to partake in research design and intervention development. There are various definitions of what PPI may be, and research studies use various terminology to illustrate this. As part of the National Institute for Health Research (NIHR), a national advisory group called INVOLVE was established in 1996. The organisation aims to support public and patient involvement in the NHS, social care, and public health research. INVOLVE provides expertise, insight, and experience to research. According to NIHR INVOLVE (2017):

> "Public involvement in research is often defined as doing research 'with' or 'by' people who use services rather than 'to,' or 'about' or 'for' them."

According to a systematic review, PPI is multifaceted and involves engagement and communication, whilst focusing on outcomes and improving primary care services. This is based on forming strong relationships between the public and those making decisions at all levels, leading to transparency and support (Mockford et al., 2012).

Thus, PPI may inform the importance of research at all stages and increases the quality of implementation. Efficient PPI in research involves adapting existing methods for developing research or creating new methods (Brett et al., 2014). PPI consultants can develop the research project, reviewing procedures and information material for future participants and co-designing interventions (Nissen et al., 2018).

Over the last two decades, there have been policy efforts in the UK to promote PPI in healthcare planning, research, delivery, and evaluation (Boote, Telford and Cooper, 2002). As a result, there is a history within mental health research to include service-users in developing the research design, thereby increasing the validity of the trial (Rose, 2017). Thus, there is growing literature on the importance of implementing participatory design methodologies involving service users, carers and clinicians to inform and design interventions (Riper et al., 2010; Vaughan et al., 2018). Two systematic reviews have identified participatory methods in ehealth interventions as a vital factor in influencing the usability and acceptability of many ehealth interventions (Orlowski et al., 2015; Simblett et al., 2018). In the UK, there is research to indicate that PPI research is positively associated with recruitment, retention rates and trial success (Ennis and Wykes, 2013).

PPI is a complex method of engagement, which is consistently developing, frequently changing and is dependent on the culture and context. For PPI to be successful, time and financial resources need to be utilised. Furthermore, it is important that power structures between researchers and members of the public, are dismantled (Martin and Larsen, 2012). Thus, it requires various methods and a collaborative approach, which leads to expertise and an increase in knowledge.

Traditionally, PPI involves workshops, face-to-face interviews and focus groups (Tritter and McCallum, 2006). Therefore, for this trial. Two PPI workshops were conducted online to gather feedback on a VR-360° videos, which formed part of a novel VR intervention to target social cognition deficits in those with FEP.

The below table highlights the key similarities and differences between qualitative research and PPI research.

Table 10: Key similarities and differences between PPI and qualitative research (adapted from Morgan et al., 2016)

	Similarities	**Differences**
Who	Both can involve representatives from a target population.	• PPI studies usually involve a smaller sample size. • Qualitative research may seek to recruit a larger more diverse sample of participants. • PPI studies may recruit several representatives that are trained and/or experienced in PPI.
What	Both studies use data collection methods such as discussions, activities, and workshops.	• Qualitative research is usually used to advance the understanding of a particular research question and involves recruiting participants as part of an active research study. • PPI is seen as a two-way exchange of knowledge between researchers and participants, lead to developing and refining aspects of the research (i.e., the task, intervention, documents).
Where	Both can be conducted in various settings, such as in face-to-face settings or virtually.	• Qualitative research usually takes participants' preferences into consideration and what is most appropriate for data collection. • PPI can take place during research team meetings.

Why	Both can be used to answer specific research questions, including gathering relevant information to assist with developing an intervention.	• Qualitative research involves collecting data from participants to answer research questions. • PPI involves recruiting non-researchers to inform a study design.
When	Both can involve either single or multiple meetings.	• Qualitative research usually will take place over one session/meeting. • PPI usually takes place over an extended period over multiple meetings.
How	Both may use purposive sampling approaches to recruit participants.	• Depending on the aims and research design, qualitative research may use various strategies to recruit participants from backgrounds. • PPI usually recruit from an established network of individuals who are interested in contributing to research.

3.13.2 Aims

The aim of phase 3, study 7, was to develop an immersive VR intervention to target social cognition deficits in those with FEP. The SCIT manual that was refined for the VEEP trial would be used in this therapy. However instead of asking participants to attend therapy in a virtual world, a service user would be asked to attend a face-to-face one-to-one SCIT therapy. During the session, a therapist would be facilitating the SCIT, and service users would be allowed to watch 360° videos via a headset as part of their treatment. These 360° videos would replace the 2D videos that service users are usually asked to watch as part of the SCIT and involve being immersed in social situations that target their social cognition abilities.

However, prior to developing a proof-of-concept trial, a PPI study was undertaken with young people with lived experience of mental health conditions, to gather their opinions on the feasibility and acceptability 360° video prototypes. These protypes would form a VR intervention for people with FEP to improve their social cognition. An advisory group was created with the aims of exploring young adults' experiences, thoughts, and opinions around:

1. The features and functions of the 360° video prototypes.
2. barriers and concerns in participating and engaging with the 360° videos.

3.13.3 Background to developing the 360° videos

3.13.3.1 What are 360° videos?

A live action 360° video is filmed using 360° omnidirectional cameras, which record the view from every direction and combine the footage into a 3D sphere.

The content is photo-realistic, contains a large freedom of view (FoV) and has a fixed viewpoint. 360° videos are not generated in real time and so therefore, such videos are more appropriate for non-interactive experiences. The development and production of 360° videos are significantly more challenging than 2D videos for various reasons. This is because there are many steps, which need to be planned:

1. Scripts need to be written.
2. Recruitment of actors to take part in the filming.
3. The scenes are filmed with the appropriate 360°camera.
4. Once the footage is recorded, each angle of the scene is added together to produce a 360° video called 'stitching.'
5. The 360° footage is edited using the appropriate software.
6. The completed film is then loaded up onto the appropriate device with a 360° viewer.

3.13.3.2 Development of the VR-360° storyboards

For phase 3, scripts were written following a narrative structure. A narrative structure is a framework, that dictates how the story is presented to the viewer. These videos were scripted according to a nonlinear narrative. This refers to an increase in temporal and spatial freedom within a VR environment; therefore, users do not have to view each scene in succession to get to an 'ending' or 'conclusion' (Moser and Fang, 2015).

3.13.3.2.1 VR-360° prototype 1

The candidate wrote the prototype 1 script, and it was reviewed by Professor Andrew Thompson, prior to filming. The storyboards were based on the SCIT videos because they have been standardised and reviewed, as part of a manualised intervention. In total, four scenes were written (see appendix 26 for the completed storyboard 1). The full video can be watched here: https://www.youtube.com/watch?v=yFfoRLuXkZM (Infinite Pixel Ltd, 2017).

Scene one is called ‘Facial Emotion Recognition.’ Scenes two to four is called ‘Jumping to Conclusion Bias/Perspective Taking.’ In these scenes, the viewer is observing different conversations taking place around them. Whilst watching, the viewer would be asked to pay attention to the facial expressions, as well as the discussions and interactions that are occurring.

The VR-360° prototype 1 was set in a café. A café was chosen because it is a social environment that many people are familiar with. The filming was undertaken in the Department of Social Science Café at the University of Warwick. In preparation for shooting, the Department of Social Science provided the candidate with the opportunity to film during the official Christmas holiday period in 2016-2017. Therefore, this helped to manage crowd control and avoid the possibility of other individuals being captured in film. Furthermore, the Department had contacted their colleagues to inform them that filming was taking place during a specific time. During the filming process, the candidate and Professor Andrew Thompson stood near the building’s entrances to prevent people from entering and therefore being on camera.

Before filming, the café environment was reviewed to plan where to place the camera, consider the most efficient ways of setting up the scene and utilise the area. Variables such as noise level outside and crowd size were also considered. The camera needed to be placed at the correct height, leading to heightened feelings of realism. Utilising the café space was important so that the viewer could observe different scenes in different areas.

3.13.3.2.2 VR-360° prototype 2

The candidate wrote the prototype 2 script, and it was reviewed by Professor Andrew Thompson, Dr Imogen Bell and Dr Cali Bartholomeusz prior to filming. Like prototype 1, this script was also based on the SCIT videos. The filming took place at Orygen in Melbourne, Australia in 2019. The videos represented various job interview scenarios. The purpose of these videos would be to assist those with FEP, in helping them to develop their job interview social skills.

Below are the number and titles of each scene (see appendix 27 for full details of the VR-360° prototype 2 script). The full video can be watched here: https://www.youtube.com/watch?v=vuvB4B5lwwU (eOrygen VR, 2020). Throughout the videos, the viewers were asked to pay attention to the actors' body language and facial expressions. Below is an outline of each scene:

Scene one-three: Facial Emotion Recognition. In these scenes, the viewers were asked to observe the changing facial expressions of each actor.

Scene four: Waiting Room. Here the viewers were observing a conversation between two candidates in a waiting room area.

Scene five: Candidate 1 Interview. Viewers were observing an interview taking place between an employer and a candidate for an administration job. This is an example of an 'challenging' interview due to the interviewee's performance.

Scene six-seven: Candidate 2 Interview. Viewers were observing an interview taking place between an interviewer and interviewee for an administration job.

In contrast to the previous scene, the action appears to be more relaxed, and so the interview experiences are more comfortable.

Scene eight-nine: Interview from the First-Person Perspective Pathway. Compared to the previous scenes, these two scenes allowed the viewer to become an active participant in the scenes. Here the viewer is being interviewed by two employees.

An office was used to film the above job interview scenes. This was a more challenging environment to film in, compared to the previous café environment. This is because this was a building filled with individuals working, and so there was a chance that filming could be interrupted. It was vital that variables such as noise levels were taken into consideration before filming. The room that was chosen to film in was selected, because it was the most secluded room in the building. Variables such as the size of the room, lighting and openness were all taken into consideration. Multiple practice runs were undertaken without the actors to ensure that the camera worked and was in the most appropriate position. One of the most challenging factors in filming was ensuring that the camera was in the most suitable position, i.e., height and distance fit.

Figures 13 and 14 are floor plans for both prototypes. They provide an ariel view of the space in which the 360° videos were filmed.

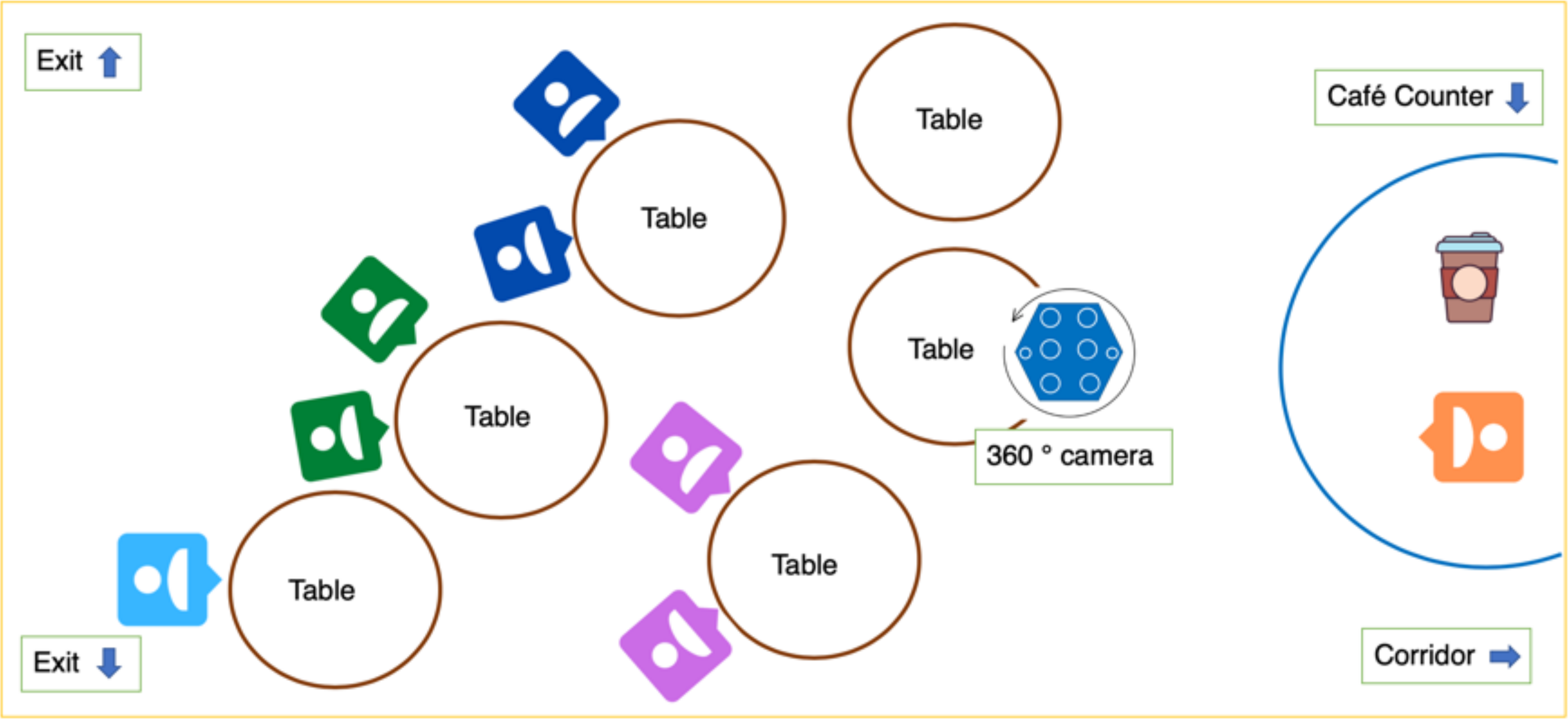


Figure 13: VR-360° prototype 1 – floor plan

The 360° camera was moved and repositioned for each scene.

This logo represents the position of each actor during the filming.

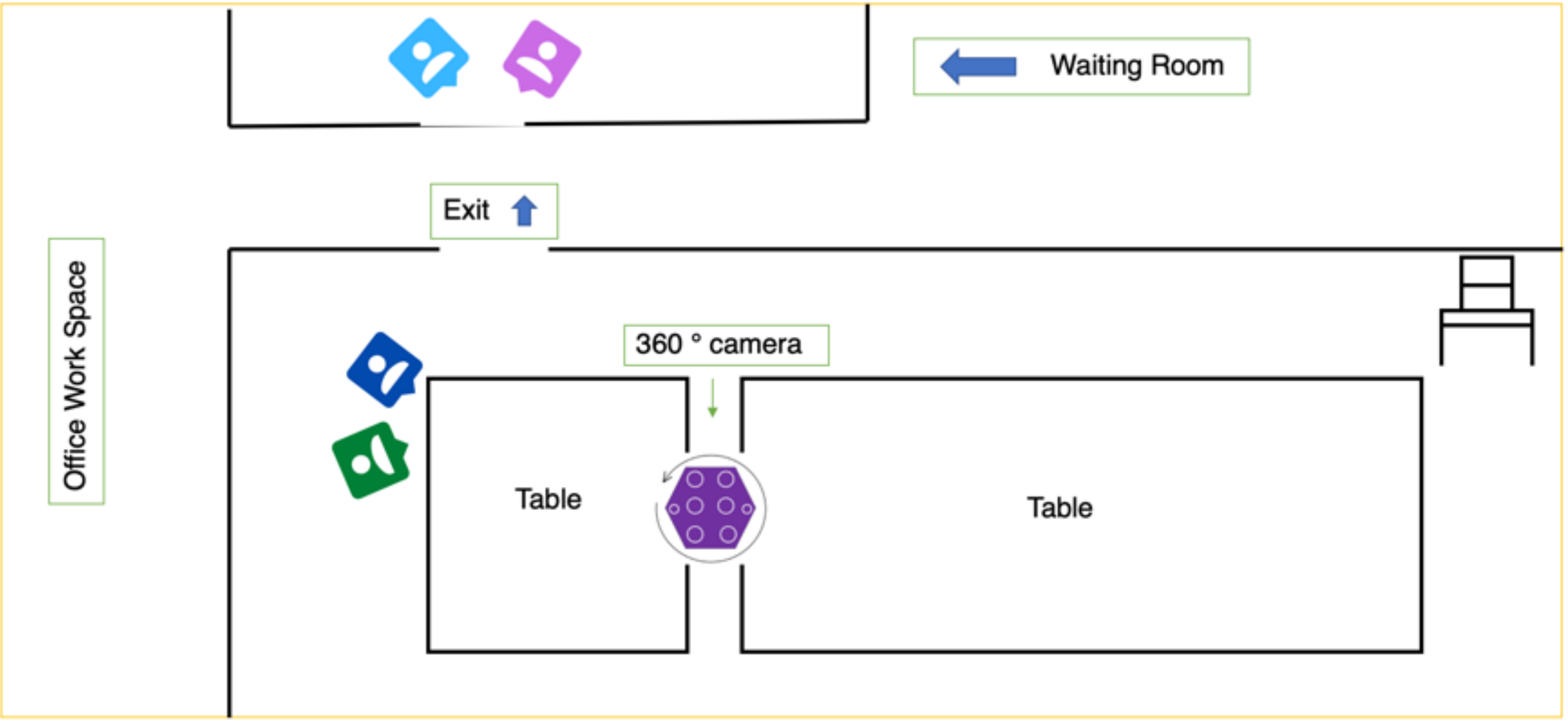


Figure 14: VR-360° prototype 2 – floor plan

The 360° camera was moved and repositioned for each scene.

👤 This logo represents the position of each actor during the filming.

3.13.3.3 Development and implementation of VR-360° videos

3.13.3.3.1 360° camera selection

The Insta360 Pro 2 was used to film the 360° videos. This is an updated version of the Insta360. It has the following features:

1. Audio: six microphones and a Mic at the top and bottom of the camera.
2. Compatibility: this camera is compatible with a Mac, Windows, Android, and iOS.
3. Field of View: Fully spherical.
4. High dynamic range, which goes up to 8k 30fps in 2D.
5. High speed in either 6.7k 3D (6400 x 6400) or 8k mono.
6. High resolution 3D 360 at 8K 30fps (7680 x 7680).
7. 8K 3D VR headset viewing.
8. Lenses: six fisheye lenses (200° field of view per lens).
9. Live streaming resolution: 3840 x 3840 at 30fps (while recording at 6K 3D). It is compatible with Youtube, Facebook, Twitter, and Weibo.
10. No stitch workflow: proxy files are created in real time, which allows individuals to edit the videos before it is stitched.
11. Wi-Fi connection: the camera has a long-range Wi-Fi of up to 300 metres.

3.13.3.3.2 Recruitment of actors

VR-360° Prototype 1: four postgraduate students at the University of Warwick volunteered to participate as actors in the filming of the VR-360° video. Three PhD students and one MSc student consented to be actors in the filming. Four Infinite Pixel Crew members also consented to be actors in the filming. Therefore, there were eight actors in total.

VR-360° Prototype 2: four actors were hired from a local acting company by Dr Imogen Bell and Professor Andrew Thompson, to take part in the filming. This was funded by Orygen. Prior to the filming, the actors were briefed on the rationale for filming the videos and were provided with a script to memorise their lines.

3.13.3.3.3 Filming the 360° footage

When filming 360° videos, the camera films everything in the line of sight. In both 360° prototypes, the camera was used to represent the user’s head watching the video. Therefore, this ensured that the film felt realistic, as the user would feel like they are part of the scene and immersed in the virtual experience. When filming the 360° videos, it was vital to consider the length and pace of it to ensure that it contains all the vital details. The video length imitated the real aesthetic experience as much as possible. This is important because an unnecessary long video could increase cybersickness or even boredom (Caserman et al., 2021; Litleskare and Calogiuri, 2019).

3.13.3.3.4 Obtaining the audio for the 360° videos

There are multiple ways of recording the audio when filming 360° videos. VR-360° prototype 1 was filmed by the organisation Infinite Pixel, which specialised in filming 360° videos. Therefore, microphones and sound equipment were used to pick up the dialogue from the actors.

VR-360° prototype 2 was filmed by the candidate, Professor Andrew Thompson, and Dr Imogen Bell at Orygen. Thus, the only equipment they had access to be the 360° camera, with its built in microphone. The difficulty with obtaining audio from the 360° camera is that it may not always provide the best audio quality. Therefore, when filming the video, the camera was kept as close to the actors as possible.

3.13.3.3.5 Editing the 360° video prototypes

The editing process was a very time-consuming task. This is because each frame from each camera needed to be stitched together to create a video, which contained the 360° view of each scene. 360° videos were stitched together with software to create a spherical view. For VR-360° prototype 1, the editing and stitching process was completed by Infinite Pixel.

For VR-360° prototype 2, the Insta360 Pro 2 included an auto stitch function, which allowed the data to be exported directly to the editing software. Therefore, is made the stitching process quicker and easier to complete. The stitching and editing were completed by Professor Andrew Thompson, Dr Imogen Bell and Mr. Tamar Wong.

After the stitching and editing process was completed, the video files were in an equirectangular format. This meant that the 360° views have been distorted and flattened into a 2D view. Therefore a 360° video viewer must be used to watch the videos to maintain the relative dimensions.

3.13.3.3.6 Stimuli viewing and device types

360° videos can be viewed on computers, smartphones, and devices. A HMD can be used to provide a more immersive and 360° experience. HMD devices include a Samsung Gear, Google Cardboard and a HTC Vive.

Different devices and HMDs can provide different levels of immersion and presence. With laptops, users must click and drag the screen in front of them to change their perspective. However, when using smartphones, the user only needs to change the orientation of their device. Thus, for this research, smartphones were used to view the 360° videos.

The VR-360° prototypes 1 and 2 were uploaded onto Youtube in a 360° format and viewed by participants, using a smartphone and Google Cardboard viewer. This low-cost product increased its accessibility for the public and can be easily employed in various scenarios. Before this, VR technology was mainly inaccessible to the public (Zantua, 2017). The Google Cardboard can be folded together to form a headset. A smartphone can be inserted into the headset and therefore acts as a screen. However, the disadvantages of it include its limited interactivity and absence of motion tracking. As it is made of cardboard, it is also vulnerable to breaking.

3.13.4 Methods

3.13.4.1 Participant information and recruitment

The INVOLVE and GRIPP2 guidelines were used and adhered to throughout this PPI research (NIHR, 2017; Staniszewska et al., 2017). PPI participants were recruited via a purposive sampling strategy. An advertisement was circulated on twitter to recruit young people with lived experience of mental health issues (see appendix 28). Emails were also sent out to relevant academics who were asked to circulate the advertisement as well. Recruitment took place during the height of the COVID-19 pandemic; therefore, a smaller number of participants were recruited than initially anticipated. Three participants approached the candidate via email and were eligible to take part. Table 11 illustrates the approach taken to undertake the PPI.

Table 11: Summary of approach used for PPI

Format
• Developing a PPI group.
Stage of Project

- Defining research questions.
- Intervention development.
- Project development.

Type of Engagement

- Consultation and collaboration.

Recruitment Method

- Identified potential PPI participants online

Recruitment Timescale

- Three weeks from contacting participants to the workshop.

Approach

- Workshops, which adopted a focus group approach

Benefits

- PPI participants were experienced in taking part in research, and familiar with PPI.
- PPI participants were reimbursed for their time.

Challenges

- Facilitation skills are required.
- Limited time in completing activities, as they occur during workshops.

The PPI advisory group comprised of young individuals with lived experience of mental health conditions. Two of the PPI participants had previously worked on PPI projects. The study was developed, to address the importance of participatory research (Green et al., 2018). PPI participants were recruited from diverse backgrounds (please see table 12).

Table 12: Participant demographics

Variable	**Value**	
Age	Mean	24
	SD	1.41
Gender	Male	0

	Female	3
Mental Health Condition	Depression	2
	Anxiety	2
Access to Digital Technologies	Smart Phone	1
	Computer/laptop	1
	Tablet	1
Used Digital Technologies for Health	Yes	3
	No	0
Prior Experience with VR	Yes	1
	No	2

As PPI workshops were conducted online during the COVID-19 pandemic, participants needed to have adequate digital skills and digital infrastructure in place. Participants were provided with one £10 Amazon voucher for taking part. This was emailed to them after attending both workshops.

3.13.4.2 Workshop design

PPI participants were emailed with a participant information sheet (see appendix 29) and signed a consent form electronically participate in these workshops (see appendix 30). Participants were given the opportunity to ask questions via email or via videoconferencing before the workshops. Each participant also received a Google Cardboard via post, to watch the 360° videos during the workshop. Two workshops were undertaken to assist with the PPI process. They took place over two weeks.

Each workshop followed a particular schedule (please see table 13 and 14) and lasted one hour. Due to COVID-19 restrictions, the workshop took place online using videoconferencing tools. Thus, it was easily accessible for all participants. During these workshops, the candidate was the research facilitator, who led the discussions and took field notes.

Table 13: Workshop 1 schedule

Duration: 1 hour

Time: 18:00 – 19:00

5 mins – Welcome

- Participants were welcomed and thanked for taking part.
- PPI facilitator introduced herself, briefly explained the purpose of the PPI research and the workshop.
- The Workshop 1 agenda was shared on the screen and participants were informed of what would be covered.

30 mins – Outline and Background to Research

- PPI facilitator provided a theoretical background into this research, using a PowerPoint presentation (please see appendix 31).

8 min – Watch 360° Video 1 – Café scene

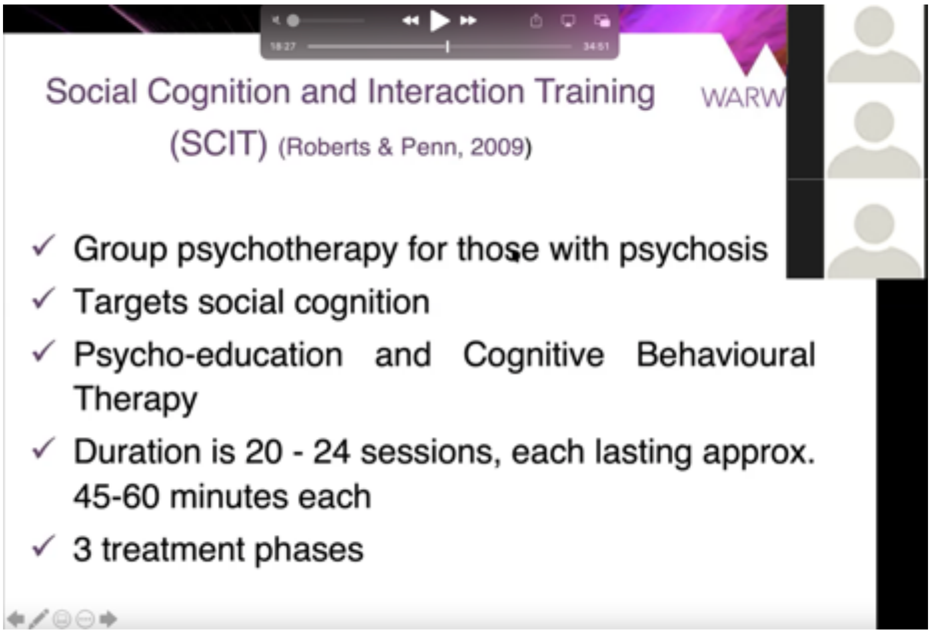
- Participants were asked to watch the first set of 360° videos.
- They were asked to use the Google Cardboard and their smartphone for this.
- If this was not an option, they could watch the videos in 2D mode online via Zoom.

12 min – Group Discussion and Feedback

- Group discussion then took place, where participants provided feedback on the videos.
- Discussions were guided by the interview schedule (please see appendix 32).

5 min – Post-workshop

- PPI facilitator thanked everyone for taking part.
- They were given the opportunity to ask any questions.
- PPI facilitator confirmed when the next workshop would take place.



Social Cognition and Interaction Training (SCIT) (Roberts & Penn, 2009)

- ✓ Group psychotherapy for those with psychosis
- ✓ Targets social cognition
- ✓ Psycho-education and Cognitive Behavioural Therapy
- ✓ Duration is 20 - 24 sessions, each lasting approx. 45-60 minutes each
- ✓ 3 treatment phases

Figure 15: VR-360° workshop 1 image

Table 14: Workshop 2 schedule

Duration: 1 hour

Time: 18:00 – 19:00

5 min – Welcome

- Participants were welcomed and thanked for taking part.
- Participants were reminded about what was discussed in the prior workshop.
- The Workshop 2 agenda was shared on the screen and participants were informed of what would be covered.

15 min – 360° Videos 1 – Café Scene Discussion (continued)

- Group discussion continued from the previous workshop, where participants provided feedback on the videos.
- Discussions were guided by the interview schedule.

15 min – Watch 360° videos 2

- Participants were asked to watch the second set of 360° videos.

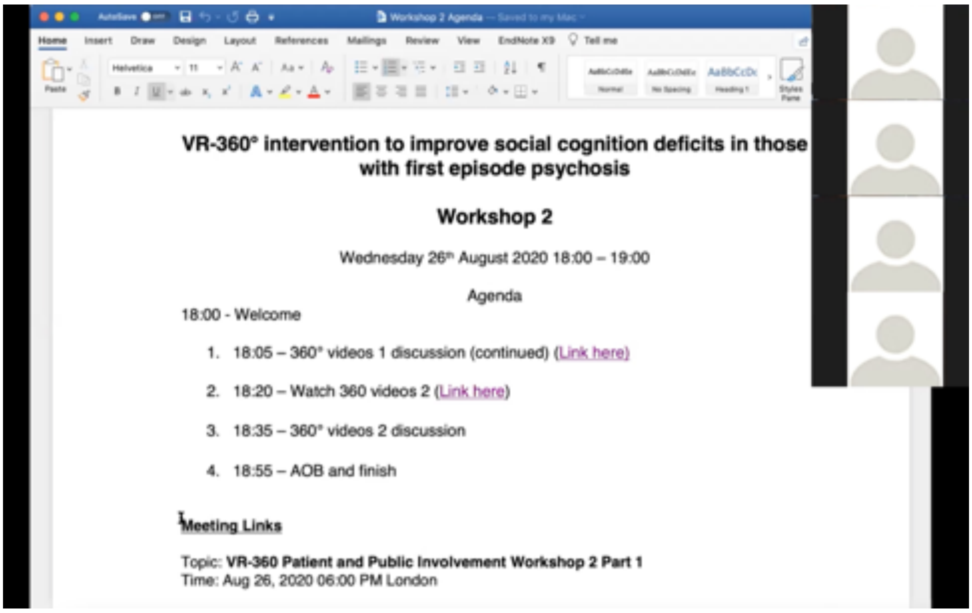
- The PPI group facilitator put the videos on, on YouTube and shared her screen.
- Participants were able to watch the 360° videos either
    1. Online via Zoom
    2. Using their smartphone and the Google Cardboard headset

20 min – Group discussion and Feedback

- A group discussion about the videos then took place.
- An interview schedule was used to guide the discussion.
- Summarise the feedback.
- Clarify whether there is further contributions and any additional feedback.

5 min – post-workshop

- PPI facilitator thanked everyone for taking part.
- They were given the opportunity to ask any questions.
- It was reiterated that they were able to keep the Google Cardboard and would receive a £10 Amazon Voucher online.
- Participants were informed that they would receive information about the results of the PPI research.



VR-360° intervention to improve social cognition deficits in those with first episode psychosis

Workshop 2

Wednesday 26th August 2020 18:00 – 19:00

Agenda

18:00 - Welcome

1. 18:05 – 360° videos 1 discussion (continued) (Link here)
2. 18:20 – Watch 360 videos 2 (Link here)
3. 18:35 – 360° videos 2 discussion
4. 18:55 – AOB and finish

Meeting Links

Topic: **VR-360 Patient and Public Involvement Workshop 2 Part 1**
Time: Aug 26, 2020 06:00 PM London

Figure 16: VR-360° workshop 2 image

PPI process: iterative process

This PPI research involved a reiteration process. This is a cyclical process that involves planning, conducting, reflection and evaluation to refine a process (Leask et al., 2019). The aim is to achieve the desired goal by consistently learning and reflecting. Figure 17 illustrates this process.

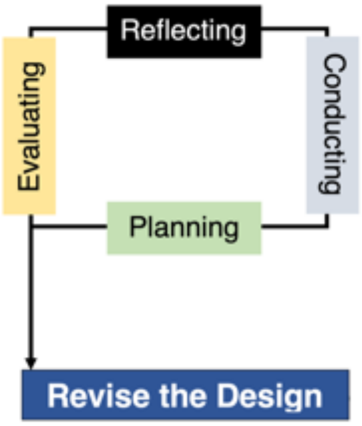


Figure 17: Iterative co-creation process

Videoconferencing as a Research Tool

Due to the COVID-19 pandemic, it was decided that PPI would occur online. After asking participants what their preferred option was, the videoconferencing platform chosen was Zoom, which features include secure group messaging services (Archibald et al., 2019). Zoom allows individuals to communicate via computer, tablet, or smartphone device. Literature for online research is currently limited, and when discussed, online methods are often jointly reviewed with other internet communication technologies as emails (Lo Iacono, Symonds and Brown, 2016; Sullivan, 2012).

3.13.5 Data collection

A topic guide was developed by the candidate and reviewed by the doctoral thesis supervisors. This topic guide contained a series of questions designed to determine participants’ opinions and views on the 360° videos. Due to the COVID-19 pandemic, PPI workshops took place virtually using a video conferencing programme. Participants were emailed with the participant information sheet and consent form. Signed copies of the consent form were returned via email and stored in a secure password protected server at the University of Warwick. Participants were asked what videoconferencing programme they wanted to use; all participants requested Zoom. Two PPI workshops were scheduled at a time that was convenient for all participants. Before the workshops, the candidate mailed over Google Cardboard headsets to each participant; these would be used to view the 360° videos on Youtube. They were also emailed with an agenda and background information on the development of the 360° videos. The workshops were recorded using a dictaphone and stored in a secure server at the University of Warwick.

3.13.5.1 Data analysis

Despite increasing interest, there are limited resources assessing the rigorous and practical methodologies analysing and interpreting PPI data (Jennings et al., 2018). A focus style methodology was adopted to collate a variety of views (Krueger and Casey, 2014). Furthermore, participants consented for the facilitator (the candidate) to take notes and to use these in publications. The workshops were audio recorded. Field notes recorded the discussions throughout, and PPI participants were asked to check that the notes accurately reflected the discussions and feelings (Sanjek, 1990; Wengraf, 2001).

Researchers must decide whether an inductive or deductive approach to data analysis is appropriate (Frith and Gleeson, 2004). A deductive approach was used to identify themes from the data and was grounded in the participants' perceptions and experiences. The themes focused on the design, content, usability, privacy and security and engagement. The analytic strategy was data-driven and deductive, focusing on identifying the salient themes.

Thematic analysis (Braun and Clarke, 2006) was used to analyse the data collected from the workshops. The audio recording from the workshops was transcribed verbatim and analysed according to the thematic analysis framework. The process of thematic analysis has been explained in more detail in section 3.7.6.

3.13.6 Ethical considerations

The active involvement of members of the public in research development does not require NHS ethical approval. This is because there is a key distinction between a PPI participant's role and a research participant's role; PPI participants are advisers who provide their expertise and knowledge on a particular area (INVOLVE, 2011). This decision was confirmed by the Biomedical and Scientific Research Ethics Committee (BSREC) at the University of Warwick. University ethical approval was not required either.

Despite this, the principles of informed consent were adhered to. Therefore, participants were provided with an information sheet and consent form to sign. Before the workshops, they were provided with the agenda as well. Due to COVID-19, all consent forms, information sheets and agendas were emailed to the candidate's Warwick email address. The workshops were audio recorded using a dictaphone. All data was stored securely (please see section 3.12.4 Data protection for more information).

3.13.7 Main strengths and limitations

According to the candidate, this is one of the first studies to conduct a PPI approach to reviewing participants' experiences of 360° videos, which form part of a VR intervention, for those with psychosis. Findings suggested that the 360° videos were well scripted, feasible to view and could improve social cognition deficits. As the videos were uploaded onto YouTube, they were accessible to all people with an internet connection. Furthermore, all participants had lived experience of mental health difficulties and therefore were able to provide feedback relating to their own experiences.

Due to COVID-19, there were difficulties in recruiting participants. Furthermore, the PPI study (which had been initially designed to take place face-to-face) had to be conducted online.

3.14 Summary of chapter

This chapter provides a brief outline of the methods and methodologies of each study. Additionally, the rationale of each study combined with the strength and limitations allows the reader to receive an overview of what is expected in this thesis. The results, discussion and conclusion of each study are provided in detail in the following chapters.

4. Study 1: a systematic review of the feasibility, acceptability and efficacy of virtual reality interventions for psychosis

4.1 Introduction to the chapter

This chapter systematically reviewed the evidence for the feasibility, acceptability and efficacy of VR treatments for those diagnosed with psychosis. Firstly, this chapter provides an introduction for the area. Secondly, the results are provided. Finally, the discussion summarises the main findings, including the strengths and limitations of the review.

4.2 Previous reviews into VR and psychosis

There have been three systematic reviews that have been conducted to review VR assessments and treatments for those diagnosed with psychosis and related disorders. Valmaggia et al. (2016) conducted a systematic review to assess VR use, to explore the mechanisms associated with the onset and maintenance of psychosis. The review concluded that VR could be used to assess the psychological mechanisms and processes associated with psychosis. The benefits were that therapists and researchers could assess individuals' cognitive, physiological, emotional, and behavioural responses in real-time, within a controlled environment.

Another review conducted by the same team of colleagues (Rus-Calafell et al., 2018) analysed VR as an assessment tool and technique for treatment for those diagnosed with psychosis. It was concluded that VR is a 'safe and well-tolerated' tool to explore casual factors, symptom correlations and neurocognitive deficits. Furthermore, it was concluded that VR treatments could benefit those with psychosis; however, at the time of the review, the majority of studies that were published were pilot studies. The review stated that more research was required to establish whether VR treatments translate to real-life changes in individuals’ functioning.

A recent review conducted by Riches et al. (2021) into VR assessments and treatment for social functioning impairments in psychosis, found that it is feasible, acceptable and effective. However, there were some methodological limitations; many of the included studies had small sample sizes and there was a limit to the number of RCTs.

Several systematic reviews have explicitly focused on VR and schizophrenia and related conditions. A Cochrane review conducted in 2014 found that there was not enough evidence to establish whether VR treatment was effective or not in those with serious mental illnesses, such as schizophrenia. Therefore, more research needed to be undertaken (Välimäki et al., 2014).

Macedo, Marques and Queirós (2015) conducted a review into using VR to assess and treat those with schizophrenia. They concluded that VR could be considered a complementary tool to integrate various therapeutic approaches. Furthermore, the therapist could customise the approach to suit the needs of the individual. The authors concluded that more RCTs and studies with longer-term follow-ups are required.

Bisso et al.’s (2020) systematic review focused on immersive VR in those on the schizophrenia spectrum. There was limited available data on the effectiveness of immersive VR; nevertheless, it does demonstrate the effectiveness and versatility of treating various psychotic symptoms. A comprehensive review on VR for the treatment of violence in young people with schizophrenia found that it had a therapeutic element to reduce anger and improve conflict resolution (Dellazizzo et al., 2019).

Other systematic reviews have focused on using VR in psychiatric disorders more broadly, with a subsection on psychosis. Kim and Kim (2020) stated that there were limitations on the studies that focused on the therapeutic effects of VR on psychosis. Cieślik et al. (2020) conducted a systematic review of reviews into VR in psychiatric disorders. It was concluded that those reviews on psychosis found that VR was predominantly used to assess paranoid thinking. Freeman et al.'s (2017) review came to similar conclusions and stated that the heterogeneity of studies focusing on psychosis reflected the differences in understanding the condition and its complexity.

4.3 Results

4.3.1 Study selection

A total of 4581 articles were identified in the initial search. Following removal of duplicates, 2642 abstracts were screened, 56 of which were selected for full text retrieval. In total, 13 articles were excluded following full-text review. There was a high level of agreement between raters (Kappa = 0.9). 43 articles were included in the final review.

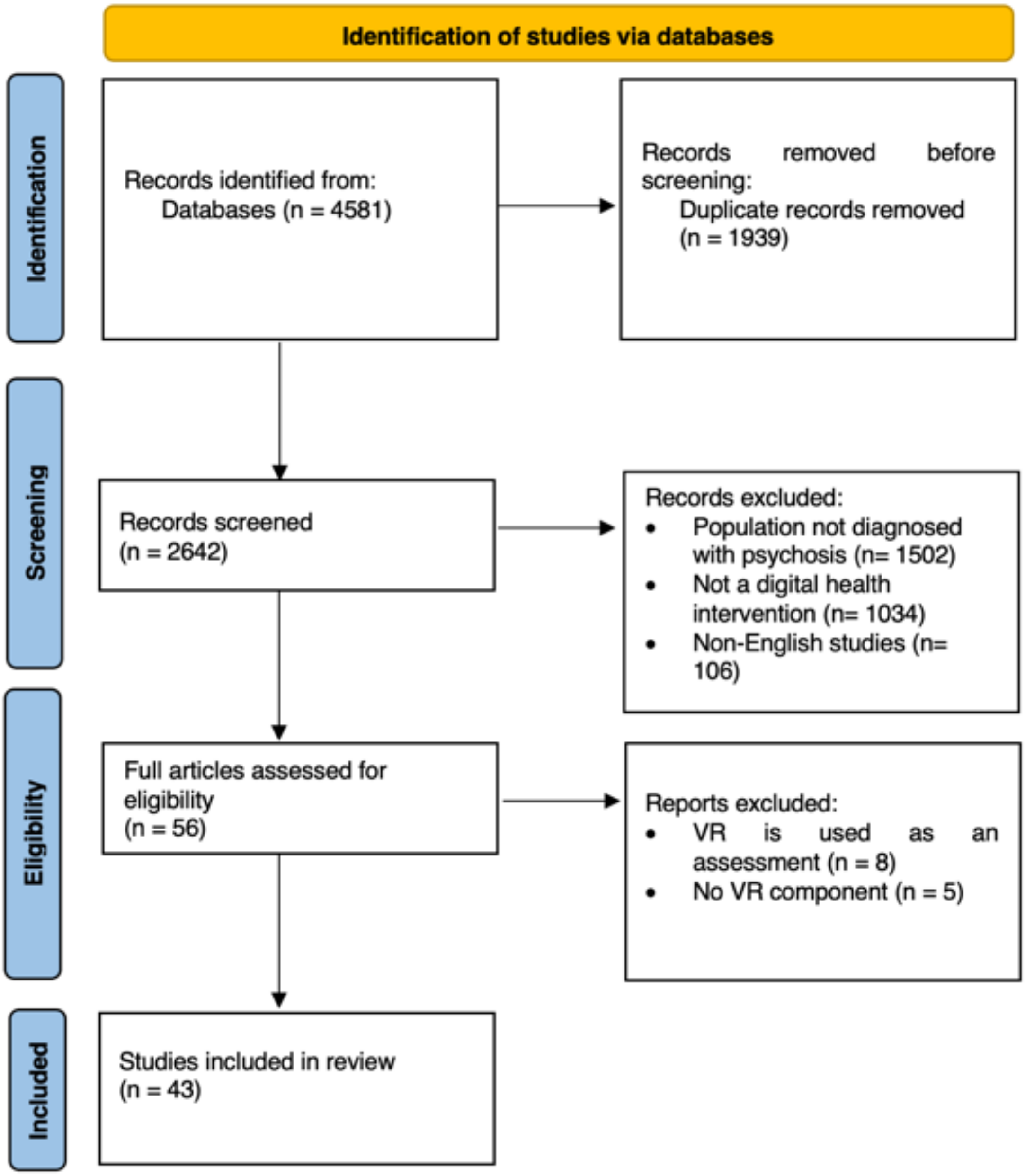


Figure 18: Flowchart of literature search results and selection of studies

4.3.2 Study characteristics

Characteristics of the included studies are provided in table 15. The table is arranged in order of publication date and target of the VR intervention.

The highest percentage of studies were conducted in the USA (7/43; 16.3%) followed by the UK (6/43; 14%), South Korea (5/43; 11.6%) and The Netherlands (5/43; 11.6%). Most studies were published in or after 2013 (86%) and employed quantitative methods (95%). Most studies were RCTs (20/43; 46.5%) as well as feasibility studies and pilot studies (10/43; 23.3%), followed by case studies/case series (7/43; 16.3%).

- 53.5% (23/43) of studies recruited those diagnosed with schizophrenia only and 14% (6/43) recruited those diagnosed with psychosis only. The remaining studies recruited a combination of conditions.
- Sample size in respective studies ranged from one to 150 participants.
- Mean ages across studies ranged from 21.6 to 66.14 years, with the mean age overall being 39.1 years.
- Over half (53.5%, n=23) of studies included a CG in their sample size. Interventions ranged from one session to 80 sessions, over a period of one day to 14 weeks.
- 56% (24/43) of studies collected data at two time points of pre-intervention and post-intervention, whilst 30.2% (13/43) of studies collected data at three time points of pre-intervention, post-intervention and at follow up.

Table 15: Characteristics of eligible studies

Author (year)	Study Aim	Sample characteristics	Intervention	Main findings
1. Chan et al. (2010)	Assessing whether the VR cognitive training program using IREX improves cognitive functioning in older adults with chronic schizophrenia	• **Sample size**: 29 • **Population type**: Schizophrenia • **Comparison/control**: Yes (Experimental Group (EG): 14 CG: 15) • **Location**: Hong Kong **Data collection**: inpatient setting	• **Intervention Name:** virtual reality cognitive training program • **Study Type**: Pilot Study • **Domain Target**: Cognitive training • **Intervention Task**: Simulated tasks within a VR environment through video contact. • **Manual:** No • **Hardware**: Not recorded • **Software**: VR system - IREX • **Immersion**: not recorded	**Feasibility and Acceptability** • Eligibility – 29 eligible • Attrition – 2/14 • Personalisation – No **Technology** • Results showed a reduction in simulator sickness ($p < .047$) within the first session. • VR sickness - overall score of simulator sickness (SSQ) before and after the first session was non sig.

			- **Intervention Dosage**: 10 sessions, 15 min each. - **Measurements**: Cognistat, SSQ, VQ - **Timepoints**: Pre intervention and post intervention	**Clinical impacts** - Significant difference: Yes - Cognistat: non-significant condition effect, a significant time effect and a significant condition x time interaction, - VQ and SSQ in the VR group showed a sig. improvement in volition ($p < .000$) between the first and the last sessions of the VR program.
2. La Paglia et al. (2013)	NeuroVr 2.0 software (a cognitive task) was developed for rehabilitation of shifting,	- **Sample size:** 12 - **Population type:** Schizophrenia - **Comparison/control:** Yes (EG: 6 CG: 6) - **Location:** Italy	- **Intervention Name:** VR cognitive task - **Study Type:** Experimental Design - **Domain Target:** Cognitive training	**Feasibility and Acceptability** - Eligibility – Not provided - Attrition – No dropouts - Personalisation – No **Technology:** not recorded

	sustained attention, and action planning functions	• **Data collection:** Outpatient setting	• **Intervention Task:** Virtual attention and executive function training settled into four different virtual environments • **Manual:** No • **Hardware:** Not recorded • **Software:** NeuroVr 2.0 software • **Immersion**: Not recorded • **Intervention Dosage:** one session per week (90-min). Ten sessions total. • **Measurements:** MMSE, FAB, TMT, ToL, the Memory Battery, WCST, SCWT • **Timepoints:** Pre intervention and post intervention	**Clinical impacts** • Significant difference: Yes • VR training associated with improved performance in the divided attention task. • VR training was related with improved planning and reduced cognitive deficits. • After the executive function training EG showed sig improvements in increased observance of rules, reduced time of execution and decreased errors. • After attention training, EG showed improvements in reduced time of execution, decreased perseverative

				errors, improvement in sustained attention.
3. Tsang and Man (2013)	The present study adopted theory-driven training strategies and one of the training programs was enhanced using virtual reality (VR), a cutting-edge computer technology, as an intervention tool.	• **Sample size:** 95 • **Population type:** Schizophrenia **Comparison/control:** Yes (EG: 33, TAG: 32 CG: 30) • **Location:** Hong Kong • **Data collection:** Inpatient setting	• **Intervention Name:** Virtual reality-based vocational training system (VRVTS) • **Study Type:** Single blind RCT • **Domain Target:** Cognition • **Intervention Task:** 3D non-immersive type of VR training • **Manual:** Yes • **Hardware:** Desktop computer - Pentium IV CPU 2.40GHz, joystick, keyboard, mouse, LCD monitor, stereo speakers. • **Software:** Not recorded • **Immersion**: Yes	**Feasibility and Acceptability** • Eligibility – 130 assessed for eligibility. • Attrition - (EG: 8/33, TAG: 7/32 CG: 5/30) • Personalisation – No **Technology** • One patient experienced stimulator sickness during the first session; however, they continued with the intervention, and did not experience any further discomfort.

			• **Intervention Dosage:** Ten session (30 min) over five weeks • **Measurements:** *Cognitive* - BNCE, DVT, RBMT, WCST-CV4 *Work* – VCRS, Self-designed checklist on participants' knowledge and skills in performing sales-related activities, Participants' self-efficacy in performing sales-related activities (self-designed) • **Timepoints:** Baseline and post intervention	**Clinical impacts** • Significant difference: Yes • A marginally sig. interaction effect of group over time was found for the WCST-percentage of preservative response and VCRS. • VRG and the TAG showed significantly better improvements in the on-site test than the CG. VRG showed a significantly better improvement in the self-efficacy score than the CG.

4. Amado et al. (2016)	Test a method to improve cognitive abilities in patients with schizophrenia, using a virtual city	• **Sample size**: 10 • **Population type**: Schizophrenia, Schizoaffective Disorder • **Comparison/control**: No • **Location**: France • **Data collection**: Outpatient	• **Intervention Name:** The virtual town • **Study Type**: Pilot Study - pre and post design • **Domain Target**: Cognitive training • **Intervention Task**: Interacting in a virtual town • **Manual:** No • **Hardware**: Joystick • **Software**: Virtual world • **Immersion:** Yes • **Intervention Dosage**: 90-minute session per week x 12 sessions • **Measurements**: *Neuropsychological Assessments*: D2 cancelation test, WAIS-III,	**Feasibility and Acceptability** • Eligibility – 10 eligible • Attrition – 4/10 at intervention • Personalisation – No **Technology** • All participants reported a good tolerance to the intervention. **Clinical impacts:** • Significant difference: Yes • Sig. improvement in BPRS scores ($p < 0.001$) & GAF scores ($p < 0.01$). • Sig. improvement for the EAS-Total score ($p < 0.01$). • D2 cancelation test: the KL score ($p < 0.05$) and GZ-F

			verbal learning test, zoo map one, zoo map two, BADS, RCFT *Clinical*: BPRS, GAF *Psychosocial*: EAS, S- QoL, SERS, BIS - **Timepoints**: Pre intervention and post intervention	score ($p < 0.05$) was sig. different at post intervention compared to pre intervention. - Code subtest of the WAIS-III: change in total score was sig. ($p < 0.05$). - Copy-Code: change in total score was sig. ($p < 0.05$).
5. La Paglia et al. (2016)	This study investigated the feasibility of VR in improving selective divide and sustained attention	- **Sample size:** 15 - **Population type:** Schizophrenia - **Comparison/control**: Yes (EG: 9 CG: 6) - **Location:** Italy - **Data collection:** Outpatient setting	- **Intervention Name:** VR attention training - **Study Type:** Trial - **Domain Target:** Cognitive training - **Intervention Task:** Virtual attention and executive	**Feasibility and Acceptability** - Eligibility – Not provided - Attrition – No dropouts - Personalisation – No **Technology:** not recorded

			function training settled into four different virtual environments - **Manual:** No - **Hardware:** HMDs, displays, trackers, computer, joypad. - **Software:** NeuroVr 2.0 software Intervention Dosage: one session per week (90-min). Ten sessions total. - **Immersion**: Not recorded - **Measurements:** MMSE, FAB, TMT, ToL, Memory Battery WCST - **Timepoints:** Pre intervention and post intervention	**Clinical impacts** - Significant difference: Yes - VR training related to improved performance in the divided attention task, better general cognition, functioning, improved planning, and sustained attention. VR training showed reduced time of execution, decreased request of assistance, decreased need of therapists' intervention, decreased no. of omissions, improvement in sustained attention.

6. Peyroux and Franck (2016)	Assess whether the RC2S program may be helpful in improving higher-order social cognitive functions and to transfer of acquired abilities to everyday life	• **Sample size:** 2 • **Population type:** Schizophrenia • **Comparison/control:** No • **Location:** France • **Data collection:** Not recorded	• **Intervention Name:** Computerized social cognitive remediation program • **Study Type:** Case Studies • **Domain Target:** Cognitive Remediation • **Intervention Task:** social interaction scene to improve skills • **Manual:** No • **Hardware:** Computer screen • **Software:** Not recorded • **Immersion**: Not recorded • **Intervention Dosage:** One x 30 min weekly session = 14 weeks total • **Measurements:** TREF, MASC-VF, ToM-15, RMET,	**Feasibility and Acceptability** • Eligibility – Not provided • Attrition – No dropouts • Personalisation – No **Technology:** Not recorded **Clinical impacts** • Significant difference: Yes Participant one • ToM scores improved nine months after the end of the therapy. Improved facial emotion recognition after the therapy and at follow-up (non sig.). • Mental wellbeing scores remained stable throughout

			AIHQ, PerSo, QCAE, WEMWBS, SERS, EAS - **Timepoints:** Pre intervention, post intervention and follow up (six months)	the treatment. Improvement in daily social functioning. - PANSS total score of psychotic symptoms – decrease, which shows improvement. Participant two - Self-esteem and mental well-being remained stable, as did symptoms measured with the PANSS.
7. Vanitha et al. (2018)	The aim is to assess the effectiveness of VR therapy upon cognition among	- **Sample size:** 35 - **Population type:** Schizophrenia - **Comparison/control**: No - **Location:** India	- **Intervention Name:** Virtual reality therapy - **Study Type:** Pre experimental research design - **Domain Target:** Cognition	**Feasibility and Acceptability** - Eligibility – Not provided - Attrition – No dropouts - Personalisation – No **Technology:** Not recorded

	schizophrenic clients.	• **Data collection:** Not recorded	• **Intervention Task:** Not provided • **Manual:** No • **Hardware:** Not recorded • **Software:** Kinect Adventures programme • **Immersion**: Not recorded • **Intervention Dosage:** not provided • **Measurements:** clinical variables, MMSE. • **Timepoints:** Pre intervention and Post intervention	**Clinical impacts** • Significant difference: Yes • Improvement in cognition
8. Li et al. (2020)	Intervention study to explore the effect of using virtual reality supermarket training system	• **Sample size:** 68 • **Population type:** Schizophrenia • **Comparison/control:** Yes (VRT: 34 TAU: 32) • **Location:** China	• **Intervention Name:** Virtual reality training (VRT) • **Study Type:** RCT • **Domain Target:** Cognition and clinical symptoms	**Feasibility and Acceptability** • Eligibility – Not recorded • Attrition – 6/68 dropouts • Personalisation – No

	(VRSTS) to improve cognitive function deficiency and clinical symptoms in Han Chinese patients with schizophrenia in the remission stage.	• **Data collection:** Not recorded	• **Intervention Task:** Patients were asked to interact in a virtual supermarket and complete different shopping tasks. • **Manual:** No • **Hardware:** Joystick and headset • **Software:** Visual studio 2015 & Unity 5.3.5f1 • **Immersion**: Yes • **Intervention Dosage:** (One x day) x (five days per week) x (two weeks) • **Measurements:** MCCB, PANSS, PSP • **Timepoints:** Pre intervention and post intervention	**Technology** • One patient reported dizziness, but this feeling disappeared. No other uncomfortable feelings reported. **Clinical impacts** • Significant difference: Yes • PANSS general psychopathology scores at T1 in VRT group is sig. less than in TAU group. However, no sig. difference was found in PANSS total scores, neither in PANSS positive and PANSS negative scores

				at T1 between two groups (all $p > 0.05$).
9. Nijman et al. (2020)	The aim is to assess the feasibility and acceptability of the DiSCoVR intervention on social cognition, in those with psychosis.	- **Sample size:** 22 - **Population type:** Psychosis - **Comparison/control:** No - **Location:** The Netherlands - **Data collection:** not recorded	- **Intervention Name:** Dynamic Interactive Social Cognition Training in Virtual Reality (DiSCoVR) - **Study Type**: Single group feasibility pilot study - **Domain Target:** Social cognition - **Intervention Task:** Virtual environments (a shopping street, a supermarket, and a bar) were shown. The VR software was controlled by the therapist, using one monitor to observe the	**Feasibility and Acceptability** - Eligibility – Not provided - Attrition – (5/22) drop out during intervention - Personalisation –Yes PARTICIPANT FEEDBACK - Participants gave positive ratings for the following: ○ amount learned ○ usefulness of daily social activities ○ combination of both the VR and the therapist

			participant’s field of vision, and another monitor to control the virtual environment with the user interface. Participants interacted with avatars, which were controlled by the therapist and asked to complete specific tasks. • **Manual:** Yes • **Hardware:** Oculus Rift VR-headset • **Software:** VR software developed by CleVR BV • **Immersion**: Not recorded	○ opportunity to practice with social situations ○ Personalisation of the intervention ○ improved social skills ○ increased confidence and assertiveness ○ improved emotion recognition • Areas to improve: ○ Realism of the intervention ○ Intervention only partly fit the needs of participants

			• **Intervention Dosage:** two sessions per week (45-60 mins each). 16 sessions in total. • **Measurements:** ○ *Diagnostic Measures* (MINI PLUS, NART, ○ *Feasibility and Acceptability* self-reported questionnaire ○ *Social Cognition* Ekham 60 Faces Test, BLERT, TASIT, EAT, Faux Pas ○ *Neurocognition* RVP, TMT ○ *Symptom Measures* GPTS, SIAS, BDI, SERS, PANSS	○ The dosage of the intervention was too high THERAPIST FEEDBACK • Therapists gave positive ratings for the following: • Opportunity to practice social situations in VR • Treatment protocol • Intervention structure **Technology** • Most common weakness was technical issues (n=7, 35%) **Clinical impacts** • Significant difference: Yes

			- **Timepoints:** Pre intervention and post intervention	- Emotion perception improved significantly after the intervention - Small improvements were also observed for most symptom domains, with effect sizes ranging between *d*=0.16 and *d*=0.34 Small effect size was also found for self-esteem (*d*=–0.25)
10. Thompson et al. (2020)	The aim was modifying an existing group social cognitive intervention entitled 'Social Cognition and Interaction Training'	- **Sample size:** 19 - **Population type:** Psychosis - **Comparison/control:** No - **Location:** UK - **Data collection:** Community setting	- **Intervention Name:** Social cognition and interaction training virtual reality therapy (SCIT-VR) - **Study Type:** Feasibility and acceptability - pre and post design - **Domain Target:** Social cognition	**Feasibility and Acceptability** - Eligibility – Not recorded - Attrition – 3/19 - Personalisation – Yes - Acceptability – Acceptability was rated >3 out of five on every item in the feedback forms.

	(SCIT) to be delivered through a virtual world environment (Second Life©), for those with early psychosis.		- **Intervention Task:** Participants attended a virtual world therapy using avatars - **Hardware:** Computer desktop, headphones. - **Software:** Second Life® virtual world - **Manual:** Yes - **Immersion**: Non immersive - **Intervention Dosage:** One pre intervention session (one hour) intervention (eight sessions, 45-60 mins each, x two a week)	**Technology** - No concerns regarding safety - Participants found the environment to be relatively immersive. - There were some issues with the technology reported. - Participants illustrated a reasonable degree of presence **Clinical impacts** - Significant difference: Yes - Sig. increase in emotion recognition scores from pre- to post-intervention

			- **Measurements:** *Social Cognition*: SCSQ, BLERT, Hinting task, CSQ-SF *Social Function*: PSP *QoL*: EuroQual 5-D *Behavioral Change Intention*: TDF—D4, TDF—D8, TDF—D9, *Presence*: presence questionnaire *Psychopathology*: BPRS, *Neurocognition*: NART Adverse Events were recorded Feedback forms qualitative interviews - **Timepoints:** Pre intervention and post intervention	- Sig. decrease in the anxiety/depression subscale of the EuroQual-5D

11. Vass et al. (2020)	The current RCT aims to evaluate the feasibility and tolerability of VR-ToMIS on theory of mind, pragmatic language skills and negative symptoms for those with schizophrenia.	• **Sample size:** 21 • **Population type:** Schizophrenia • **Comparison/control:** EG: 9, CG: 8 • **Location:** Hungary • **Data collection:** outpatient setting	• **Intervention Name:** Virtual reality-based targeted theory of mind intervention (VR-ToMIS) • **Study Type:** RCT • **Domain Target:** Theory of Mind • **Intervention Task:** Participants took part in simulated social interactions with an avatar in an immersive environment (controlled by the therapist). • **Manual:** No • **Hardware:** Samsung Gear HMD, Samsung G7 Smartphone, Samsung Simple Controller, Temporal Disc Controller	**Feasibility and Acceptability** • Eligibility – 54 • Attrition – 3/21 • Personalisation – Yes • Participants found this novel intervention engaging, interesting, easy, and safe to use. **Technology** • Subjective evaluation ○ Use of VR made my therapy interesting – 70% strongly agree ○ Temporal disc controller is easy to use – agree (66%)

			- **Software:** vTime virtual environment - **Immersion**: Yes - **Intervention Dosage**: Nine sessions per week (50 mins per session) - **Measurements:** PANSS, RBANS, WCST-64, LQoLP, SSQ, Faux Pas Recognition Test, BCMET - **Timepoints:** Pre intervention and post intervention	**Clinical impacts** - Significant difference: Yes - EG was associated with significant improvements in negative symptoms on the PANSS score, with large effect size. - EG associated significant changes were noted regarding faux pas detection and understanding inappropriateness overall scores. - EG group showed apparent and greater change in detecting implicatures in all aspects, except from quantity implicature.

				• WCST-64: number of correct responses showed EG-associated significant improvements.
12. Park et al. (2009)	Explore the possibility of the use of Virtual Reality Functional Skills Assessment (VRFSA) in a future regular clinical trial.	• **Sample size:** 33 • **Population type:** Schizophrenia • **Comparison/control:** Yes (EG: 18 CG: 15) • **Location:** South Korea • **Data collection:** Inpatient setting	• **Intervention Name:** Virtual Reality Functional Skills Assessment (VRFSA) • **Study Type**: Randomised Dose Study • **Domain Target:** Functional Skills • **Intervention Task:** Participants walked around in a virtual street 3 times • **Manual:** No • **Hardware:** HMD, receiver, transmitter, computer system • **Software:** Not recorded • **Immersion**: Not recorded	**Feasibility and Acceptability** • Eligibility – 24 patients with schizophrenia • Attrition – EG (6/18) at follow up • Personalisation –Yes **Technology:** not recorded **Clinical impacts** • Significant difference: Yes • Trend toward a large treatment effect on the SBS. • Very large effect of treatment x skills phase x group interaction on the VRFSA

			- **Intervention Dosage:** 6 weeks - **Measurements:** Receptive skills score & Expressive skills score, SBS, RCS, PANSS, PANAS, BARS, SARS - **Timepoints:** Pre intervention and post intervention	- There were significant treatment effects on positive, negative, and general symptoms of the PANSS.
13. Bell and Weinstein (2011)	Feasibility and tolerability of the simulated job interview in vocational rehabilitation programs, involving those with psychiatric disability.	- **Sample size**: 10 - **Population type**: 8/10 Schizophrenia, Schizoaffective Disorder, one Borderline Personality Disorder, one Chronic Post Traumatic Stress Disorder	- **Intervention Name:** Simulated job interview training - **Study Type**: Observational Study - **Domain Target**: Social Skills Training	**Feasibility and Acceptability** - Eligibility – not recorded - Attrition – no dropouts - Personalisation – No - Representative sample of clients had a highly positive response.

		- **Comparison/control**: No - **Location**: USA - **Data collection**: Not recorded	- **Intervention Task**: Simulated interviews - **Manual:** Yes - **Hardware**: Not recorded - **Software**: Simulation software - **Immersion**: Yes - **Intervention Dosage**: 15-minute session x two - **Measurements**: Self-Reported Scores - **Timepoints**: Post intervention	Scores on the 1– 5 Likert scale (strongly disagree to strongly agree). All means are above 4.0. **Technology** - Ease of using the program showed a similar range and a mean of 4.5. Indicates that they felt that they could negotiate use of the software. **Clinical impacts** Significant difference: Not applicable
14. Park et al. (2011)	The aim of this study was to find advantages of	- **Sample size:** 91 - **Population type:** Schizophrenia	- **Intervention Name:** Social skills training VR-role playing (SST-VR) - **Study Type:** RCT	**Feasibility and Acceptability** - Eligibility – 128 assessed for eligibility

	the use of VR in social rehabilitation for patients with schizophrenia.	- **Comparison/control:** Yes (EG: 46 CG: 45) - **Location:** South Korea - **Data collection:** Inpatient setting	- **Domain Target:** Social Skills Training - **Intervention Task:** Virtual environments as simulators of the scenes and avatars as the actors were used in VR role-plays. - **Manual:** Yes - **Hardware:** computer, HMD, position tracker - **Software:** interaction with avatars - **Immersion**: Yes - **Intervention Dosage:** Ten semiweekly sessions over five weeks - **Measurements:** SBS, RAS, RCS, SPSI-R	- Attrition – EG (7/46), CG (8/45) at intervention, EG (6/46), CG (6/45) at drop out, EG (1/46) data analyses. Final number – EG (32/46), CG (31/45) SST-VR group showed a higher attendance rate than the SST-TR group. - Personalisation –Yes **Technology** - No health problems (i.e. simulator sickness) that were related to the use of immersive HMD in the EG group. **Clinical impacts** - Significant difference: Yes

			- **Timepoints:** Pre intervention and post intervention	- The SST-VR group had greater improvement in the conversational skills than the SST-TR group, but lesser improvement in the nonverbal skills. - Sig. group effects on the nonverbal skills and time effect on all three of the outcomes on the vocal skills. - Time × group interaction effects on the nonverbal and conversational skills of the SBS. - Sig. group effects on the RAS Score and time effect on all three of the secondary outcomes

				SST-VR group had a greater improvement on the RAS score.
15. Rus-Calafell et al. (2012)	The objective is to help people with schizophrenia to overcome everyday social difficulties via the use of new technologies.	• **Sample size:** 1 • **Population type:** Schizophrenia • **Comparison/control:** No • Location: Spain • **Data collection:** Outpatient	• **Intervention Name:** SOSKITRAIN - integrated VR programme for social skills training • **Study Type:** Case Study • **Domain Target:** Social Skills Training • **Intervention Task:** An integrated VR programme for social skills training (called SOSKITRAIN) was developed based on the target behaviours • **Manual:** No • **Hardware:** Not provided • **Software:** Not provided • **Immersion**: Not recorded	**Feasibility and Acceptability** • Eligibility – Not provided • Attrition – No drop out. • Personalisation –Yes **Technology:** not recorded **Clinical impacts** • Significant difference: Yes • Sig. differences between baseline and post-treatment for facial emotion recognition, and an increase in the frequency of assertive behaviours and the time spent on conversation. This

			• **Intervention Dosage:** 16 sessions twice a week; one extra session to discuss content • **Measurements:** PANSS, SADS, SFS, AI • **Timepoints:** Baseline, treatment and follow up	pattern was maintained in the follow-up. • Post-treatment - decrease in negative symptomatology, general psychopathology, social anxiety, and social discomfort. • AI - improvement in terms of the likelihood of behaving assertively during social interactions (reverse subscale). • Sig. increase in the patient's social functioning, specifically on interpersonal communication subscale.

16. Humm et al. (2014)	Assessing the effectiveness of a virtual-reality role-play utilizing PeopleSimTM technology – Training with Molly Porter.	**Sample size:** 96 (37: schizophrenia) **Population type:** Schizophrenia/other (n=37), ASD (n=26), PTSD (n=33) **Comparison/control:** Yes; Schizophrenia (EG: 25/64, CG: 12/32) **Location:** USA **Data collection:** Community setting	**Intervention Name:** Job Interview Training System with Molly Porter **Study Type:** RCT **Domain Target:** Job interview training **Intervention Task:** Interactive role-play simulation with Molly Porter **Manual:** No **Hardware:** Desktop computer **Software:** 'Molly Porter' programme. **Immersion**: Yes **Intervention Dosage:** Five session (ten-hour total)	**Feasibility and Acceptability** Eligibility – not provided Attrition – not recorded Personalisation –Yes TEQ - Using a 7-point Likert scale (7 being the most positive), majority provided a mean score above six. **Technology**: not recorded. **Clinical impacts** Significant difference: Yes Highly sig. treatment condition effect for the Molly group ($F_{1,86} = 8.3$, $p < .005$).

			- **Measurements:** Baseline assessments 1) demographic and vocational interviews, 2) neurocognitive and social cognitive assessments 3) standardized interview role-plays (4) a self-report of self-confidence. - Vocational data collected. *Social Cognition* RBANS, BLERT - **Timepoints:** Pre intervention and post intervention	- Highly sig. training effect (F1,86 = 12.18, p < .001). 59 out of 63 participants (94%) assigned to the Molly groups completed three or more hours of training. - 20 weeks post-intervention – nine of the 16 contacted had obtained work.
17. Rus-Calafell et al. (2014)	Developed an integrated VR program into an individual cognitive-behavioural	- **Sample size:** 15 - **Population type:** Schizophrenia, Schizoaffective Disorder	- **Intervention Name:** SOSKITRAIN - integrated VR programme for social skills training - **Study Type:** Pilot Study	**Feasibility and Acceptability** - Eligibility – 20 patients - Attrition – 3/15 - Personalisation –Yes

	social skills program intervention, to 1) promote accessibility to train social skills 2) improve the generalisation of the learned responses in the patients' daily lives.	- **Comparison/control:** No - **Location:** Spain - **Data collection:** Outpatient setting	- **Domain Target:** Social Skills Training - **Intervention Task:** An integrated VR programme for social skills training (called SOSKITRAIN) was developed based on the target behaviours. - **Manual:** Yes - **Hardware:** laptop, stereoscopic view, 3D glasses, headphones - **Software:** Not recorded - **Immersion**: Not recorded - **Intervention Dosage:** 16 session (60-mins) x two a week over eight weeks.	- Participants reported a high level of satisfaction concerning the perceived intervention's benefits, the psychologist's work **Technology** - Participants reported high levels of acceptance of the VR system **Clinical impacts** - Significant difference: Yes - AI - Participants improved their performance from pre- to post-treatment. However, this improvement was not maintained at follow-up.

			- **Measurements:** *Psychopathology*: PANNS, *Social Performance and Anxiety*: AI, SSIT, SADS, *Social Functioning*: SFS, Objective Scores, Assertive Behaviours, Time Spent in Conversation, VR Acceptance Assessment - **Timepoints:** Pre intervention, post intervention and follow up (four months)	- PANSS - a sig. time effect was observed on the negative and psychopathology - SSIT - a sig. time effect was observed on the performance and anxiety subscales - SADS - a sig. time effect was observed for both the avoidance and anxiety subscales - SFS - a sig. time effect was observed for the social functioning (SFS) variables: withdrawal, interpersonal communication, recreation, and pro-social activities.

18. Smith et al. (2014)	Thus, the current study sought to examine the feasibility and efficacy of the full version of VR-JIT in a randomized controlled trial.	• **Sample size:** 6/37 • **Population type:** Schizophrenia, Schizoaffective Disorder • **Comparison/control:** Yes (EG: 3/25 CG: 3/12) • **Location:** USA • **Data collection:** Community setting	• **Intervention Name:** Virtual reality job interview training (VR-JIT) • **Study Type:** RCT • **Domain Target:** Job interview training • **Intervention Task:** VR-JIT adopts SIMmersion's patented PeopleSIM technology, which uses video recordings to generate a virtual human character that interacts with trainees. • **Manual:** No • **Hardware:** Desktop computer • **Software:** PeopleSim™ technology	**Feasibility and Acceptability** • Eligibility – not provided • Attrition – not provided. • Personalisation –Yes • The TEQ's found very positive views (scores 6.0 – 6.4). • Attendance: 95.2% **Technology:** not recorded **Clinical impacts** • Significant difference: Yes • VR-JIT group improved on the total role-play assessment score between baseline and follow-up, whereas the TAU group did not

			- **Intervention Dosage**: Ten hours within a two-week period - **Immersion**: Not recorded - **Measurements:** *Primary Efficacy Assessments:* role-play performance and job interview self-confidence *Neurocognitive and Social Cognitive Measures*: RBANS, BLERT, EPT *Feasibility Assessments*: TEQ *Process Measure*: The participants' VR-JIT performance score for each trial and time spent engaged with the simulated interviews	- VR-JIT group increased their self- confidence in their interview skills - VR-JIT group demonstrated sig. improvement on their simulated role-play performances across increasing levels of difficulty - The follow-up role-play performances did not differ between groups at post test

			• **Timepoints:** Pre intervention and post intervention	
19. Smith et al. (2015a)	This study evaluated the efficacy of virtual reality job interview training (VR-JIT) at improving job interview skills and employment outcomes among individuals with schizophrenia.	• **Sample size:** 32 • **Population type:** Schizophrenia • **Comparison/control:** Yes (EG: 21 CG: 11) • **Location:** USA • **Data collection:** Not recorded	• **Intervention Name:** Virtual reality job interview training (VR-JIT) • **Study Type**: RCT • **Domain Target:** Job interview training • **Intervention Task:** VR- JIT adopts SIMmersion's patented PeopleSIM technology, which uses video recordings to generate a virtual human character that interacts with trainees. • **Manual:** No	**Feasibility and Acceptability** • Eligibility – not provided • Attrition – EG (23/21), CG (7/11) at six month follow up • VR-JIT sessions were well attended - trainees completed mean = 15.7 (SD = 4.3) trials • Personalisation –Yes • Participants reported that VR-JIT was easy to use, enjoyable, helpful, and

			- **Hardware:** Desktop computer - **Software:** PeopleSim™ technology - **Intervention Dosage**: 10 hrs - **Immersion**: Not recorded - **Measurements:** *Cognition*: RBANS, BLERT, emotional perspective-taking task. *Acceptability* – TEQ. *Efficacy* – Role-play performance, Interviewing self-confidence, VR-JIT process measures *6-Month Follow-Up Measures*	increased their self-confidence in interviewing **Technology:** not recorded **Clinical impacts** - Significant difference: Yes - VR-JIT performance scores significantly improved across the number of completed trials. - Trainees improved their role-play performance between pre-test and post-test. - Trainees sustained interviewing self-confidence between the post- test and six-month follow-up

			• **Timepoints:** Pre intervention, post intervention and follow up (six months)	
20. Smith et al. (2015b)	In this study, six-month follow-up data was collected from participants who completed the efficacy studies.	• **Sample size:** 51 • **Population type:** Schizophrenia • **Comparison/control:** Yes (EG: 39 CG: 21) • **Location:** USA • **Data collection:** Not recorded	• **Intervention Name:** Virtual reality job interview training (VR-JIT) • **Study Type:** Follow up study • **Domain Target:** Job interview training • **Intervention Task:** VR- JIT adopts SIMmersion's patented PeopleSIM • technology, which uses video recordings to generate a virtual human character that interacts with trainees. • **Manual:** No • **Hardware:** Desktop computer	**Feasibility and Acceptability** • Eligibility – Not provided • Attrition – One drop out • Personalisation –Yes • Approx. 90% of VR-JIT trainees agreed or strongly agreed that the training increased their confidence to go on interviews, helped improve their interview skills, and better prepared them for interviews. • 90% also agreed or strongly agreed that they would like to use VR-JIT again to enhance their interviewing skills.

			- **Software:** *PeopleSim™ technology* - **Immersion**: Not recorded - **Intervention Dosage**: Ten hours - **Measurements:** Six-month feedback - **Timepoints:** Six-month follow up	**Technology:** not recorded **Clinical impacts** - Significant difference: Yes - Similar proportion of VR-JIT and comparison participants completed job interviews. - VR-JIT trainees - mean scores for self-confidence in interviewing skills did not differ between the postintervention and the six-month follow-up. - Chances of receiving a job offer were higher for VR-JIT trainees compared with comparison participants. VR-JIT trainees had lower odds of receiving a job offer for

				each month since prior employment.
21. Sohn et al. (2016)	This study aimed to develop a virtual reality-based vocational rehabilitation training program (VR-VRTP), for patients with chronic schizophrenia can both understand and to evaluate	- **Sample size:** 10 - **Population type:** Schizophrenia - **Comparison/control:** No - **Location:** South Korea - **Data collection:** Outpatient setting	- **Intervention Name:** Virtual reality based vocational rehabilitation training (VR-VRTP) - **Study Type:** Feasibility Study - **Domain Target:** Rehabilitation Training - **Intervention Task:** Interacting in virtual reality scenarios for both convenience store and market environments, in which schizophrenic patients are considered likely to be employed. - **Manual:** No	**Feasibility and Acceptability** - Eligibility – Not provided. - Attrition - 1/10. - Personalisation –Yes **Technology:** not recorded **Clinical impacts** - Significant difference: Yes - Sig. pre-to-post program changes were observed on both the general symptoms score of the Manchester Scale and the PSP score.

	the feasibility of this program.		• **Hardware:** 3D surround screen using three LX400 LCD digital projectors • **Software:** • **Immersion**: Not recorded • **Intervention Dosage**: 1 a week x 8 weeks • Measurements: *Clinical*: MANSA, CGI-S, CGI-I, PSP, HAM-D, ZDRS, BAI *Cognitive Function*: WCST and Stroop Test for executive function, RCFT, K-AVLT • **Timepoints**: Baseline and eight-week post intervention	

22. Ku et al. (2007)	VEs designed to train people with schizophrenia to develop conversational skills in specific situations	• **Sample size:** 10 • **Population type:** Schizophrenia • **Comparison/control:** No • **Location:** South Korea • **Data collection:** Inpatient setting	• **Intervention Name:** VR-Based Conversation Training Program • **Study Type:** Experimental Design • **Domain Target:** Conversation Based Training • **Intervention Task:** VR tasks involves several types of conversational skills • **Manual:** No • **Hardware:** Big screen, HMD, joystick, • **Software:** 3D Game Studio • **Immersion**: Not recorded • **Intervention Dosage**: Not recorded • **Measurements:** PANSS, Presence questionnaires	**Feasibility and Acceptability** • Eligibility – Not provided • Attrition – Not recorded • Personalisation – No • Mean scores to questions regarding subjective interest and usability were scored 6.3 ± 1.67 for the evaluated usefulness, 7.3 ± 2.01 for subject's interest, 5.7 ± 2.1 for subject's anxiety reduction, and 7.5 ± 2.7 for subject's willingness. **Technology** • All three presence scores were recorded as high

			- **Timepoints:** Pre intervention and post intervention	- PANSS subscale 'negative symptoms' was sig. correlated with social presence and perceived other's copresence - Sig. negative correlation between social presence and silence-breaking time - Sig. correlation between silence breaking time and lack of spontaneity and flow of conversation **Clinical impacts** - Significant difference: Yes

				• All three presence score percentages were 68.6 ± 18.9 for self-reported copresence, 71.67 ± 18.0 for perceived other's copresence, and 67.5 ± 16.9 for social presence, which could be also regarded high. • PANSS - the emotional withdrawal symptom significantly correlated with social presence (r = -0.649, p = 0.042) and perceived other's copresence (r = -0.709, p=0.022).

23. Adery et al. (2018)	Feasibility and acceptability of Multimodal Adaptive Social Intervention in Virtual Reality (MASI-VR) for improving social functioning and clinical outcomes in schizophrenia.	- **Sample size**: 18 - **Population type**: Schizophrenia - **Comparison/control**: No - **Location**: USA - **Data collection**: Community setting	- **Intervention Name:** Multimodal Adaptive Social Intervention in Virtual Reality (MASI-VR) - **Study Type**: Feasibility and Acceptability - Pre and Post Design - **Domain Target**: Social Skills Training - **Intervention Task**: Engagement with avatars by looking at them, paying attention to the avatar's facial expressions and body language across three different social scenarios. - **Manual:** No	**Feasibility and Acceptability** - Eligibility – 19 eligible - Attrition – 2/18 at post intervention - Personalisation – No - Survey feedback ○ 94% of participants reported some degree of satisfaction. ○ 81% endorsed Extreme Satisfaction. ○ No dissatisfaction reported. ○ 81% participants found the training to be helpful, acceptable length, and that they would participate

			- **Hardware**: Desktop computer - **Software**: Video game - **Immersion**: No - **Intervention Dosage**: 10 sessions - **Measurements**: Feasibility and Acceptability, BPRS, SANS, SAPS - **Timepoints**: Pre and post intervention	again or recommend it. **Technology:** Not recorded **Clinical impacts** - Significant difference: Yes - Psychiatric symptom severity as measured by the BPRS significantly improved from pre intervention (M = 21.0, SD = 8.65) to post intervention (M = 16.06, SD = 7.54) training, F(1,15) = 8.83, p = 0.01, η2 = 0.23. - Negative symptom severity significantly decreased from pre intervention (M = 36.44, SD = 13.06) to post intervention (M = 26.37, SD =

				10.79), $F(1,15) = 8.64$, $p = 0.01$, $\eta 2 = 0.22$. • No improvement of positive symptoms nor significant changes overall or across subscales of the SFS.
24. Geraets et al. (2020)	This study examined whether treatment with virtual reality based cognitive behavioral therapy (VR-CBT) for paranoia influences momentary	• **Sample size:** 91 • **Population type:** Psychosis • **Comparison/control:** Yes (EG: 43 CG: 48) • **Location:** The Netherlands • **Data collection:** Outpatient service	• **Intervention Name:** Virtual reality based cognitive behavioral therapy • **Study Type:** RCT • **Domain Target:** Paranoia and Negative Affective States • **Intervention Task:** VR exercises to explore social situations • **Manual:** Yes • **Hardware:** Logitech F310 Gamepad, Sony HMZ-T1/T2/T3 HMD	**Feasibility and Acceptability** • Eligibility – not provided • Attrition – EG (4/43), CG (4/48) at follow up • Personalisation –Yes **Technology:** not recorded. **Clinical impacts** • Significant difference: Yes • VR-CBT patients reported feeling less suspicious, disliked, and experienced

	affective states.		- **Software:** Not recorded - **Immersion**: Not recorded - **Intervention Dosage:** 16 x one hour session - **Measurements:** ESM - **Timepoints:** Pre intervention, post intervention and follow up (six months)	lower levels of persecutory ideations, compared with TAU. - Treatment effects maintained at 6-month follow-up. - Post-treatment – VR-CBT patients' anxiety levels decreased more compared with TAU - Follow-up – Feelings of insecurity were also lower in the VR-CBT group. - Improvements in negative affect seemed consistently bigger in the VR-CBT group (non-sig).

25. Leff et al. (2013)	To encourage participants to engage in a dialogue with the avatar.	• **Sample size:** 26 • **Population type:** Schizophrenia • **Comparison/control:** Yes (Immediate therapy: 14, delayed therapy: 12) • **Location:** UK • **Data collection:** Community setting	• **Intervention Name:** Computer-assisted therapy • **Study Type:** Randomised partial cross over trial • **Domain Target:** Auditory Hallucinations • **Intervention Task:** Patient interacted with an avatar. Voice of the avatar was provided by a therapist in another room. • **Manual:** No • **Hardware:** Not recorded • **Software:** Commercial software - Facegen Modeller version 3.5.1, Annosoft Real-time LipSync SDK 4.0.0.0 • **Immersion**: Not recorded	**Feasibility and Acceptability** • Eligibility – not provided • Attrition: 9/26 • Personalisation – Yes **Technology:** not recorded **Clinical impacts** • Significant difference: Yes • Sig. positive effects for the PSYRATS total score, the BAVQ-R total score • Post-treatment – positive changes for both the PSYRATS and the CDS score.

			- **Intervention Dosage:** six sessions (30-min) one post intervention session - **Measurements:** PSYRATS, BAVQ-R, CDS - **Timepoints:** Pre intervention, post intervention and follow up (three months)	- Three month follow up – remained sig. better on both the PSYRATS and the BAVQ-R total score. An effect on the CDS score was also found.
26. Moritz et al. (2014)	The aim is to conduct a proof-of-concept study to assess whether feedback for false judgements positively influences	- **Sample size:** 33 - **Population type:** Schizophrenia - **Comparison/control:** No - **Location:** Germany - **Data collection:** Inpatient and outpatient setting	- **Intervention Name:** Virtual reality paradigm - **Study Type:** Proof of Concept - **Domain Target:** Targeting Delusions - **Intervention Task:** Navigating in a virtual world street - **Manual:** No - **Hardware:** Not recorded	**Feasibility and Acceptability** - Eligibility – Not recorded - Attrition – No dropouts - Personalisation – No **Technology:** Not recorded **Clinical impacts** - Significant difference: Yes - Paranoia symptomatology decreased significantly t (32)

	delusion severity in a VR environment.		• **Software:** Unity3D, DAZ-Studio • **Immersion**: Not recorded • **Intervention Dosage:** Not recorded • **Measurements:** POD • **Timepoints:** Pre intervention and post intervention	= 2.21, p = .034, at a medium effect size (Cohen's d = .54)
27. Freeman et al. (2016)	Aim is to establish a potential therapeutic use of virtual reality for delusions.	• **Sample size:** 30 • **Population type:** Schizophrenia, Schizoaffective Disorder, Delusional Disorder, Psychosis Not Otherwise Specified	• **Intervention Name:** VR cognitive therapy • **Study Type:** Randomised controlled experimental study • **Domain Target:** Persecutory Delusions • **Intervention Task:** VR environments: an underground train ride and a lift • **Manual:** No	**Feasibility and Acceptability** • Eligibility – not provided • Attrition – no dropouts • Personalisation – No **Technology:** not recorded **Clinical impacts** • Significant difference: Yes

		• **Comparison/control:** Yes (Threat belief testing group - 15, Exposure group - 15) • **Location:** UK • **Data collection**: Community setting	• **Hardware:** HMD, Computer tracking system • **Software:** Avatar creation • **Immersion**: Yes • **Intervention Dosage**: one day • **Measurements:** Delusions Visual analogue scale ratings for the virtual reality testing, behaviour test • **Timepoints:** Pre intervention and post intervention	• VR cognitive therapy led to a reduction in conviction in the delusion of 22.0% (s.e. = 9.2), 95% CI 3.2–40.9%, F(2,27) = 5.75, P = 0.024, d = 1.3. • Compared with virtual reality exposure, and controlling for the level of distress caused by the real-world situation the first time of entering, virtual reality cognitive therapy led to a reduction in distress in the real-world situation of 19.6% (s.e.=7.9), 95% CI 3.4–35.7, F(2,27)=6.15, P=0.020, d=0.8.

28. Lopez-Luengo & Muela-Martinez (2016)	Investigate the efficacy of attention training for reducing hallucinations in individuals with psychosis.	• **Sample size:** 40 • **Population type:** Schizophrenia, Schizoaffective Disorder • **Comparison/control:** Yes (EG: 20 CG: 20) • **Location:** Spain • **Data collection:** Community setting	• **Intervention Name:** RehaCom program of attention training • **Study Type:** Preliminary Study • **Domain Target:** Auditory Hallucinations • **Intervention Task:** Computer-based training program aimed at improving their attentional processes • **Manual:** No • **Hardware:** Not recorded • **Software:** Not recorded • **Immersion**: Not recorded • **Intervention Dosage:** Phase one (8 sessions – one x day, two x week.	**Feasibility and Acceptability** • Eligibility – 80 participants • Attrition – EG (12/20), CG (12/20) at intervention • Personalisation – No **Technology:** not recorded **Clinical impacts** • Significant difference: Yes • BPRS positive symptoms – sig. improvement between the pre and post assessments. • PSYRATS – sig. improvements in frequency, location, loudness, beliefs about origin of voices,

			Phase two (four sessions). Phase three (12 sessions) • **Measurements:** PSYRATS, BPRS, CPT-II, Cancellation Test, Dichotic Listening, Cancellation Test (Divided Attention), Dichotic Listening (Divided Attention), Color Trail Test, WCST • **Timepoints:** Pre intervention and post intervention	amount of negative content, amount of distress, level of disruption to life caused by voices and ability to control the voices. • Five out of eight in the EG, reported that hallucinations had stopped by the end of the training. • Cancellation Test – EG showed a sig. reduction in the number of errors committed in divided attention conditions • Dichotic Listening Test – sig. reduction in the number of errors during the when attention was undivided.

				• WCST – sig. reduction in the percentage of errors, percentage of perseverative errors, and number of categories completed.
29. Stefaniak et al. (2017)	The main objective of the proposed cognitive behavioural therapy (CBT) was to reduce emotional discomfort and functioning limitations associated with the symptoms.	• **Sample size:** 1 • **Population type:** Schizophrenia • **Comparison/control:** No • **Location:** Poland • **Data collection:** Outpatient setting	• **Intervention Name:** Use of an avatar • **Study Type:** Case Study • **Domain Target:** Auditory Hallucinations • **Intervention Task:** Serious games are video games with a primary purpose to promote well-being • **Manual:** No • **Hardware:** Computer monitor • **Software:** Video Games • **Immersion**: Not recorded	**Feasibility and Acceptability** • Eligibility – Not provided. • Attrition – No dropouts. • Personalisation –Yes **Technology:** not recorded **Clinical impacts** • Significant difference: Not applicable Follow up - patient confirmed reduced frequency of hallucinations and being coping

			- **Intervention Dosage:** 20 sessions - **Measurements:** Feedback - **Timepoints:** Six month follow up	mechanisms during periods of aggravation
30. Craig et al. (2018)	To test the clinical efficacy of AVATAR therapy compared with supportive counselling.	- **Sample size**: 150 - **Population type**: Psychosis - **Comparison/control**: Yes (EG: 75 CG: 75) - **Location**: UK - **Data collection**: Community setting	- **Intervention Name:** AVATAR therapy - **Study Type**: Single blind RCT - **Domain Target**: Auditory Verbal Hallucinations - **Intervention Task**: Participants facing their avatar (therapist) on a computer monitor and interacting with them, leading to a change in a severity,	**Feasibility and Acceptability** - Eligibility – 369 assessed for eligibility - Attrition – EG (12/75), CG (14/75) at 12 weeks, EG (18/75), CG (17/75) at 24 weeks - Personalisation –Yes - There was no evidence of any adverse events attributable to either therapy **Technology:** not recorded

			malevolence, and frequency of voices. • **Manual:** Yes • **Hardware**: Computer monitor • **Software**: Avatar creation • **Immersion**: not recorded • **Intervention Dosage**: 50-min session per week x six • **Measurements**: PSYRATS, PSYRATS-AH, PSYRATS-DEL, BAVQ-R, VAAS, VPDS, SAPS, SANS, DASS-21, CDS, RSES, MANSA, MAP • **Timepoints**: Baseline, 12 weeks, 24 weeks	**Clinical impacts** • Significant difference: Yes • 12 weeks – reduction in PSYRATS–AH total score was sig. greater for AVATAR therapy compared to supportive counselling. • 12 weeks – sig. differences in reductions in BAVQ-R–Omnipotence, VAAS–Acceptance, and VAAS–Action • 24 weeks – improvements in the scores on PSYRATS-AH, BAVQ, and VAAS in the AVATAR group were maintained

31. Dellazizzo et al. (2018)	Developing and testing a novel experiential avatar treatment to gain control over their symptoms.	- **Sample size**: 1 - **Population type**: Schizophrenia - **Comparison/control**: No - **Location**: Canada - **Data collection**: Community setting	- **Intervention Name:** Avatar therapy - **Study Type**: Case Study - **Domain Target**: Auditory Verbal Hallucinations - **Intervention Task**: Avatar (which closely resembles the participant's 'persecutor') was voiced by the psychiatrist in real time and confronted the participant with their hallucinations. - **Manual:** No - **Hardware**: Samsung Gear HMD - **Software**: Avatar creation; Morph3D character system, BehaVR software, Unity - **Immersion**: yes	**Feasibility and Acceptability** - Eligibility – not applicable - Attrition – not recorded - Personalisation –Yes **Technology** - Presence – 75% **Clinical impacts** - Significant difference: Yes - There were reductions of 24% on the total PANSS - There were reductions of 75% on depressive symptoms - Improvements remained stable at the three month follow -up

			• **Intervention Dosage**: one pre-session, six session x 45 min • **Measurements**: PSYRATS, PANSS, BDI-II • **Timepoints**: Baseline, post-intervention, three months	
32. Dietrichkeit et al. (2018)	Two cases from an ongoing study are discussed, in order to investigate feasibility and benefit from a VR intervention to improve delusions.	• **Sample size:** 2 • **Population type:** Schizophrenia • **Comparison/control:** No • **Location:** Germany • **Data collection:** Not provided	• **Intervention Name:** VR intervention • **Study Type:** Case Studies • **Domain Target:** Auditory Verbal Hallucinations • **Intervention Task:** VR scenarios • **Manual:** No • **Hardware:** Oculus Rift D2 • **Software:** Unity • **Immersion**: No	**Feasibility and Acceptability** • Eligibility – Not applicable • Attrition – No dropouts • Personalisation – No **Technology** • Case one - total SSQ score decreased in both paradigms across time. Participant did not report any signs of discomfort because of the VR intervention

			• **Intervention Dosage:** Baseline session 1.5 hrs. Two intervention session x 45-min. Post-diagnostic assessment one hour. • **Measurements:** PANSS, PSYRATS, CAPE, SSQ • **Timepoints:** Pre and post intervention	• Case two - SSQ total score increased by one point after the social paradigm; increased score on both the nausea and disorientation subscales. Participant suffered from nausea and opted to continue without the HMD. They rated the social paradigm less favourably and she did not like the graphics **Clinical impacts** • Significant difference: Not provided CASE ONE • PANSS total score decreased by 13 points.

				• Recognition task - 52% of the two recognition tasks answered correctly. • Participant’s paranoia decreased by 15 points on the Paranoia Checklist and 0.3 points on the positive symptom scale of the CAPE. CASE TWO • PANSS total score improved by nine points. • For the object paradigm, positive symptoms improved by 0.7 points on the relevant CAPE scale.

				Recognition task - 62% of the two recognition tasks answered correctly.
33. du Sert et al. (2018)	Immersive VR was used to provide therapy to those patients experiencing auditory and verbal hallucinations.	• **Sample size:** 19 • **Population type:** Schizophrenia, Schizoaffective Disorder • **Comparison/control:** No • **Location:** Canada • **Data collection:** Community setting	• **Intervention Name:** VR-assisted therapy • **Study Type:** Randomised partial cross over trial • **Domain Target:** Auditory Verbal Hallucinations • **Intervention Task:** Patients created an avatar, which best resembled the most distressing person/entity that was the source of a malevolent voice • **Manual:** Yes	**Feasibility and Acceptability** • Eligibility – not provided • Attrition – (4/19) during intervention • Personalisation –Yes **Technology** • Participants rated their avatar credible enough to make them feel in presence of their persecutor.

			• **Hardware:** Roland AIRA VT-3, Samsung GearVR HMD, Samsung Galaxy S6 • **Software:** Unity, Morph3D Character System • **Immersion**: Yes • **Intervention Dosage:** one pre session & six x 45-min session • **Measurements:** PSYRATS, BAVQ-R, PANSS, BDI-II, Q-LES-Q-S • **Timepoints:** Pre intervention, post intervention and follow up	**Clinical impacts** • Significant difference: Yes • Concerning VRT sessions, there was no significant relationship between the number of therapy sessions and clinical outcomes ($p < 0.05$). • PSYRATS - a reduction of AVH symptoms ($p < 0.01$) • Beliefs about voices improved sig. both for the related beliefs of omnipotence and malevolence ($p < 0.05$). • Sig. reductions were found for the distress related to AVH ($p < 0.001$).

				- PANSS and depressive symptoms reduced ($p < 0.05$). - QoL improved ($p < 0.05$). - The effects of VRT on AVH and related beliefs were large (PSYRATS total: Cohen's d = 1.0; PSYRATS-distress d = 1.2; BAVQ-R: d = 0.7). - Sig. decreases in anxiety as well as fear occurred during VRT beginning at Week four.
34. Stefaniak et al. (2019)	A pilot study on avatar therapy, targeting chronic auditory hallucinations.	- **Sample size:** 23 - **Population type:** Schizophrenia - **Comparison/control:** Yes (EG: 13 CG: 10) - **Location**: Poland	- **Intervention Name:** AVATAR therapy - **Study Type:** Pilot Study - **Domain Target:** Auditory Hallucinations - **Intervention Task:** Patient hallucinations relationship	**Feasibility and Acceptability** - Eligibility – Not provided - Attrition – No dropouts - Personalisation –Yes **Technology:** Not recorded

		- **Data collection:** Not recorded	was modified by using dialogues with the use of the avatar - **Manual:** No - **Hardware:** Computer monitor - **Software:** Not recorded - **Immersion**: Not recorded - **Intervention Dosage:** 80 sessions - **Measurements:** PSYRATS, VPDS - **Timepoints:** Pre intervention, post intervention and follow up	**Clinical impacts** - Significant difference: Yes - PSYRATS auditory hallucinations – statistically sig. improvement at follow up. - statistically sig. decrease in scores was observed in most PSYRATS-AH items. - PSYRATS-AH follow up – decrease in scores.

35. Rus-Calafell et al. (2020)	The aim of this study is to assess the sense of voice presence in a psychological therapy for distressing auditory hallucinations.	• **Sample size:** 39 • **Population type:** paranoid schizophrenia (29); schizoaffective disorder (6); unspecified psychosis (1); depression 3 with psychotic symptoms (3) • **Comparison/control:** No • **Location:** UK • **Data collection:** Not recorded.	• **Intervention Name:** AVATAR therapy • **Study Type:** RCT • **Domain Target:** Anxiety reduction • **Intervention Task:** Virtual embodiment of the voice-hearing experience. This allows the user to visualise their persecutory voice and take part in "face-to-face" dialogue in real time. • **Hardware:** not recorded • **Software:** Avatar creation • **Immersion**: No • **Intervention Dosage:** One introductory session & 50-min session per week x 6	**Feasibility and Acceptability** • Eligibility – 44 • Attrition – 5/44 • Personalisation – Yes **Technology** • Mid to high levels of sense of presence (> ten) were reported consistently across the therapy **Clinical impacts** • Statistically sig. reductions in paranoid attributions and self-reported levels of anxiety were observed between the first and last session.

			• **Measurements:** PSYRATS-AH, BAVQ-R, SSPS, SUS, VAS • **Timepoints:** 12 week follow up assessment	PSYRATS total and frequency of voices, explaining 24% and 28% of the total variance.
36. Dellazizzo et al. (2021)	A pilot randomized comparative trial evaluating the short and long-term efficacy of VR-assisted therapy over CBT for patients with schizophrenia.	• **Sample size**: 74 • **Population type**: Schizophrenia • **Comparison/control**: Yes (EG: 37, CG: 37) • **Location**: Canada • **Data collection**: Not provided.	• **Intervention Name:** VR-assisted therapy • **Study Type:** Pilot RCT • **Domain Target:** Refractory voices • **Intervention Task:** Participants interacted with an avatar in a separate room from the therapist controlling it • **Manual:** Yes	**Feasibility and Acceptability** • Eligibility – 103 • Attrition – EG: 9/37, CG: 3/37 • Personalisation – Yes **Technology:** none recorded **Clinical impacts** • Significant difference: Yes • Findings showed that both interventions produced significant improvements in depressive symptoms and

			- **Hardware:** Samsung Gear VR HMD, Oculus Rift HMD, - **Software:** Unity 3D, Morphy 3D Character System, Roland AIRA VT-3 (voice transformer), SALSA with RandomEyes Unity 3D extension (lip synchronization) - **Immersion:** yes - **Intervention Dosage**: nine weekly sessions (one avatar creation session & eight therapy sessions). - **Measurements:** PSYRATS-AH, BAVQ-R, BDI-II, PANSS, Q-LES-Q-S	AVH severity. VRT did achieve larger effects particularly on overall AVH. - Results suggested a superiority of VRT over CBT on affective symptoms. - VRT also showed significant results on persecutory beliefs and QoL - effects were maintained up to the one-year follow-up.

			• **Timepoints:** Baseline, post therapy and three months, six months, twelve months	
37. Gega et al. (2013)	Explore the feasibility of the VE system as a therapy tool when used during a single session halfway through a 12-week CBT intervention.	• **Sample size:** 6 • **Population type:** Psychosis • **Comparison/control:** No • **Location:** UK • **Data collection:** Outpatient service	• **Intervention Name:** The VE system • **Study Type:** Case Series • **Domain Target:** Social Anxiety and Paranoia • **Intervention Task:** Virtual environments with which patients interact from a library of 100 specially scripted video clips that last two–ten minutes and depict a variety of social situations. • **Manual:** No	**Feasibility and Acceptability** • Eligibility – not provided • Attrition – no dropouts • Personalisation –Yes Benefits/positive aspects • Participant one – confidence about going to the pub and socializing with people increased by 30%, from the beginning of the first in virtuo behavioral experiment to 50% at the end of the last experiment. • Participant six – VE system was useful because the clips

			• **Hardware:** Video-processing unit with a camera, a computer, video recorder, screen monitor. • **Software:** virtual environment video clips • **Immersion**: No • **Intervention Dosage:** One session (60-min) • **Measurements:** Feasibility and Acceptability • **Timepoints:** One session	were not as overwhelming as real life. Hindering aspects: • Participant three was initially skeptical as to whether ‘taking to a video’ was going to make him feel anxious. • Participant four said that he felt better without safety behaviors during his virtual social encounters. However, he predicted that this may not be the same in reality. • Participant five and six stated that seeing oneself interact live on screen was unusual. • Participant six said that using the VE system was an enjoyable experience.

				However, they felt that meeting a therapist face-to-face would be more helpful. **Technology:** see above **Clinical impacts** - Significant difference: Not applicable
38. Pot-Kolder et al. (2019)	Investigated the effects of virtual-reality-based cognitive behavioural therapy (VR-CBT) on paranoid thoughts and	- **Sample size:** 116 - **Population type:** Psychosis - **Comparison/control:** Yes (EG: 58 CG: 58) - **Location:** The Netherlands	- **Intervention Name:** Virtual reality based cognitive behavioural therapy (VR-CBT) - **Study Type:** Single blind RCT	**Feasibility and Acceptability** - Eligibility – 858 assessed of eligibility - Attrition – EG (11/58), CG (5/58) at 6 month follow up

	social participation.	- **Data collection**: Outpatient	- **Domain Target:** Paranoid Ideation & Social Avoidance - **Intervention Task:** An individualised case formulation guided exposure to idiosyncratic social environmental cues that elicited fear, paranoid thoughts, and safety behaviours. - **Manual:** Yes - **Hardware:** Vizard software, Logitech F310 Gamepad, Sony HMZ-T1/T2/T3 HMD - **Software:** Not recorded - **Immersion**: Not recorded - **Intervention Dosage:** One hour x 16 session = eight-12 weeks total	○ One participant drop out due to cybersickness - Personalisation –Yes - Therapists had “good” to “very good” adherence to the protocol and CBT quality. **Technology** - Participants felt sufficiently present in the virtual environments on all three subscales of the group Presence Questionnaire - Two participants found the HMD too uncomfortable and dropped out at session five and six respectively.

			- **Measurements:** Experience Sampling Method, Paranoid Thoughts Scale, Safety Behaviour Questionnaire – Persecutory Delusions, SIAS, BDI, MANSA, SOFAS, Internalized Stigma of Mental Illness, DACOBS, BCSS, SSQ - **Timepoints:** Pre intervention, post intervention and follow up (six months)	- One participant experienced nausea and dropped out after session two. - VR-CBT group used less safety behaviour and reported fewer social cognition problems, compared to the CG. This led to less paranoid ideation. **Clinical impacts** - Significant difference: Yes - Participants felt sufficiently present in the virtual environments. - Baseline and the post-treatment assessment - a large reduction in momentary paranoia in the VR-CBT group, whereas a slight

				increase was noted in the CG. • A sig. larger decrease in momentary anxiety was noted in the VR-CBT group than in the control. • Compared with the CG, use of safety behaviours decreased significantly in the VR-CBT group at both the post-treatment and follow-up assessment. • Post-treatment and follow-up assessments - levels of ideas of persecution and social reference were sig. lower in the VR-CBT group compared to the CG.

				• The VR-CBT group had improvements in self-stigmatisation and social functioning at follow-up. • Individuals who received VR-CBT used less safety behaviour and reported fewer social cognition problems than did those in the CG, and in turn experienced less paranoid ideation.

39. Chavez et al. (2020)	Assessment of the feasibility of delivering VR meditation one session on homeless youth.	• **Sample size:** 29 • **Population type:** Schizophrenia (1/29), Bipolar Disorder (4/29) • **Comparison/control:** Yes • **Location:** USA • **Data collection:** Not recorded	• **Intervention name:** Virtual reality meditation • **Study Type:** Pilot randomised controlled trial of feasibility • **Domain Target:** Anxiety and physiological stress • **Intervention Task:** Guided Meditation VR – participants asked to complete a guided meditation, by viewing natural scenes in a 360 format. VR Imagery – viewing historical images and text (looking glass VR) • **Manual:** No • **Hardware:** Oculus Go headset • **Software:** Not recorded	**Feasibility and Acceptability** • Eligibility – 35 screened for eligibility • Attrition – two lost during follow up (VR meditation condition) • Personalisation – No • Feedback - all reported interest in future use. **Technology** • Feedback - "presence" was high in both groups. **Clinical impacts** • Significant difference: • VR meditation group reported that their stress had

			- **Immersion**: Yes (this was measured as well) - **Intervention Dosage:** Two visits. 2nd visit: ten-15 minutes - **Measurements:** *Feasibility feedback* (open ended questions), STAI-6, salivary cortisol - **Timepoints:** Pre intervention and post intervention	"dropped" or that they felt "calm." - Amongst completers, mean anxiety scores declined in all groups, with the greatest difference observed in the VR meditation group. - No sig. differences between the VR meditation group and other groups in pre and post differences for anxiety or cortisol outcomes.
40. Tan et al. (2020)	This study aimed to examine the effects and feasibility of a	- **Sample size:** 41 - **Population type:** Bipolar Disorder (*n* = 11, 27.5%) and schizophrenia (*n* = 6, 15%).	- **Intervention Name:** Virtual reality-based stress management programme (V-DESSERTS) - **Study Type:** A pilot randomised controlled trial	**Feasibility and Acceptability** - Eligibility – 67 assessed for eligibility - Attrition – 2/41 (both participants from EG) - Personalisation – No

	virtual screen-based stress management programme (V-DESSERTS) on inpatients with mental disorders.	• **Comparison/control:** Yes (EG: 20, CG: 21) • **Location:** Singapore • **Data collection:** Inpatient setting •	• **Domain Target:** Stress management • **Intervention Task:** Participants asked to view videos targeting relaxation i.e. imagery and breathing techniques. • **Manual:** No • **Hardware:** iTV Goggles Wide View 3D+ • **Software:** Not known • **Immersion**: Not recorded • **Intervention Dosage:** Two sessions (40 mins each) • **Measurements:** PSS, NSRS, PRS, KSMMQ and participants' perception of the programme.	• Participants agreed or somewhat agreed: 1. Programme was useful and comprehensive 2. Device was fun and interesting 3. Programme duration was suitable 4. They would recommend it to other patients. **Technology** • One participant felt that the iTVGoggles irritated their eyes • One participant stated that the iTVGoggles were slightly uncomfortable for those who wear glasses

			Physical: Blood pressure, heart rate and skin temperature • **Timepoints:** Pre intervention and post intervention	• One participant wanted more sessions with the goggles. **Clinical impacts** Significance • EG had sig. lower NSRS scores compared to CG for both sessions. However not observed with the PSS. • EG had sig. higher skin temperature scores (i.e. lower objective stress) than did the participants in the CG at Session one but not at Session two. However, there was no sig. mean difference in the post-test scores for HR, systolic BP or diastolic BP for either session.

				• EG reported sig. higher perceived relaxation at session one and session two than CG. EG reported a sig. greater improvement in knowledge about stress and medication management at session one and session two.
41. Veiling et al. (2021)	To investigate the immediate impact of VR relaxation on short-term effects on perceived stress and symptoms and negative and positive	• **Sample size:** 50 • **Population type:** Psychiatric disorders (Bipolar Disorder: 13, Psychotic disorder: 6) • **Comparison/control:** Yes (EG: 25, CG: 25) • **Location:** The Netherlands • **Data collection:** Not recorded.	• **Intervention Name:** VR self-management relaxation tool (VRelax) • **Study Type:** RCT • **Domain Target:** Negative and positive affective states and short-term effects on perceived stress and symptoms.	**Feasibility and Acceptability** • Eligibility – 81 • Attrition – 1/50 • Personalisation – No **Technology:** • SSQ: Several participants reported cybersickness • Two stopped using VRelax because of nausea and dizziness.

	affective states.		• **Intervention Task:** VR Relax (360 videos) vs standard relaxation (audio). • Participants asked to watch 'relaxing' 360 videos of the beach and mountain view for example. • **Manual:** Yes • **Hardware:** Samsung Galaxy S6, S7, Samsung Gear VR HMD, headphones • **Software:** 360 videos • **Immersion:** Yes • **Intervention Dosage**: Ten days • **Measurements:** VAS, BAI, GPTS, IDS-SR, PSS, SSQ	• Scores reduced post VRelax intervention compared to pre VRelax intervention. **Clinical impacts** • Significant difference: Yes • Both VRelax and standard relaxation exercises led to a statistically sig. improvement of all negative and positive affective states. • VRelax resulted in a significantly greater reduction of total negative affective state, compared to the standard relaxation. • VRelax had a stronger beneficial impact on

			- **Timepoints:** Pre and post intervention	momentary anxiety, sadness, and cheerfulness.
42. Jo et al. (2018)	The main purpose of the current study was to examine the effects of VRE using Nintendo Wii-Fit.	- **Sample size:** 4 - **Population type:** Schizophrenia - **Comparison/control:** No - **Location:** South Korea - **Data collection:** Inpatient setting	- **Intervention Name:** Virtual reality exercise (VRE) - **Study Type:** Case Studies - **Domain Target:** Exercise Therapy - **Intervention Task:** Nintendo Wii-Fit program detects participants' movement and transmits participants' movement data to the Wii console - **Manual:** No - **Hardware:** Nintendo Wii-Fit - **Software:** Not recorded - **Immersion**: Not recorded	**Feasibility and Acceptability** - Eligibility – Four participants - Attrition – 2/4 - Personalisation – No **Technology:** not recorded **Clinical impacts** - Significant difference: Not provided - There were positive changes with regards to the upper body strength, upper and lower body flexibility, cardiovascular endurance, and agility/dynamic balance

			• **Intervention Dosage:** three x weekly for 35-min. Eight weeks • **Measurements:** Physical Fitness • **Timepoints:** Baseline, intervention, and post intervention baseline	• Slight improvement in mobility in the ten-metre walking test • Little to no desired changes were observed in lower body strength in the SFT
43. Tuente et al. (2020)	The aim is to investigate the effectiveness of VRAPT on aggressive behaviour on a forensic population.	• **Sample size:** 128 • **Population type:** *Schizophrenia* (EG: 12/128, CG: 14/128) *Schizoaffective Disorder* (CG: 2/128) *Delusional disorder* (CG: 2/128) Psychotic disorder not otherwise specified	• **Intervention Name:** Virtual Reality Aggression Prevention Therapy (VRAPT) • **Study Type:** RCT • **Domain Target:** Aggression • **Intervention Task:** Personalised role plays and exposure exercises • **Manual:** Yes	**Feasibility and Acceptability** • Eligibility – not recorded • Attrition – 13/128 • Personalisation – Yes • No serious adverse events were reported • One adverse event was reported

		(EG: 6/128, CG: 4/128) - **Comparison/control:** Yes (EG: 64, CG: 64) - **Location:** The Netherlands - **Data collection:** inpatient setting	- **Hardware:** Oculus Rift 2, headphones - **Software:** Unity software by CleVR BV - **Immersion**: Yes - **Intervention Dosage**: 16 sessions (1 hour each) x 8 weeks - **Measurements:** Aggression, SDAS, AVL, BIS-11, BDHI-D, NAS-PI, STAXI-2, RPQ, HIBT, CTQ-SF, IPQ, heart rate, galvanic skin response	- Most participants valued VRAPT as an addition to their current treatment. - Half experienced positive changes in their daily life. - For those who did drop out of treatment, the majority of people did so for reasons not related to VR. **Technology** - Participants felt moderately present in the virtual environments on all three subscales of the IPQ. **Clinical impacts** Significant difference: Yes.

			• **Timepoints:** Pre intervention, post intervention and follow up (3 months)	• Self-reported aggression decreased both in the EG and the CG (non-sig.), but there was no effect of VRAPT treatment. • Aggression subscales/ total scores - EG group improved more than the CG group. • Improvements were not maintained at three-month follow-up.

Clinical: Anxiety Visual Analogical Scale (VAS), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Beck Depression Inventory II (BDI-II), Brief Psychiatric Rating Scale (BPRS), Brief Core Schema Scales (BCSS), Calgary Depression Scale (CDS), Clinical Global Impression-Improvement (CGI-I), Clinical Global Impression-Severity (CGI-S), Cognitive Style Questionnaire-Short Form (CSQ-SF), Community Assessment of Psychic Experiences (CAPE), Depression Anxiety and Stress Scale (DASS-21), Ecological Momentary Assessment (ESM), Green Paranoid Thought Scale (GPTS), Hamilton Depression Rating Scale (HAM-D), Hinting task , Knowledge on Stress and Medication Management Questionnaire (KSMMQ), Inventory of Depressive Symptomatology-Self Report (IDS-SR), Maudsley Addiction Profile (MAP), Mini Mental State Examination (MMSE), Mini International Neuropsychiatric Interview Plus (MINI PLUS), Numeric Stress Rating Scale (NSRS), Obsessive-compulsive and depression questionnaire (POD), Perceived Relaxation Scale (PRS), Perceived Stress Scale (PSS), Positive Affect Negative Affect Scale (PANAS), Positive and Negative Syndrome Scale (PANSS), Psychotic Symptom Rating Scale (PSYRATS), Auditory hallucinations subscale (PSYRATS–AH), Symptoms Rating Scale–Delusions (PSYRATS-DEL), Revised Beliefs about Voices Questionnaire (BAVQ-R), Social Interaction Anxiety Scale (SIAS), Schedule for the Assessment of Positive Symptoms (SAPS), Schedule for the Assessment of Negative Symptoms (SANS), State Social Paranoia Scale (SSPS), Strait-Trait Anxiety Inventory-6 (STAI-6), WEMWBS, Zung Depression Rating Scale (ZDRS) **Psychosocial:** Birchwood Insight questionnaire (BIS), EuroQol Group Quality of Life measure – five dimensions (EuroQual 5-D), Global assessment functioning scale (GAF), Lancashire Quality of Life Profile (LQoLP), Manchester Short Assessment of Quality of Life (MANSA), Personal and Social Performance Scale (PSP), Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form (Q-LES-Q-S), Relationship Change Scale (RCS), Rosenberg self-esteem (RSES), Social Autonomy Scale (EAS), Social Avoidance and Distress Scale (SADS), Social Behavior Scale (SBS), Social Cognition Screening Questionnaire (SCSQ), Social Functioning Scale (SFS), Social Perception and Knowledge – (PerSo), The Schizophrenia questionnaire for Quality of life (S- QoL), The self-esteem rating scale (SERS), The Stroop Colour and Word Test (SCWT), Voice Acceptance and Action Scale (VAAS), Voice Power Differential Scale (VPDS) **Social Cognition/Social Functioning:** Assertion Inventory (AI), Baren-Cohen Mind in the Eyes Test (BCMET), Bell-Lysaker Emotion Recognition Task (BLERT), Emotional perspective-taking (EPT), Empathic Accuracy Task (EAT), Female Emotion Recognition – (TREF), Frontal Assessment Battery (FAB), Movie for the Assessment of Social Cognition (MASC-VF), Rapid Visual Processing (RVP), Reading the Mind in the Eyes Test (RMET), Simulated Social Interaction Test (SSIT), Social Autonomy Scale (EAS), Social and Occupational Functioning Assessment Scale (SOFAS), Social Anxiety and Distress Scale (SADS), Social Dysfunction and Aggression Scale (SDAS), Social Problem Solving Inventory-Revised (SPSI-R), Trail Making Test (TMT), The Awareness of Social Inference Task (TASIT), Theoretical Domains Framework—Domain Four (TDF—D4), Theoretical Domains Framework—Domain Eight (TDF—D8), Theoretical Domains Framework—Domain Four (TDF—D9), Theory of Mind-15 (ToM-15), Tower of London (ToL), Wisconsin Card Sorting Test (WCST), Wisconsin Card Sorting Test — Computer Version 4 (WCST-CV4) **Cognition:** Auditory Verbal Learning Test (K-AVLT), Brief Neuropsychological Cognitive Examination (BNCE), Continuous Performance Test II (CPT-II), Davos Assessment of Cognitive Biases Scale (DACOBS), Digit Vigilance Test (DVT), MATRICS Consensus Cognitive Battery (MCCB), Questionnaire of Cognitive and Affective Empathy (QCAE), The neurobehavioral cognitive status examination (Cognistat), National Adult Reading Test (NART), The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Rey–Osterrieth Complex Figure Test (RCFT) Rivermead Behavioural Memory Test (RBMT), Simpson-Angus Rating Scale (SARS), Wechsler Adult intelligence Scale 3rd edition (WAIS-III), Vocational Cognitive Rating Scale (VCRS) **Usability:** Simulator sickness questionnaire (SSQ), Training Experience Questionnaire (TEQ), Volitional questionnaire (VQ), Barnes Akathisia Rating Scale (BARS), Trower's Rathus Assertiveness Schedule (RAS), Ambiguous Intentions Hostility Questionnaire (AIHQ), Category Fluency Test (CFT), Observed Tasks of Daily Living Test (OTDL), Aggression Questionnaire (AVL), Barratt Impulsiveness Scale (BIS-11), Buss-Durkee Hostility Inventory-Dutch (BDHI-D), Novaco Anger Scale and Provocation Inventory (NAS-PI), State-Trait Anger Expression Inventory-2 (STAXI-2), Reactive-Proactive Questionnaire (RPQ), Hostile Interpretation Bias Task (HIBT), Child Trauma Questionnaire-Short Form (CTQ-SF), Igroup Presence Questionnaire (IPQ), , Sense of Presence Scale (SUS).

4.3.3 Quality assessment

Below are the results for the quality assessment using the MMAT (Hong et al., 2018).

Table 16: Quality assessment results

Study design	Number of studies (%)	MMAT score distribution				
		0	25	50	75	100
RCT	20 (46.5)	-	-	1	9	10
Feasibility studies	4 (11.6)	-	-	-	1	3
Pilot studies	5 (11.6)	-	-	2	2	1
Case series/studies	7 (16.3)	-	-	3	2	2
Experimental research design	3 (7)	-	-	-	2	1
Observational Study	1 (2.33)	-	-	-	1	-
Preliminary study	1 (2.33)	-	-	-	1	-
Proof of concept study	1 (2.33)	-	-	-		1
Follow up study	1 (2.33)	-	-	-	1	-

4.3.4 Primary outcomes

4.3.4.1 Feasibility and acceptability of VR interventions

4.3.4.1.1 Recruitment, retention, and attrition

17 studies provided information on recruitment and retention. On average, 71.1% of those who were eligible, provided consent to take part. There was an average 88.8% retention rate amongst those studies. 62.8% (n=27) of

studies reported participant attrition: 13 studies provided reasons as to why. Of these 13 studies, 12 of them provided numerical information as to why participants dropped out. From 13 studies, reasons included:

- Participants were either unable to or no longer willing to continue with the intervention (52.6%)
- Participants experienced deterioration in their mental and/or physical health, which rendered them unsuitable to continue with treatment (35.5%)
- Participants no longer met the inclusion criteria and were therefore excluded (2.6%)
- Participants' changed address (3.9%)
- There were technical issues (3.9%)
- There was a lack of therapeutic alliance (1.3%).

Twelve studies (28%) did not experience attrition, and 9.3% (n=4) of studies did not record any information on their participant recruitment.

4.3.4.1.2 Feedback from participants and therapists

17 studies (39.5%) recorded participant and/or therapist feedback on VR treatments. These studies collected feedback via non-standardised feedback forms/surveys (n=6), the Training Experience Questionnaire (TEQ) outcome measure (n=3), observations (n=6) and qualitative interviews and open-ended questions (n=3).

The three studies used the TEQ to measure participants' acceptability and feasibility (Humm et al., 2014; Smith et al., 2014; Smith et al., 2015). The TEQ uses a likert scale of 1-7. The average scores for each of the subscale were the following: 1) ease of use – 6.1 2) enjoyable – 6.5 3) helpful - 6.4 4) instilled confidence – 6 5) prepared for interview– 6.

When reviewing the self-reported measures, participants consistently provided positive feedback. These outcome measures collected feedback on various aspects of feasibility, acceptability, and usability, from intervention length, difficulty, ease of use and commitment, interest, and satisfaction.

Adery et al. (2018) found that 94% of participants reported some level of satisfaction with the intervention, 81% stating that they would recommend it to others. This was reiterated by Rus-Calafell et al. (2014): participants reported a high level of satisfaction with the intervention. Bell and Weinstein (2011) stated that the overall mean of participants' responses was 4.3 (1-5 Likert scale), whilst Nijman et al. (2020) stated that the overall mean score was 7.9 (1-10 scoring). Thompson et al. (2020) found that the average acceptability score for each session was 22.67 (1-25), and for each questionnaire item, it was 4.5 (1-5). Tan et al. (2020) found that participants agreed or somewhat agreed, the programme to be beneficial. Ku et al. (2007) found that evaluated usefulness was scored as 6.3 (out of 10), subject's interest was scored as 7.3 (out of 10), subject's anxiety reduction was scored as 5.7 (out of 10), and finally, subject's willingness was scored as 7.5 (out of 10).

Qualitative feedback and observations provided more detail as to the reasons why participants rated the interventions positively. Some participants felt that the intervention was stimulating and interesting and allowed them to improve their skills and knowledge (Bell and Weinstein, 2011). Nijman et al. (2020) reported that participants found that the treatment fit their personal needs, leading to enhanced satisfaction and improved confidence.

Two studies asked therapists to provide feedback on their experience of delivering the VR therapy. Pot-Kolder et al. (2018) found that the therapist reported good-very good adherence to the protocol. Nijman et al. (2020) found that therapists reported role-play exercises as the main strength of the VR intervention (67%), along with the opportunity to reflect on social situations

(50%). 67% felt that the VR software was adequate and was intuitive, and easy to work with. The main criticisms were the challenges faced regarding technical reliability and limitations of the software (83%). Half of the therapists believed that whilst the scenarios were relevant; they could be improved. Suggested improvements involved adding new features to the VR environment and making improvements to the functionality of the VR intervention.

4.3.4.2 Efficacy of VR interventions

4.3.4.2.1 Personalisation of VR interventions

Personalisation of VR interventions has the potential to provide effective treatment to individuals at a faster rate, leading to better possible outcomes in the long term (Cancela et al., 2021). To the candidate's knowledge, this is the first systematic review to assess personalisation as an outcome, in those VR treatments for people with psychosis.

53.5% (23/43) of studies provided some degree of personalisation in their interventions. Of the 23 studies, 14 involved individual interventions, and nine involved group interventions. Table 17 outlines what personalisation entails and the characteristics which represent. Table 18 describes the studies that contained personalised interventions.

Table 17: Personalisation assessment list*

Target	Personalisation for whom
Individual	Personalisation is targeted at a specific individual

Group	Personalisation is targeted at a particular group of people
Aspects Of The intervention	What is personalised
Content	The information provided.
Delivery medium	The medium by which the information is delivered
Functionality	What users can do with the information and interface

*Adapted Fan and Poole (2006) and Kocaballi et al. (2019).

All the articles that provided personalised VR interventions, did so through tailoring the interventions. Tailoring is a process by which the information, support and advice is individualised to the individual (Lustria et al., 2013). The process of tailoring involves an assessment of individual level characteristics (Ryan, Dockray and Linehan, 2019). From this, the information is either processed by a computer (i.e., via algorithms) or a human (i.e., a professional). Most articles used human tailoring to provide a personalised experience for participants (as seen in table 18). This involved dialogues between a health and social care professional and the participant, to ensure that the content and activities being discussed were tailored to the suit the individual's needs.

Table 18: Personalisation features of included studies

Author (year)	**Study aim**	**Target**	**Aspects of the Intervention**		
			Content	Delivery Medium	Functionality
1. Craig et al. (2018)	To test the clinical efficacy of AVATAR therapy compared with supportive counselling.	Individual	The therapist used their voice to communicate to the participant, via an avatar. Both were in a separate room.	Avatar creation. Computer monitor. Video link. Avatar dialogue was provided via MP3 player.	The therapist could adjust the content based on the discussions.
2. Dellazizzo et al. (2018)	Developing and testing a novel experiential avatar treatment to gain control	Individual	The psychiatrist created a dialogue between the patient and the avatar. The words used, speech and	Avatar creation – The Judge.	The dialogue topics were based on the patients' disclosed

	over their symptoms.		tone were controlled by the psychiatrist.		thoughts and anxieties.
3. Dellazizzo et al. (2021)	A pilot randomized comparative trial evaluating the short and long-term efficacy of VR-assisted therapy over CBT for patients with schizophrenia.	Individual	The patient sat in a separate room from the therapist. The therapist would converse with them via the avatar.	Avatar creation – the face and voice were created by the participant to best represent the source of their most distressing voice. Programme Unity 3D was used. Samsung VR HMD and Oculus Rift HMD.	The therapist could control the facial expressions of the avatar to express emotions that the patient could recognise.
4. du Sert et al. (2018)	The aim is to provide a VR assisted therapy to target auditory visual hallucinations in	Individual	The therapist induced a dialogue between the patient and the avatar.	Avatar creation – Unity 3D and the Morph3D was used along with voice transformer Roland AIRA VT-3. Samsung Gear	The conversation was tailored to improve emotional regulation, assertiveness, and self-esteem. The aim was for the patient to

	those with schizophrenia.			VR/Oculus Rift HMD was used. Patients were asked to create an avatar that best represented the source of the malevolent voice. Each session was audio recorded.	view the malevolent voice as more supportive and less abusive.
5. Gega et al. (2013)	Explore the feasibility of the VE system as a therapy tool when used during a single session halfway through a 12-week CBT intervention.		Patient entered the VE system, with the support of a psychologist. They were provided with a description of the scenes and characters before entering.	VE system using video clips.	Video clips could be restarted, paused and recorded, so patients could review them and discuss them.

6. Geraets et al. (2020)	This study examined whether treatment with virtual reality based cognitive behavioral therapy (VR-CBT) for paranoia influences momentary affective states.	Individual	See Pot-Kolder et al. (2019) below.		
7. Humm et al. (2014)	Assessing the effectiveness of a virtual-reality role-play utilizing	Individual	Participants took part in interview role plays.	Molly Porter, which is an interview role simulation was used.	Molly personalises the training experience for everyone based on their answers to the

	PeopleSimTM technology – Training with Molly Porter.				questions about their preferred job. Furthermore, Molly has a database of over 1000 video-recorded questions for individuals that range from personal history to job duties.
8. Leff et al. (2013)	To encourage participants to engage in a dialogue with the avatar.	Individual	Both the therapist and patient were sat in separate rooms. They were faced with a computer monitor with the avatar on it.	Avatar creation – the therapist could switch between the avatar's voice and their voice. Each session was recorded on an MP3 player.	The patient was encouraged to have a dialogue with the avatar and stand up to them. They could also listen to the recording of the

					session in their own time.
9. Nijman et al. (2020)	The aim is to assess the feasibility and acceptability of the DiSCoVR intervention on social cognition, in those with psychosis.	Group	Participants took part in a series of sessions by interacting in a VR environment, with the support of the therapist.	Virtual environments (shopping street, supermarket, and a bar). Software was developed by CleVR BV, and participants wore an Oculus Rift HMD.	The VR environments were controlled by the therapist. The therapist could view and control the participants' view and the VR environment itself. The therapist could control the tasks in the VR environment to tailor the needs of the participant i.e., intensity of emotions, allocated time for answers.

					Participants could practice what they learned at home and in the VR environment.
10. Park et al. (2009)	Explore the possibility of the use of Virtual Reality Functional Skills Assessment (VRFSA) in a future regular clinical trial.	Group	Participants took part in six VR scenarios.	Participants wore a HMD, which connected to the VE environment. Here, they could interact with an avatar.	The six scenarios were designed to represent common conversational situations. Each scenario consisted of both the consecutive skills phase and the expressive skills phase.

11. Park et al. (2011)	The aim of this study was to find advantages of the use of VR in social rehabilitation for patients with schizophrenia.	Group	Participants took part in VR role-playing.	HMD. Participants used a joystick and buttons to operate an avatar from their first-person perspective.	Conversational skills training - participants took part in conversations with the avatars as well as completing multiple choice questions. Feedback was provided by the therapist.
12. Pot-Kolder et al. (2019)	Investigated the effects of virtual-reality-based cognitive behavioural therapy (VR-	Individual	Participants completed VR exercises.	Four virtual social environments (a bus, café, street, and supermarket) were created with Vizard software. Participants could move by operating a Logitech F310 Gamepad. They used a	Therapists could vary the number and characteristics of human avatars, as well as the responses to patients. Both patients and therapists communicated during

	CBT) on paranoid thoughts and social participation.			Sony HMZ-T1/T2/T3, HMD with a high-definition resolution of 1280×720 with 51·6 diagonal FoV, and a 3DOF tracker for head rotation.	sessions to explore and challenge suspicious thoughts, test harm expectancies and reduce drop safety behaviours.
13. Rus-Calafell et al. (2012)	The objective is to help people with schizophrenia to overcome everyday social difficulties via the use of new technologies.	Group	Participants attended VR simulated complex daily situation (i.e. supermarket).	Not recorded.	Social information processing and facial emotion recognition were addressed in the first stage. In the second stage, the patient focuses on social anxiety and interpersonal interactions. The participant was supported by a

					therapist throughout this intervention.
14. Rus-Calafell et al. (2014)	Developed an integrated VR program into an individual cognitive-behavioural social skills program intervention, in order to 1) promote accessibility to train social skills 2) improve the generalisation of the learned responses in the	Individual	Patient took part in the Soskitrain program. This consisted of seven activities based on seven target behaviours.	Virtual avatars were used.	Participant could practice social interactions with avatars. A variation in facial expressions, interactions and avatars were used to provide option. The therapist could observe in real time.

	patients' daily lives.				
15. Rus-Calafell et al. (2020)	The aim of this study is to assess the sense of voice presence in a psychological therapy for distressing auditory hallucinations.	Group	Patient took part in AVATAR therapy. Phase 1 focused on assertive responding and exposure. Phase 2 focused on emotional, developmental, and relational processes.	Avatar creation.	The therapist facilitates an interaction between the avatar and the participant. The aim is for the avatar to transform from persecutory and domineering, to supportive.
16. Smith et al. (2014)	Thus, the current study sought to examine the	Individual	Patient took part in VR-JIT therapy. This was used to train patients for job	Computer programme Molly was used.	The training experience could be personalised via a series of questions.

	feasibility and efficacy of the full version of VR-JIT in a randomised controlled trial.		interviews for eight different positions.		
17. Smith et al. (2015a)	This study evaluated the efficacy of virtual reality job interview training (VR-JIT) at improving job interview skills and employment outcomes among individuals with	Group	As above (Smith et al., 2014).		

	schizophrenia.				
18. Smith et al. (2015b)	In this study, 6-month follow-up data was collected from participants who completed the efficacy studies.	Group	As above (Smith et al., 2014).		
19. Sohn et al. (2016)	This study aimed to develop a virtual reality- based vocational rehabilitation training program (VR-VRTP), for patients with chronic	Individual	Patients took part in VR scenarios, where they are likely to be employed i.e., supermarket, convenience store.	Patients spoke directly through a microphone and could play it back.	Patients selected solutions to problematic situations on a screen. They were then provided with feedback.

	schizophrenia can both understand and to evaluate the feasibility of this program.				
20. Stefaniak et al. (2017)	The main objective of the proposed cognitive behavioural therapy (CBT) was to reduce emotional discomfort and functioning limitations associated with the symptoms.	Individual	Patients took part in avatar therapy.	Avatar creation. Patients created an avatar with physical features.	Patients had a dialogue with the avatar, which was then modified.

21. Stefaniak et al. (2019)	A pilot study on avatar therapy, targeting chronic auditory hallucinations.	Individual	As above (Stefaniak et al., 2017).		
22. Thompson et al. (2020)	The aim was modifying an existing group social cognitive intervention entitled ‘Social Cognition and Interaction Training' (SCIT) to be delivered through a virtual world environment (Second Life©),	Group	Participants took part in the SCIT training, to improve social cognition.	Second Life® virtual world environment programme. Computer/laptop, mouse, keyboard, and headphones.	The SCIT was a structured psychoeducation intervention. Participants were given time to take part in activities and provide feedback during the sessions.

	for those with early psychosis.				
23. Tuente et al. (2020)	The aim is to investigate the effectiveness of VRAPT on aggressive behaviour on a forensic population.	Group	Patients took part in a therapy, where they interacted with avatars in a VR environment.	Avatar creation. Participants wore an Oculus Rift 2 HMD and headphones. The therapist used a microphone for voice morphing.	The therapist could tailor the conversation via the avatar, between themselves and the patient. The therapist was also able to control the environment and to stop it in the event of adverse events. The avatar’s body movements and facial expressions could also be controlled by the therapist.

24. Vass et al. (2020)	The aim is to evaluate the tolerability and feasibility of VR-ToMIS on ToM, pragmatic language skills and negative symptoms for those diagnosed with schizophrenia.	Individual	The patient took part in simulated social interactions in VR environments.	Avatar creation. Samsung VR HMD. Samsung S7 smartphone, Samsung Simple Controller and Temporal Disc Controller and a computer screen.	Patients took part in virtual conversations, simulations and followed by tasks. These were discussed with a trained psychotherapist.

4.3.4.2.2 VR interventions that target cognition

25.6% (11/43) studies provided interventions, which targeted cognition in those with psychosis.

Cognitive States Five studies (Chan et al., 2010; La Paglia et al., 2013; La Paglia et al., 2016; Li et al., 2020; Tsang and Man, 2013) used various screening tests to assess the cognitive states of participants. La Paglia et al. (2013) concluded that VR training was associated with reduced cognitive deficits. La Paglia et al. (2016) used the Mini Mental State Examination (MMSE) (Folstein, Folstein and McHugh, 1975) and concluded that VR training was associated with better cognitive functioning. Li et al. (2020) found many improvements in the MATRICS consensus cognitive battery post-intervention (Nuechterlein et al., 2008). Using the Cognistat (Mueller, Kiernan and Langston, 2001), Chan et al. (2010) found a significant time x condition interaction. However, using the Brief Neuropsychological Cognitive Examination (BNCE) (Tonkonogy, 1997), Tsang and Man (2013) did not find a significant interaction effect of the group over time.

Neuropsychological Assessments Five studies (Amado et al., 2016; Nijman et al., 2020; Thompson et al., 2020; Tsang and Man, 2013; Vass et al., 2020) used neuropsychological outcomes and assessments to assess participants' cognitive function and mental state. Nijman et al. (2020) observed significant improvements in emotion perception post intervention, whilst Thompson et al. (2020) observed significant improvements in emotion recognition post intervention. Using the Wisconsin Card Sorting Test (WCST) (Grant and Berg, 1948), Tsang and Man (2013) found that the VR EG showed better performances compared to the CGs when it came to the conceptual level response. Vass et al. (2020) concluded that there was a trend towards significance in the case of non-perseverative errors. However, using the Rey-

Osterrieth Complex Figure Test (RCFT) (Osterrieth, 1944), Amado et al. (2016) found no significant changes from pre to post-intervention.

Executive Functioning There were mixed results for the two studies that measured executive functioning; La Paglia et al. (2016) found that VR training led to a significant decrease in the number of omissions post intervention, whilst Amado et al. (2016) did not observe any changes in executive functioning assessments.

Attention Five studies measured attention at pre and post-intervention. All five studies showed improvements in participants' attention post-intervention. Using the Rapid Visual Processing (RVP) (Cambridge Cognition, 2018) outcome, Nijman et al. (2020) observed small to moderate effects for the probability of hit and sensitivity subscales. Using the Digital Vigilance Test (DVT) (Lee, Li and Hsieh, 2011; Lewis, 1992) (time subscale), which assesses attention during rapid visual tracking, Tsang and Man (2013) observed a significant interaction effect of group over time. Both studies conducted by La Paglia et al. (2013; 2016) found that both the experimental and CGs improved their performances in the divided attention task post-intervention. Furthermore, both studies found that VR cognitive training led to improvements in sustained attention. Additionally, La Paglia et al. (2016) found that VR training was related to sustained attention. Amado et al. (2016) found that D2 Cancelation Test (Brickenkamp and Zillmer, 1998) KL and GZ-F scores were significantly different at week 12 compared to week zero.

Memory Assessment Amado et al. (2016) found a significant difference between week 12 and week zero in the digit span forward and backward span subscales. Furthermore, Tsang and Man (2013) observed a significant interaction effect of group over time in the Rivermead Behavioural Memory Test (RBMT) (Man and Li, 2001; Wilson, Cockburn and Baddeley, 1985).

Theory of Mind Nijman et al. (2020) found negligible to small effects on ToM outcome measures. Vass et al. (2020) concluded that the VR EG illustrated promising improvements in many aspects of ToM, supported by medium to large effect sizes.

4.3.4.2.3 VR interventions that target functioning

28% (12/43) of studies provided VR interventions that target functioning in those with psychosis.

Social Skills Training

Six studies aimed to provide VR social skills training to those with psychosis (Adery et al., 2018; Bell and Weinstein, 2011; Park et al., 2009; Park et al., 2011; Rus-Calafell et al., 2012; Rus-Calafell et al., 2014). Five of the six studies used questionnaires and outcome measures to assess participants' psychopathology, symptomatology and social functioning post intervention. Bell and Weinstein's (2011) study was the only one to collect qualitative data via feedback forms and open-ended questions post-intervention.

Adery et al. (2018), Rus-Calafell et al. (2012) and Rus-Calafell et al. (2014) used the social functioning scale (SFS) (Birchwood et al., 1990) to measure the social skills of those diagnosed with schizophrenia: two reported sig post-intervention improvements in social functioning (Rus-Calafell et al. 2012; 2014), specifically on the interpersonal communication. Rus-Calafell et al. (2014) found a significant time effect for the following SFS subscales: interpersonal communication, recreation, pro-social activities, and withdrawal. All these improvements were significantly maintained at follow up.

Further studies implemented outcomes that evaluated the social and emotional behaviours. Using the social behaviour scale (SBS) (Wykes and

Sturt, 1986), Park et al. (2011) found that the VR intervention experimental group (EG) showed greater improvement in conversational skills compared to the CG, but showed lesser improvement in non-verbal skills. Park et al. (2009) found a trend towards a large treatment effect for the SBS. Furthermore, the significant correlation between the VR component and the SBS at both baseline and post-treatment, was found for total expressive skills only.

Rus-Calafell et al. (2014) used the simulated social interaction test (SSIT) (Curran, 1982) to measure social interactions. A significant time effect was observed for the performance and anxiety subscales, with these changes maintained at follow up. Furthermore, using the social avoidance and distress scale (SADS) (Watson and Friend, 1969), a significant time effect was observed for both avoidance and anxiety subscales, with these changes only obtained for avoidance at follow up. Similar results were found by Rus-Calafell et al. (2012), where there was a reduction in anxiety at post-intervention.

Three studies (Park et al., 2011; Rus-Calafell et al., 2012; Rus-Calafell et al., 2014) measured the impact of the VR interventions on participants' assertiveness. Park et al. (2011) found that the VR EG showed a greater improvement in the Trower's Rathus Assertiveness Schedule (TRAS) (Mann and Flowers, 1978). Using the Assertion Inventory (AI) (Gambrill and Richey, 1975), Rus-Calafell et al. (2012) found improvements in scores post-intervention. Rus-Calafell et al. (2014) found during their follow up analysis that there were improvements from pre to post-treatment.

Job interview Training

Five studies provided job interview related training using VR technology (Humm et al., 2014; Smith et al., 2014; Smith et al., 2015a; Smith et al., 2015b; Sohn et al., 2016). Humm et al. (2014) used a simulated interview scenario using an avatar called Molly Porter. Smith et al. (2014; 2015a; 2015b) used

PeopleSim™ technology, which used video recordings to generate a virtual human character interacting with participants. Sohn et al. (2016) provided vocational rehabilitation training.

Four studies measured the impact of VR job interview training on functioning outcomes. Humm et al. (2014) observed a highly significant training effect, whilst Smith et al. (2014) found that the VR EG's role play assessment score improved between baseline and follow up when compared to the TAU group.

There were mixed results regarding self-confidence; Smith et al. (2014) found an increase in self-confidence in both the VR EG and the CG. Similar results were found by Smith et al. (2015b). However, Smith et al. (2015a) found that with the VR EG, there were no differences in confidence between post intervention and six month follow up.

Both Smith et al. (2015a) and Smith et al. (2015b) collected six-month vocational outcomes. Smith et al. (2015b) found that 47.8% of trainees received job offers post-intervention, compared with the 14.3% of controls. Similarly, Smith et al. (2015a) found that 51% of trainees obtained job offers post-intervention, compared to 25% of controls; however, this difference was significant only after adjusting for post-traumatic stress disorder diagnoses.

Sohn et al. (2016) used the PSP (Patrick et al., 2009) to measure social functioning in those who took part in the VR intervention. Significant improvements were observed between pre and post-intervention in the PSP outcome measure.

4.3.4.2.4 VR interventions to improve hallucinations and delusions

26% (11/43) of studies developed VR interventions to target hallucinations and/or delusions in people diagnosed with psychosis. Of these 11 studies, nine of them collected data on hallucinations and/or delusions.

Seven of the 11 studies used the Psychotic Symptom Rating Scales (PSYRATS) (Haddock et al., 1999) and The Revised Beliefs About Voices Questionnaire (BAVQ-R) (Chadwick, Lees and Birchwood, 2018) to assess participants' hallucinations and delusions. The PSYRATS measures several dimensions of delusions and auditory hallucinations. The BAVQ-R measures omnipotence, which is an important concept in understanding auditory hallucinations. Most studies reported improvements in participants' hallucinations and delusions, some of which were maintained at follow up.

Freeman et al. (2016) found that in comparison with exposure, VR cognitive therapy led to large reductions in delusional conviction. Lopez-Luengo & Muela-Martinez (2016) found that five out of eight participants in the EG reported that their hallucinations stopped by the end of their training. Furthermore, PSYRATS showed significant improvements in frequency, duration, location, loudness, beliefs about the origin of voices, amount of negative content, amount of distress, level of disruption to life caused by voices and ability to control the voices. Leff et al. (2013) compared the immediate therapy group with the delayed therapy group and found significant positive effects on the PSYRATS total score and the BAVQ-R total score. These significant improvements were maintained at a three month follow up.

Du Sert et al. (2018) found a reduction in auditory and visual hallucinations (AVH) symptoms post-VR treatment; these were found most prominently for distress. Furthermore, beliefs about voices improved significantly for both malevolence and related beliefs about omnipotence. Stefaniak et al. (2017)

concluded that there was a significant reduction in the intrusiveness and frequency of voices and the sustainability at six months post-intervention.

In a case study of one patient's experiences of attending avatar therapy, Dellazizzo et al. (2018) found that while the participant believed there had been improvements in their hallucinations, this was not observed in the outcome measure PSYRATS.

Stefaniak et al. (2019) found statistically significant improvements in the majority of the PSYRATS subscales, including auditory hallucinations, belief about the origin of voices and number and level of negative content. For the auditory hallucination subscale, there was a significant improvement at follow up. However, the delusion subscale showed statistically insignificant changes. The VPDS showed significant improvements at T1.

Craig et al. (2018) found that AVATAR therapy led to a significant reduction in auditory hallucinations, compared to supportive counselling, at 12 weeks. There were also significant differences between both groups in the reported reduced distress, frequency of voices and perceived omnipotence of voices at 12 weeks. At 24 weeks, the improvements in scores were maintained for the AVATAR therapy group; however, the supportive counselling group continued to improve. This meant that there were no significant differences between both groups on their secondary outcomes at both 12 and 24 weeks. It is concluded that whilst AVATAR therapy had a positive impact on omnipotence, the therapy had no significant effect on the malevolence of voices.

Dellazizzo et al. (2021) participants completed avatar therapy. Both the VRT and CBT groups showed significant reductions in AVH symptoms at three months, focusing on distress and voice frequency. VRT also showed significant improvements in participants' persecutory beliefs at a three month follow up. Both therapies showed moderate effects on persecutory beliefs about voices. Most of the VRT group results displayed at three months were maintained at 12 months; the only exception was the BAVQ-R engagement subscale which significantly diminished and returned to baseline levels.

4.3.5 Secondary outcomes

4.3.5.1 Positive and negative symptoms

12 studies measured the symptom severity of participants who took part in VR interventions. The majority of these twelve studies (83.3%) used the Positive and Negative Syndrome Scale (PANSS), which was originally published by Kay, Fiszbein and Opler (1987). This medical scale has historically been used to measure symptom severity in patients diagnosed with schizophrenia. Patients are assessed according to three factors: positive symptoms, negative symptoms, and general psychopathology.

Seven studies reported on negative symptoms, with six of these studies (85.7%) reporting improvements in negative symptoms at post-intervention (Adery et al., 2018; Dellazizzo et la., 2018; Park et al, 2009; Rus-Calafell et al., 2012; Rus-Calafell et al., 2014; Vass et al., 2020). Delazzizo et al. (2018) and Rus-Calafell et al. (2020) found that these improvements were maintained at follow up.

Five studies reported on positive symptoms, with three studies reporting improvements at post-intervention (Dietrichkeit et al., 2018; Dellazizzo et al., 2018; Park et al., 2009). Adery et al. (2018) found no improvement in symptoms from pre to post-training. Vass et al. (2020) found that the experimental condition was associated with a non-significant but small effect size compared with the control condition.

Five studies measured general symptoms or general psychopathology in those who took part in VR interventions. There were mixed results as to whether general symptoms improved in participants post-intervention. Du Sert et al. (2018) observed improvements in general symptoms, which remained significant at follow up. Dellazizzo et al. (2021) found that although not significant, general symptoms diminished in the VR intervention group compared with the CBT group. Li et al. (2020) observed that PANSS general psychopathology scores improved significantly at time one when compared with the TAU group.

However, Park et al. (2011) did not find any differences in general symptoms at post-intervention. Ku et al. (2007) did not find a significant correlation between general psychopathology and 'silence breaking time.'

4.3.5.2 Depression

Nine studies measured depression: some studies observing improvements in depression levels post-intervention and at follow up, whilst others reporting the opposite. Leff et al. (2013) found that the VR intervention had a significant positive effect on participants' Calgary Depression Scale (CDS) scores, leading to improvements. At post-intervention, Thompson et al. (2020) observed a significant decrease in the anxiety/depression subscale of the EuroQual-5D outcome measure. Dellazizzo et al. (2018) and du Sert et al. (2018) found that the reductions in depressive symptoms post-intervention were maintained at their follow up period.

However, Dietrichkeit et al. (2018) found that whilst one participant observed an improvement in their depression levels, the other found that their depression did not change. Similarly, Moritz et al. (2014) concluded that the reduction in depression levels at post-intervention failed to reach significance. Whilst some studies observed reductions in depression levels, these did not significantly differ between intervention and CG (Pot-Kolder et a. 2019; Sohn et al., 2016). Using the Beck Depression Inventory-II, Dellazizzo et al. (2021) observed that depression levels reduced in both the VRT and CBT treatment groups, with moderate effect sizes.

4.3.5.3 Anxiety

Ten studies measured anxiety and/or stress levels in participants who had taken part in VR interventions. All ten studies observed improvements in participants' stress and/or anxiety levels. Rus-Calafell et al. (2012) observed a decrease in social anxiety at post-intervention, Rus-Calafell et al. (2020) observed statistically significant reductions in levels of anxiety post-intervention, whilst Thompson et al. (2020) observed a significant decrease in the anxiety/depression subscale of the EuroQual-5D at post-intervention. Du Sert et al. (2018) found significant decreases in anxiety from week four onwards of the VRT therapy. Geraets et al. (2020) found that anxiety had improved more after VR-CBT, compared to TAU at post-treatment. Chavez et al. (2020) found that all participants in the VR meditation group reported that their stress had improved, with the greatest improvements observed in this group compared to others.

Some of these significant improvements were maintained at follow up; Gega et al. (2013) concluded that social anxiety significant improved at 24 week follow up. However, Rus-Calafell et al. (2020) found that the significant reduction in anxiety during phase 1 was not maintained nor observed in phase two.

Whilst some studies observed improvements in anxiety post VR intervention, these significant differences were not found between EGs and CGs. Pot-Kolder et al. (2019) found that anxiety was not significantly lower in the intervention group when compared to the CG. Similarly, Veiling et al. (2021)

did not find significant differences between the effects of both treatments on anxiety; however, a trend towards a more positive effect on anxiety symptoms was found in those who took part in the VRelax intervention group. Tan et al. (2020) did not observe a significant difference between groups in subjective stress. However, the effect of the intervention on perceived relaxation illustrated a different picture; participants in the intervention group reported a significant improvement in their knowledge about stress and perceived relaxation after both session one and session two compared to the CG.

Only two studies (Chavez et al., 2020; Tan et al., 2020) used physiological methods (cortisol and blood pressure) to assess anxiety levels post-intervention between the EG and CGs. However, neither study observed significant differences.

4.3.5.4 Paranoia

Five studies assessed the levels of paranoia for those taking part in VR interventions. Rus-Calafell et al. (2020) observed significant reductions in self-reported paranoid attributions between session one and the final session of therapy. Similarly, Moritz et al. (2014) observed a significant decrease in paranoid symptomatology. Pot-Kolder et al. (2019) concluded that treatment effects on paranoid ideation were significant at both post-treatment and follow-up, with ideas of persecution lower in the VR-CBT group than the CG. Gega et al. (2013) found that paranoia improved from baseline to a 24 week follow up; there was a larger drop in scores for those who recorded on the higher end of the scale, whilst those with lower scores remained at similar levels. Dietrichkeit et al. (2018) reported the findings of two participants who took part in the intervention. Whilst case one observed a reduction in the paranoia checklist post-intervention, case two recorded improved positive symptoms.

4.3.5.5 Quality of life

There were mixed results regarding the impact the VR interventions had on QoL, as measured in four studies. Amado et al. (2016) did not find a difference in scores between week zero and week 12. Pot-Kolder et al. (2019) found no significant differences in QoL between the experimental and CGs, at both post-treatment and follow up. However, both Dellazizzo et al. (2021) and du Sert et al. (2018) observed improvements in QoL.

4.3.5.6 Presence, immersion and realism in VR interventions

Only 20 (47%) articles measured participants' immersion, presence and/or experiences with the technology used in the intervention. Of these 20 articles, 14 (70%) collected feedback from participants via surveys, open-ended questions and/or observations, three (15%) used the SSQ, and three (15%) used presence questionnaires.

Immersion can be defined as the physical/sensory simulation experienced by the user in a VR environment and the extent of perceptual realism achieved (Sanchez-Vives and Slater, 2005; Slater and Wilbur, 1997). Presence is the illusion of being in a VR environment. Therefore, a sense of presence in a VR environment can be evidence of ecological validity in a VR environment (Triberti, Repetto and Riva, 2014). Most studies did not define the relationship between immersion and presence.

13 studies referred to their VR intervention as immersive, with one of these studies measured participants' experiences of immersion in the VR environment. Furthermore, four studies referred to their VR interventions as non-immersive. However, these studies did not provide information into how they measured the level of immersion.

Only ten studies measured participants' sense of presence in the VR environment (Chavez et al., 2020; Dellazizzo et al., 2018; du Sert et al., 2018; Gega et al., 2013; Ku et al., 2007; Pot-Kolder et al., 2019; Rus-Calafell et al., 2020; Thompson et al., 2020; Tsang and Man, 2013; Tuente et al., 2020). Nine studies reported that participants experienced moderate to high levels of presence, suggesting the VR interventions effectively created a realistic environment for participants to learn and receive treatment in.

This led to positive results; Pot-Kolder et al. (2019) stated that the sense of realism and presence, led participants to reduce their 'safety behaviours' and interact with the avatar. Therefore according to Gega et al. (2013), the artificial VR environments encourage participants to take risks, which they may not necessarily do immediately in reality. Nevertheless, a powerful sense of immersion and presence is required for such VR interventions to be effective.

Ku et al. (2007) conducted a series of correlations between PANSS and presence level. There was a significant correlation between emotional withdrawal and copresence, as well as perceived other copresence. This may be because the more emotionally withdrawn a participant is, the less they can experience a sense and presence. Furthermore, the significant negative correlation between silence breaking time and social presence may mean that the participants; response characteristics in the intervention may be influenced by their level of social presence.

Rus-Calafell et al. (2020)'s article on the sense of voice presence and anxiety reduction in AVATAR therapy found that participants reported moderate to high levels of presence. This was important to achieve in AVATAR therapy, as this led to enhanced levels of realism, interactivity, and impact of the dialogue between participant and their avatar. Furthermore, the reduction in anxiety highlights those clinical changes rely on developing a realistic simulation of the avatar’s voice, which can reduce the targeted emotions. Here participants will reduce their safety behaviours.

There was a mixed response as to how participants felt about the simulation and immersion and whether it benefited their intervention experience. Bell and Weinstein (2011) found that 90% of participants found the simulation entertaining and helped to maintain interest and engagement. 80% felt that it was an efficient alternative to live role-plays. Reasons as to why participants felt this way varied considerably: whilst some felt it ‘stimulated my brain,’ others felt it was ‘life-like’ and accurate.

Whilst the opportunity to learn in a realistic, immersive, and simulated environment benefitted some participants’ learning and mental well-being, others questioned whether it was helpful. Nijman et al. (2020) found that whilst 15% of participants agreed that realism benefited the VR intervention, 20% stated that realism was a weakness. Two participants in Gega et al.’s (2013) intervention trial stated that the VR experience was ‘unusual’ as it was not real, and it may benefit those who struggle to leave their homes. Leff et al. (2013) stated that nine participants in total (four participants who refused the offer of VR therapy and five participants who dropped out during the intervention) did so because their auditory hallucinations were too distressing and distracting. Bell and Weinstein (2011) found that some participants thought the job interview simulation was anxiety provoking due to its high levels of realism.

These factors are subjective experiences and are influenced by people’s prior experiences to technology, perception of VR and prior exposure to job interviews.

4.3.5.7 Use of VR technologies

15 articles (34.9%) collected information on participants' experiences of using the VR technologies.

Amado et al. (2016) and Rus-Calafell et al. (2014) reported that participants had positive experiences and high levels of acceptance, of the VR interventions they took part in. All participants except one, found that the VR goggles made the experience 'more fun and interesting' (Tan et al., 2020). Vass et al. (2020) collected subjective feedback and found that participants felt the VR intervention was safe to use. 66% of participants believed that the temporal disc controller was easy to use, and 70% strongly agreed that the addition of VR made the intervention 'interesting.'

Whilst most participants in the above studies adhered to the VR intervention and found it tolerable, a small percentage of participants did not. Two articles (Chan et al., 2010; Dietrichkeit et al., 2018; Veiling et al., 2021) used the Simulation Sickness Questionnaire (SSQ) to measure participants' experiences of cybersickness. Chan et al. (2010) found a non-significant reduction in scores before and after the first session. However, as no one dropped out of the intervention, Chan et al. (2010) concluded that this indicated participants' tolerability to the intervention. This may have been because a single screen projection was used, as opposed to a HMD.

Dietrichkeit et al. (2018)'s case study found that both participants had opposing experiences to the VR technology; whilst participant one's SSQ score reduced, and they reported no signs of discomfort, participant two's SSQ score increased. Furthermore, participant two experienced nausea and had opted not to wear the HMD during the intervention. Veiling et al. (2021) found that SSQ scores were lower after the VR intervention than before. However, two patients stopped using the VR due to nausea and dizziness.

These results were also found in other studies: Pot-Kolder et al. (2019) found that two participants dropped out due to finding the HMD too uncomfortable, whilst another participant experienced nausea. Li et al. (2020) found that one participant did experience dizziness, but this feeling did disappear. Park et al. (2011) found that whilst the VR role-plays provided some benefit to participants, there were some disadvantages. The HMD covered the upper half of participants' faces and so therefore, participants' ability to evaluate their kinetics, postures, and proxemics was challenging. Nijman et al. (2020) collected feedback from both therapists and participants: 83% of therapists agreed that 'technical issues/shortcomings' was a weakness/annoyance of the intervention. Similarly, 35% of participants believed that the 'technical/sound issues' of the intervention were one of the weaknesses of the intervention.

4.4 Discussion

4.4.1 Summary of findings

The aim of this systematic review as to assess the feasibility, acceptability and efficacy of VR interventions for those diagnosed with psychosis. This review can conclude that it is feasible and acceptable to deliver VR therapies for those with psychosis. Thus, this contributes to the wider knowledge of VR treatments for psychosis and mental health conditions. However, the extent of what type of contribution VR provides to therapeutic interventions needs to be investigated further.

Despite there being an increase in relevant RCTs and more extensive trials with CGs included in this review, a large percentage were pilot, proof-of-concept and case studies. Thus, the methodological quality is limited along with the validity and reliability.

Overall, there was a lack of consistency in what was reported and measured in all of the studies. This, combined with many outcome measures used, meant that a meta-analysis could not be conducted. Feasibility and acceptability were measured via recruitment and retention and feedback from service users and/or therapists, in this review. However, there was a limited number of studies that provided such information. Furthermore, even those studies that recorded such data did not elaborate on participants reasons for dropping out or not completing the intervention.

The majority of studies in this review, developed VR interventions to target aspects of cognition, functioning with a focus on social functioning, and hallucinations and delusions. Findings showed that VR interventions led to significant improvements and trends towards improvements in these aspects that were targeted. Therefore, there is potential for VR interventions to be effective and efficacious.

However, those secondary outcomes that were collected in these studies showed mixed results. There were mixed results regarding the impact of the VR interventions on participants' negative and positive symptoms, depression, QoL and anxiety at post intervention and follow-up. However, the majority of studies that measured paranoia directly reported improvements.

One of the key aspects of VR interventions is the presence, immersion and realism that it provides, leading to simulated experience. It is thought that the skills and knowledge learned in VR can be utilised and adapted to real life. However, only 47% of studies in this review reported on presence, immersion and realism. Furthermore, those studies (34.9%) collected participants' feedback on these topics and reported mixed responses. Whilst some participants enjoyed the novelty of the experience, others may have experienced some discomfort. Therefore, this highlights that there should be further research into who VR interventions should be delivered to and why.

4.4.1.1 Defining VR

When searching for literature for relevant VR trials, it became clear that there was no single definition that was being used. For example, whilst desktop virtual worlds can be described as VR as well as 2D interactive videos, so can HMDs. Thus, whilst some studies focused on the hardware and software to define VR, other studies focused on the human interaction as a vital step; an example of this are the studies that implemented some form of avatar therapy and required the user to interact with the 2D computer screen. This can be supported by Kardong-Edgren et al.'s (2019) findings, who identified 14 different VR interventions in their review. Therefore, this forms a challenge for replicability and comparability between VR interventions.

4.4.2 Strengths and limitations

This review had several strengths.

1. To the candidate's knowledge, this is the first systematic review to exclusively focus on VR treatments for those with psychosis.
2. The candidate searched a range of databases, and a list of broad search terms were created. These search terms were checked by the candidate's doctoral thesis supervisors to ensure they were comprehensive.
3. The review included studies with qualitative, quantitative, and mixed methods designs, which ensured that there was an in-depth and detailed analysis of the research.
4. A broad range of study designs were included to ensure that all the research was being synthesised; this compares to some previous reviews, which have only included studies with experimental designs.

This review highlights the heterogeneity of VR approaches to target deficits in those with psychosis. This heterogeneity limits the generalisability and validity of the included studies. Many studies provided limited content on their VR sessions and level of involvement of therapists, as well as other healthcare professionals. As many studies chose to create new VR environments, there are challenges to establish reliability and validity. Furthermore, despite a comprehensive review being undertaken, there were a limited number of high-quality studies with large sample sizes. For example, there were a limited number of large scale RCTs to include in this review (8 studies included in this review). This highlights the need for further high-quality, rigorous studies. Additionally, a combination of the lack of replication and researchers creating new VR environments, mean it is challenging to establish validity and reliability (Riches et al., 2019). Although there has been an increase in the number of studies that have used CGs, the samples were still relatively small.

Alongside the methodological limitations, there has been a systematic failure to elaborate on the factors, contributing to successful VR interventions, which can impact on measuring the effectiveness of such interventions. Many studies have not defined VR and other important terminologies, such as presence and immersion. This led to difficulties in forming cross-study comparisons and a high chance of risk of bias. For example, many studies claimed that a key reason why their intervention could be defined as VR was because it was ‘immersive’ in nature. However, they failed to define why it was immersive, the extent to which it was immersive, its relationship with presence and realism and how it impacted participants’ outcomes.

Furthermore, people’s previous health conditions, demographics and personality characteristics can influence whether they adapt and adhere to the VR intervention. For example, some individuals may experience more immersion and presence than others, which can influence how they respond to the treatment. Therefore, future research should aim to distinguish between the benefits deriving from the VR itself compared with the therapy itself and other non-specific factors (Gregg and Tarrier, 2007).

4.4.3 Implications and future research

This review provides a thorough update on the development of VR treatments for those with psychosis. However, there are overarching questions that still need to be addressed:

1. What is the most appropriate way to ensure that the effects of VR treatments most readily transfer into real life?
2. Do personalised theory-driven treatments implemented into VR produce large, long-lasting real-world benefits for those who use it?
3. How can VR treatment developers ensure that the treatment is accessible and tailored to suit the needs of the individual?

Future research into VR treatments into psychosis should seek to develop more standardised and comprehensive methods, leading to increased validity and reliability. Future studies would also benefit from longer-term follow up periods to understand the maintenance of positive effects on outcomes. Only five studies in this review provided follow up periods of six months. Additionally, future studies may benefit from implementing physiological measures (i.e. heart rate variability, galvanic skin response and blood pressure) during the intervention to measure participants’ anxiety levels.

Due to the development of larger-scale RCTs, future studies should focus on implementing VR treatments into mental health services, particularly in a COVID-19 world. One of the clear benefits of VR treatment is that it could be considered an improved method of treatment delivery for those who are unable to attend face-to-face treatment. Additionally, it could also provide therapy to more people, thereby reducing waiting list times and reducing health and social care professionals' workloads. However, this will require suitable training for therapists to ensure that the VR therapy is delivered effectively. Coproduction between healthcare professionals, service users, researchers and developers are vital in order to ensure that the VR environment and therapy produced is effective and appropriate.

A more robust up to date taxonomy is required, in order to develop some consistency between VR definitions. According to a review conducted by Carroll et al. (2021) into VR/augmented reality health and wellbeing interventions for older adults, very few studies provide a definition of VR and this can subsequently lead to misunderstandings and ambiguities. Thus, this needs to be avoided, in order to undertake more high quality VR trials.

4.4.4 Conclusion

Therefore, this review suggests that VR can be used to provide therapy to target various symptoms and mechanisms in those diagnosed with psychosis. The opportunity to provide therapy in a controlled environment can be beneficial for those with psychosis. Whilst there has been an emergence in the number of larger trials and RCTs into VR therapy and psychosis, further RCTs are required to assess the effectiveness of VR therapy when compared to traditional therapy. Furthermore, researchers should provide further detail into the criteria used to define VR, presence, immersion and personalisation. This will allow for more consistency between trials.

5. Study 2 – beta testing evaluation of a virtual world intervention to deliver social cognition training to those with FEP - the VEEP trial

Co-designing a virtual world with young people to deliver social cognition therapy in early psychosis

Reference: Realpe, A., Elahi, F., Bucci, S., Birchwood, M., Vlaev, I., Taylor, D., & Thompson, A. (2020). Co-designing a virtual world with young people to deliver social cognition therapy in early psychosis. *Early Intervention in Psychiatry*, 14(1): 37-43.

Author contributions

A.T., S.B., M.B., I.V. and D.T. wrote the grant application for this feasibility and pilot trial. A.T., A.R., D.T. and **F.E.** were responsible for coordinating the design of the virtual world. A.T., A.R. and **F.E.** conducted the co-design workshops. A.R. and A.T. drafted the manuscript, all investigators have been involved in revising the report and all authors have seen and approved the final version.

A summary of the beta testing process was written in the above published paper. This has been extended in this doctoral thesis chapter. The candidate (FE) collected and analysed all the data provided in this chapter.

5.1 Introduction to the chapter

This chapter firstly introduces the VEEP intervention. The second part describes the beta testing study, which occurred before participant recruitment for the VEEP Trial. The aims and methods are discussed further in Chapter 3: Methods and Methodologies.

5.2 Development of the VEEP Trial

5.2.1 Rationale

Individuals value the accessibility, flexibility, privacy and self-management that digital health interventions provide (Hollis et al., 2017). Therefore, implementing the SCIT into Second Life® had the potential to provide treatment to those whom services have struggled to provide access to. Service users had the opportunity to access therapy in any environment with a high-speed internet connection (i.e. their own home), thereby decreasing clinical costs and influencing functional outcomes (Grinberg et al., 2014).

5.2.2 Who is VEEP appropriate for?

The VEEP trial was designed for individuals diagnosed with FEP, who were at least 18 years of age and experienced social cognitive difficulties because of their condition. This treatment was particularly appropriate for those who experience symptoms of paranoia and suspiciousness. The trial developers recommended that service users complete this treatment during the non-acute phase of their illness.

5.2.3 Group development

The intervention was designed, so that approximately five individuals and two facilitators participated in each group. This was because five individuals will provide various opinions and perspectives, whilst two facilitators can ensure that the individuals are completing tasks effectively and provide additional support if necessary.

5.2.4 Treatment phase and session structure

Individuals were required to attend sessions twice a week for 30-45 minutes for four weeks. The intervention contained an eight-session treatment phase. Further information about the intervention can be found in appendix 33.

5.2.5 Development of the virtual world environment

Second Life® is a virtual world which contains approximately half million acres of virtual land. Much of this land belongs to Second Life® users. When a user purchases land or an island, they can customise this space. Users can purchase different types of land according to their needs (Second Life, 2017).

Therefore a 65536 m2 virtual space called an ‘island’ was purchased within Second Life®, where the VEEP trial was being developed. The environment is an isolated space, which ensures that no unintended access can take place. Once the service user had logged into Second Life® (using a username and password that had been developed for them), their avatar would be able to gain access to the VEEP trial environment via a teleport system. The research team were the only other individuals who would have access to the VEEP environment. Once they had been teleported into the VEEP trial environment, they had full access to this environment.

Below are images and brief descriptions of each room in the Second Life® environment:

Figure 19: Café (Second Life® environment)

Figure 20: The library (Second Life® environment)

Café: this is where the sessions begin. It is designed to be a relaxing space, where participants can have discussions and take part in activities.

Library: this is where participants can access the VEEP website (http://veep.warmwinterarts.com) which contains the slides, activities, and extra information for each session. Participants can also fill in the feedback form via this website. Participants are encouraged to access the library in between sessions, so they can review content from previous and future sessions.

Figure 21: The white room (Second Life® environment)

This is the first of three therapy rooms, where the sessions take place. There are screens on the walls, where PowerPoint presentations can be shown. There are posters on the wall that provide participants with more information on the SCIT.

Figure 22: The red room (Second Life® environment)

This is the second of three therapy rooms.

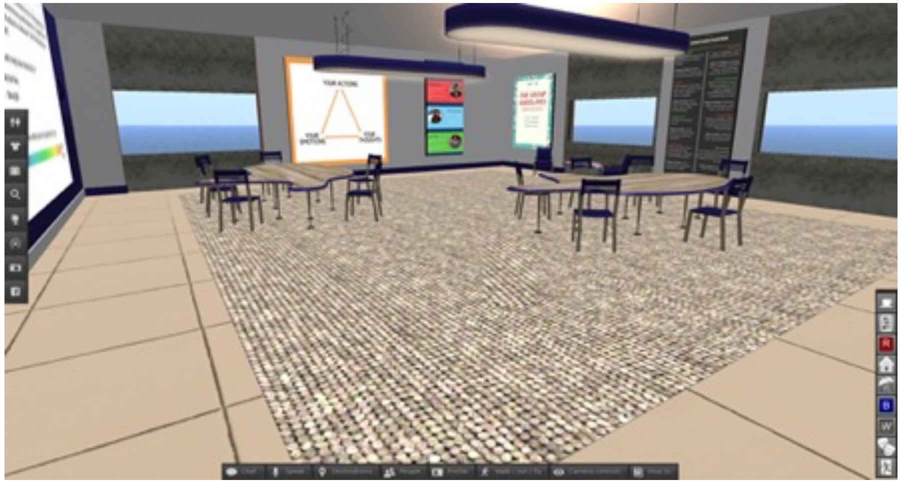


Figure 23: The blue room (Second Life® environment)

Figure 24: The outdoor cinema (Second Life® environment)

This is the third of three therapy rooms.

This is where videos relating to the intervention can be watched on a big screen. It is designed to be a relaxing space for participants.

Figure 25: Beach area (Second Life® environment)

This contains both a beach hut and a tent. This is a place where the group can have discussions about topics.

Figure 26: Beach house (Second Life® environment)

This is a relaxation space, which participants can attend.

Figure 27: The first therapist’s avatar in Second Life®

5.3 Results

Four participants were recruited and consented to take part in this study.

Below is an image taken from the VEEP beta testing session.

Figure 28: VEEP beta testing session image

The below table outlines information on the feedback provided by the facilitators and the participants.

Table 19: Beta test results

Topics	Facilitators	Participants
Logging into Second Life®	No difficulties observed.	No difficulties observed.
Communication – microphone	No difficulties observed.	One participant could not use their microphone and so used the text chat function instead.
PowerPoint presentations	The facilitators experienced delays in moving the slides in real time, so that all participants could see the same slide at the same time.	Changing the PowerPoint presentations in the sessions was slow at times and led to delays. Sometimes it was difficult for the participants to see the PowerPoint presentations.
Watching videos in the virtual world	There were inconsistencies in watching the videos in the virtual world. For three individuals, the videos would stop and start. The videos did not work for the remaining three individuals.	Please see the facilitator’s response.

Audio	No difficulties recorded.	Participants explained they could not hear the facilitators talk at times, due to background noise. Participants explained that they could not hear the avatars speak during the role-play activities.

After reviewing and organising participants' responses, the main feedback was identified and devised into categories:

Category 1: Ease of use

All participants stated that they found the virtual world easy to use and understand. Participants were able to download the programme Second Life® successfully onto their computers/laptops. They were able to follow the instructions on how to choose an avatar and navigate their way through the virtual world.

However, there were some hardware and software issues that participants experienced throughout the process:

Subcategory 1: Improvement to functionality

Before watching videos in Second Life®, participants would be asked to switch off their microphones, so the sound of their videos did not echo through into the virtual world. It was agreed that participants would be able to have control over when they could watch videos in Second Life®. Therefore, as opposed to the therapists clicking on the videos to watch, the participants would have to do this themselves. The group chat option, where individuals could communicate via text was removed. This is because it disrupted the flow of the conversations in Second Life®. Therefore, all users would be asked to use voice chat instead. Group chat would remain as an option if users wanted to send a private message to the facilitators.

Poor internet connectivity could impact the speed at which the Second Life® programme worked. The website was initially designed to review all the session content in between sessions if required. However, it was decided that participants could use the website to review the presentations and content during the sessions if their programme was working more slowly than expected.

Subcategory 2: Improve the interface

Participants were asked to either sit or stand near the screen to view the PowerPoint presentation in Second Life®. Furthermore, group activities and tasks were viewed using the treatment website instead of the cinema screen in Second Life®. For example, one of the activities in the treatment is called ‘guessing people’s emotions,’ which involved participants looking at pictures on the screen and guessing the emotion a character is showing. It would be easier and more straightforward for the participant to view this on their internet browser, to maximise their chances of identifying the correct emotion.

When liaising with the Second Life® developers, one of the challenges the research team faced, involved fixing the virtual world’s cinema screens, so videos could be viewed on the screen. There were two specific issues: 1) it is essential that participants watch the videos immediately when asked 2) the videos could be watched simultaneously. Participants were asked to view the relevant videos by logging into the treatment website via the screen in the virtual world. Once this had happened, they were then able to find the video in the relevant session and press play. However, due to the technical issues, it was decided that once participants were asked to watch a video, they were asked to access it via a link that would be sent in the group chat. Therefore, by clicking on the link, participants would be able to view the video.

Category 2: Understanding of the objectives of the virtual world intervention

All participants understood the objectives of the VEEP intervention. This included being aware of the therapy targets and why the virtual world was being used as a mechanism to facilitate this therapy. Participants stated that they could view the slides and understood the activities they were asked to take part in.

Whilst participants provided positive feedback on the group activities they were asked to take part in; they felt there should still have been more user input. This would encourage more cohesion and interaction between groups. Therefore, to encourage more user input, the facilitators agreed to ask more questions to participants during group tasks. Furthermore, participants would be given the option to ‘check-in’ and ‘check-out’ at the end of each session; this would allow participants to clarify any details or ask any questions they may have.

5.4 Discussion

This study describes the beta testing process, which is part of the development of the virtual world intervention, that used a significant codesign process (please see Realpe et al., 2020). The aims were to determine the feasibility, acceptability and usability of the VEEP intervention and to identify any technical issues prior to undertaking the proof-of-concept trial. This involved researchers, Second Life® developers and people with lived experiences of mental health conditions. Therefore, this resulted in a wide range of perspectives being incorporated into the final intervention, thereby ensuring that it is engaging, valuable and relevant for service users with FEP.

Feedback indicated that the intervention was well received, valuable and easy to use. Participants responded positively to the interface, the evidence-based psychoeducation and novel appeal. There is a significant lack of beta testing for VR interventions to improve mental health; therefore, this highlights an important need for more evidence based research into the usability of VR interventions.

Areas for improvement predominantly focused on the technical aspects of the VR intervention, as opposed to the psychoeducation itself. Feedback focused on how best to improve the feasibility and usability of the virtual world, as well as save time during the session. Improvements such as incorporating more discussions during the sessions, asking participants to use voice chat when needed (as opposed to text chat) and utilising their own web browsers on their computers (as opposed to the web browser within the virtual world) were all implemented before the intervention began with service users.

5.4.1 Strengths and Limitations

Participants reported that the virtual world intervention was feasible and acceptable. No adverse events were reported.

The generalisability of the beta study was limited by the small sample size of PhD students recruited from WMS, University of Warwick. Prior research has suggested that a representative sample of between five to seven participants, can potentially lead to a tenfold reduction in usability difficulties (Birnie et al., 2018; Gustafson and Wyatt, 2004). Furthermore, those with FEP were not recruited to take part in the beta testing process. Nevertheless, criteria suggest that interventions should be tested under the conditions by which they will be used (Brown et al., 2013; McCurdie et al., 2012). This was achieved in this beta study.

As this was a usability study, it is not possible to formulate conclusions about the virtual world intervention's ability to improve social cognition skills. Another limitation was the duration of the beta testing; the sessions were condensed down and delivered over two days. Additionally, there was only one iterative cycle to refine the intervention. However, reasons for this were logistic; ethical and university approval took longer than expected and refinements needed to be made before the proof of concept study began.

5.5 Conclusion

To the candidate's knowledge, this is the first study to describe the beta testing of a VR intervention for those with psychosis. The beta designing process was an iterative process. The findings show that the virtual world intervention was well received and rated highly in terms of usability and containing high quality information. The testing identified those modifications to enhance the successful implementation of the virtual world intervention. The following stages involved conducting a proof-of-concept pilot study with those diagnosed with FEP to assess the feasibility and acceptability of the virtual world intervention. If found to be effective, the virtual world intervention has the potential to improve social cognition deficits in those with FEP.

6. Study 3: a quantitative analysis of the SCIT delivered via a virtual world in those with FEP – the VEEP trial

A Feasibility and Acceptability Trial of Social Cognitive Therapy in Early Psychosis Delivered Through a Virtual World: The VEEP Study

Reference: Thompson, A., Elahi, F., Realpe, A., Birchwood, M., Taylor, D., Vlaev, I., Leahy, F., & Bucci, S. (2020). A feasibility and acceptability trial of social cognitive therapy in early psychosis delivered through a virtual world: The VEEP study. *Frontiers in Psychiatry*, 11: 219.

Author's contributions

AT, SB, MB, IV, and DT wrote the grant application for this feasibility and pilot trial. AT, AR, DT, and **FE** were responsible for coordinating the design of the virtual world. AT, AR, and **FE** conducted the co-design workshops. AT, **FE**, FL, and AR undertook the trial. AT drafted the manuscript. **All investigators** have been involved in revising the report, and all authors have seen and approved the final version.

- The above paper provides an analysis of the outcome measures collected at pre and post-intervention.
- The RA collected the social cognition, social functioning, behaviour change, quality of life, neurocognition and psychopathology outcome measures.
- FE collected and analysed the data for the feedback forms and the presence questionnaire, that is reported in the above publication. This is reported on in this doctoral thesis study chapter.
- FE analysed and wrote up all the data reported in this doctoral thesis study chapter.

6.1 Introduction to the chapter

This study analyses the feasibility and acceptability of the VEEP trial using quantitative outcome measures and feedback forms. Demographic information is presented, followed by the data from the feedback forms. The comparison between completers and non-completers is then presented (at pre-and-post intervention) followed by an assessment of presence (that was collected at post intervention). Findings are then discussed in more detail in the discussion. This was additional analysis to the published paper (referenced on the previous page) and completed by the candidate independently.

6.2 Results – participant information

The below table provides information on those participants who consented to take part in the VEEP trial.

Table 20: Participant demographics and neurocognition

Variable	Value	
Participant Number	19	
Age	Mean	25.61
	SD	6.49
Gender	Male	14
	Female	5
Highest level of education	A level	3
	Trade or technical training (incomplete)	5
	Trade or technical training (complete)	6

	Tertiary diploma/certificate	2
	Undergraduate degree (incomplete)	1
	Undergraduate degree (complete)	2
Nationality	UK	17
	Nepal	1
	Russia	1
NART IQ score (premorbid intelligence)	104.96	

6.3 Results – feasibility

The below table summarises the data collected from participant feedback forms:

Table 21: Participant feedback form results (statements)

Statements	Mean (SD)	Percentage score (%)
(1) Suitable level of content (e.g. easy to understand)	4.40 (0.54)	88
(2) Relevance and value of the content	4.16 (0.56)	83.2
(3) Guidance from the therapist	4.69 (0.51)	93.8
(4) Encouragement to participate and interact	4.57 (0.67)	91.4
(5) Safety of the VR world	4.70 (0.61)	94

The above results are categorised into statements. The mean score represents the average score for each statement (range 1-5 – a higher number indicates a more positive result). This score is then converted into a percentage (see column 3).

Table 22: Participant feedback form results (sessions)

Sessions	Mean (SD) score	Percentage score (%)
Session 1	22.11 (1.62)	88.44
Session 2	21.71 (2.06)	87
Session 3	22.33 (1.94)	89.32
Session 4	22.25 (2.63)	89
Session 5	22.6 (2.88)	90.4
Session 6	23.75 (1.26)	95
Session 7	22.6 (2.3)	89
Session 8	24 (0)	96

The above results are categorised into sessions. The mean score represents the average score for each session (range 5-25 – a higher number indicates a more positive result). This score is then converted into a percentage (see column 3).

Results indicated that most participants experienced a very high level of satisfaction when it came to the five statements asked about each session of the intervention. Furthermore, participants recorded very high levels of satisfaction for each session.

6.4 Results - A comparison of completers and non-completers in the VEEP trial

Table 23, 24 and 25 below, provide a comparison between VEEP intervention completers and non-completers, using secondary outcome measures: functioning and QoL, social cognition and neurocognition.

Table 23: Pre and post-intervention analyses for completers

		Pre-intervention (n=11)		Post-intervention (n=11)		P Value	Hedges g
Variable		**Mean**	**SD**	**Mean**	**SD**		
BPRS	Total*	38.82	6.95	36.63	9.24	.595	-.26
	Anxiety*	2.18	1.25	2.18	1.25	1.000	.00
	Depression*	2.00	0.89	2.36	1.29	.455	.31
SCSQ	Total SCSQ	31.44	3.90	32.60	5.03	.600	.25
	Theory of mind	7.00	2.37	8.09	1.38	.740	.54
	Schematic Inference	7.45	0.93	7.82	1.33	.630	.31
	Verbal memory	7.91	0.83	8.27	1.27	.568	.32
	Metacognition	9.08	0.94	9.27	0.70	.638	.22
	Hostility bias*	1.55	1.13	1.27	1.19	.648	-.23
BLERT		14.00	4.43	16.00	2.77	.780	.53
Hinting task		18.27	2.10	19.00	1.34	.521	.40

CSQ-SF	CSQ-SF-Total*	210.09	24.67	197.36	21.54	.465	-.53
	Internality subscale*	49.27	5.04	49.91	5.47	.674	.12
	Globality*	47.36	8.27	44.45	5.72	.512	-.39
	Stability*	45.55	6.55	41.01	6.98	.527	-.65
	Negative Consequences*	22.91	5.26	20.91	4.41	.536	-.40
	Self-worth implications*	44.64	9.17	40.91	8.12	.450	-.41
PSP		64.45	12.32	65.82	11.62	.815	.11
EuroQual-5D	Total	9.27	4.31	8.73	3.98	.553	-.13
	Anxiety/depression	2.64	1.29	2.18	1.17	.720	-.36
EuroQual-VAS		69.18	17.90	69.10	22.89	1.02	-.00
TDF-4 (Beliefs about capabilities)	Total	2.49	0.45	2.23	0.60	.420	-.47
	Group	2.47	0.39	2.41	0.82	.811	-.09
	Individual	2.52	0.53	2.23	0.61	.545	-.49
TDF-8 (intentions)	Total	2.24	0.54	2.05	0.59	.538	-.32
	Group	2.33	0.42	2.03	0.61	.795	-.55

	Individual	2.15	0.72	2.06	0.63	.748	-.13
TDF-9 (Goals)	Total	2.81	0.72	2.58	0.58	.552	-.34
	Group	2.91	0.66	2.48	0.66	.624	-.63
	Individual	2.70	0.84	2.68	0.55	.986	-.03

*Paired samples t-test is significant at the 0.05 level (2-tailed)

Bell Lysaker Emotion Recognition Task (BLERT), Brief Psychiatric Rating Scale (BPRS), Cognitive Style Questionnaire – short form (CSQ-SF), 5 level EuroQol Quality of Life outcome, Personal and Social Performance Scale (PSP), Social Cognition Screening Questionnaire (SCSQ), Theoretical Domains Framework – Belief about capabilities; domain Four (TDF-4) Theoretical Domains Framework– Intentions and goals; domains Eight and Nine. *outcome measures and/or subscales, where a lower score indicates a more positive result.

A comparison of pre and post-intervention outcomes for completers indicates that there were no significant differences found at pre and post intervention for VEEP intervention completers.

Table 24: Pre and post-intervention analyses for non-completers

		Pre-intervention (n=4)		Post-intervention (n=4)	
Variable		**Mean**	**SD**	**Mean**	**SD**
BPRS	Total*	36.25	8.05	35.75	10.31
	Anxiety*	2.50	1.29	2.75	1.71
	Depression*	2.25	1.50	1.50	0.58
SCSQ	Total SCSQ	31.66	2.65	32.83	3.86
	Theory of mind	8.25	0.96	7.75	2.22
	Schematic Inference	5.75	1.71	7.25	0.96
	Verbal memory	8.00	1.15	8.50	1.29
	Metacognition	9.66	0.39	9.33	0.55
	Hostility bias*	1.00	0.82	2.00	1.83
BLERT		11.25	4.57	14.25	4.27
Hinting task		18.00	2.71	17.75	2.50
CSQ-SF	CSQ-SF-Total*	177.75	17.52	175.50	26.79
	Internality subscale*	46.75	4.03	48.50	3.00

	Globality*	37.25	4.27	39.75	10.24
	Stability*	38.50	5.45	36.25	6.45
	Negative Consequences*	19.25	3.59	18.00	5.16
	Self-worth implications*	35.75	6.90	32.50	9.15
PSP		74.25	14.93	73.5	20.27
EuroQual-5D	Total	8.50	4.04	8.25	3.77
	Anxiety/depression	2.25	1.50	1.75	0.96
EuroQual-VAS		66.5	12.61	72.50	17.56
TDF-4 (Beliefs about capabilities)	Total	2.46	0.46	2.79	0.11
	Group	2.54	0.53	2.96	0.28
	Individual	2.38	0.44	2.63	0.34
TDF-8 (intentions)	Total	2.42	0.50	2.67	0.47
	Group	2.42	0.50	2.83	0.58
	Individual	2.42	0.50	2.50	0.58
	Total	3.03	0.43	3.11	0.26

TDF-9 (Goals)	Group	2.94	0.30	3.25	.29
	Individual	3.13	0.63	2.97	.41

The results are presented descriptively above.

Bell Lysaker Emotion Recognition Task (BLERT), Brief Psychiatric Rating Scale (BPRS), Cognitive Style Questionnaire – short form (CSQ-SF), 5 level EuroQol Quality of Life outcome, Personal and Social Performance Scale (PSP), Social Cognition Screening Questionnaire (SCSQ), Theoretical Domains Framework – Belief about capabilities; domain Four (TDF-4) Theoretical Domains Framework– Intentions and goals; domains Eight and Nine. *outcome measures and/or subscales, where a lower score indicates a more positive result.

The descriptive statistics showed that there were improvements at post-intervention when compared to pre-intervention for the non-completers for the following outcome measures: BPRS (total score as well as the depression subscale), SCSQ (total score as well as the schematic inference and verbal memory subscales) BLERT, CSQ-SF (total score as well as the stability, negative consequences and self-worth implications subscale), EuroQual-VAS, TDF-4, TDF-8 and the TDF-9 (total score as well as the group subscale). The descriptive statistics showed that there were reductions at post-intervention when compared to pre-intervention for the non-completers for the following outcome measures: BPRS (anxiety subscale), SCSQ (theory of mind, metacognition and hostility bias subscales), Hinting task, CSQ-SF (internality and globality subscale), PSP, EuroQual-5D and the TDF-9 (individual subscale).

Table 25: Post-intervention analyses between completers and non-completers

		Completers (n=11)		Non-Completers (n=4)		P Value	Hedges g
Variable		**Mean**	**SD**	**Mean**	**SD**		
BPRS	Total*	36.64	9.24	35.75	10.31	.938	-.09
	Anxiety*	2.18	1.25	2.75	1.71	.700	.39
	Depression*	2.36	1.29	1.50	0.58	.675	-.69
SCSQ	Total SCSQ	32.60	5.04	32.83	3.86	.937	.05
	Theory of mind	8.09	1.38	7.75	2.22	.904	-.20
	Schematic Inference	7.82	1.33	7.25	0.96	.677	-.43
	Verbal memory	8.27	1.27	8.50	1.29	.918	.17
	Metacognition	9.27	0.70	9.33	0.55	.910	.08
	Hostility bias*	1.27	1.19	2.00	1.83	.597	.50
BLERT		16.00	2.76	14.25	4.27	.679	-.52
Hinting task		19.00	1.34	17.75	2.50	.750	-.70

CSQ-SF	CSQ-SF-Total*	197.36	21.54	175.50	26.79	.536	-.9
	Internality subscale*	49.91	5.47	48.50	3.00	.832	-.26
	Globality*	44.45	5.72	39.75	10.24	.583	-.63
	Stability*	40.91	6.98	36.25	6.45	.614	-.64
	Negative Consequences*	20.91	4.41	18.00	5.16	.596	-.60
	Self-worth implications*	40.91	8.12	32.50	9.15	.545	-.95
PSP		65.82	11.62	73.50	20.27	.613	.51
EuroQual-5D	Total	8.73	3.98	8.25	3.77	.932	-.11
	Anxiety/depression	2.18	1.17	1.75	0.96	.712	-.36
EuroQual-VAS		69.10	22.89	72.50	17.56	.915	.15
TDF-4 (Beliefs about capabilities)	Total	2.27	0.59	2.79	0.11	.645	.94
	Group	2.41	0.82	2.96	0.28	.829	.71
	Individual	2.23	0.61	2.63	0.34	.665	.67
TDF-8 (intentions)	Total	2.03	0.59	2.67	0.47	.810	1.07
	Group	2.03	0.61	2.83	0.58	1.170	1.25
	Individual	2.06	0.63	2.50	0.58	.610	.67

TDF-9 (Goals)	Total	2.58	0.58	3.11	0.26	.630	.95
	Group	2.48	0.66	3.25	0.29	.690	1.22
	Individual	2.68	0.55	2.97	0.41	.640	.52

*Independent samples t-test is significant at the 0.05 level (2-tailed)

Bell Lysaker Emotion Recognition Task (BLERT), Brief Psychiatric Rating Scale (BPRS), Cognitive Style Questionnaire – short form (CSQ-SF), 5 level EuroQol Quality of Life outcome, Personal and Social Performance Scale (PSP), Social Cognition Screening Questionnaire (SCSQ), Theoretical Domains Framework – Belief about capabilities; domain Four (TDF-4) Theoretical Domains Framework– Intentions and goals; domains Eight and Nine. *outcome measures and/or subscales, where a lower score indicates a more positive result.

A post-intervention comparison between completers vs non-completers indicates no significant differences.

6.5 Results - a measure of presence post intervention

Presence of the virtual world was collected using both the Witmer and Singer (1998) questionnaire and through semi structured interviews (this is analysed and recorded in study 4b). In this study, presence was measured at post-intervention. Data was collected from only the last nine participants due to difficulties with providing the questionnaire at the beginning of the intervention.

The mean scores for each question (error bars and standard error are illustrated below). The results showed that overall, there was a moderate degree of presence in the virtual world: M= 154.2 and SD= 18.8. Scores could range from 32 to 224. Below results are divided into the subscales.

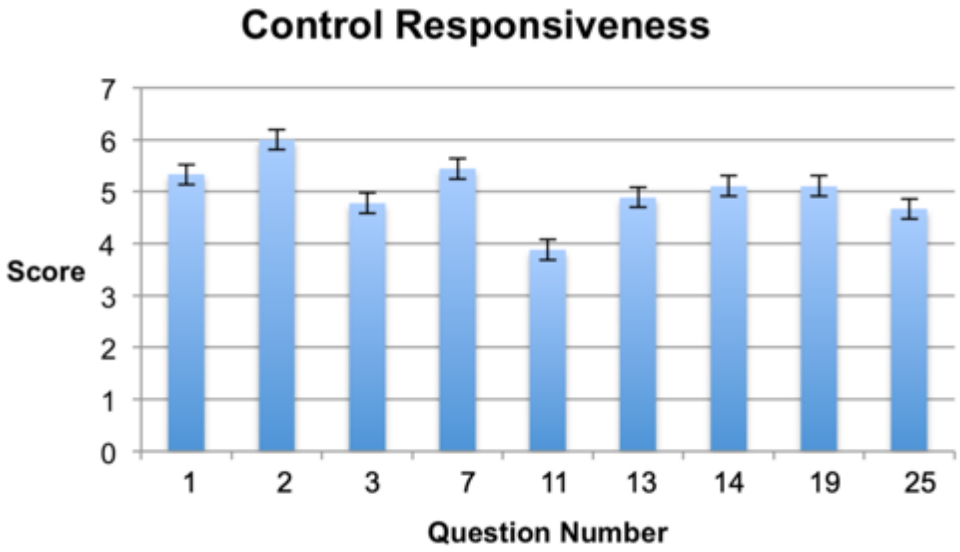


Figure 29: Bar chart – control responsiveness

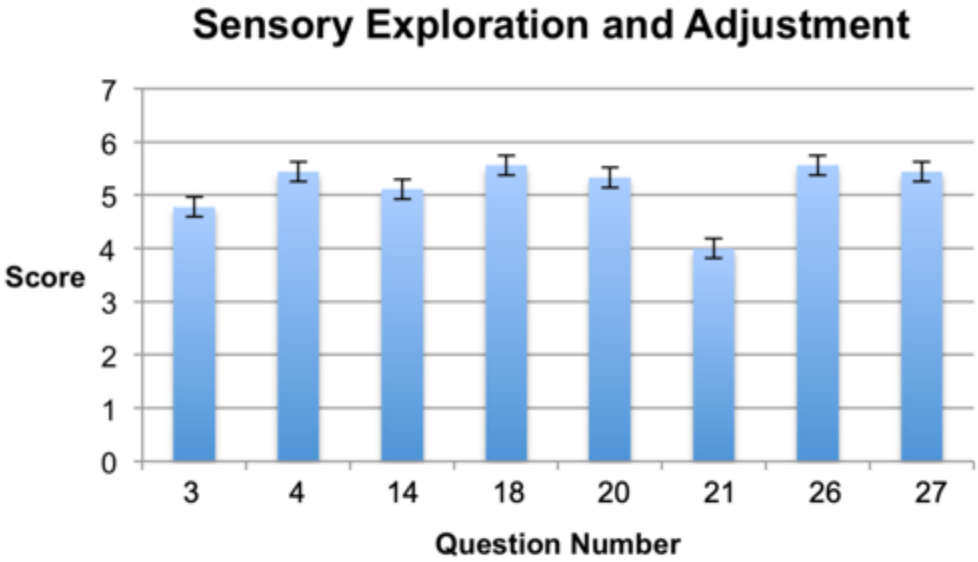


Figure 30: Bar chart – sensory exploration and adjustment

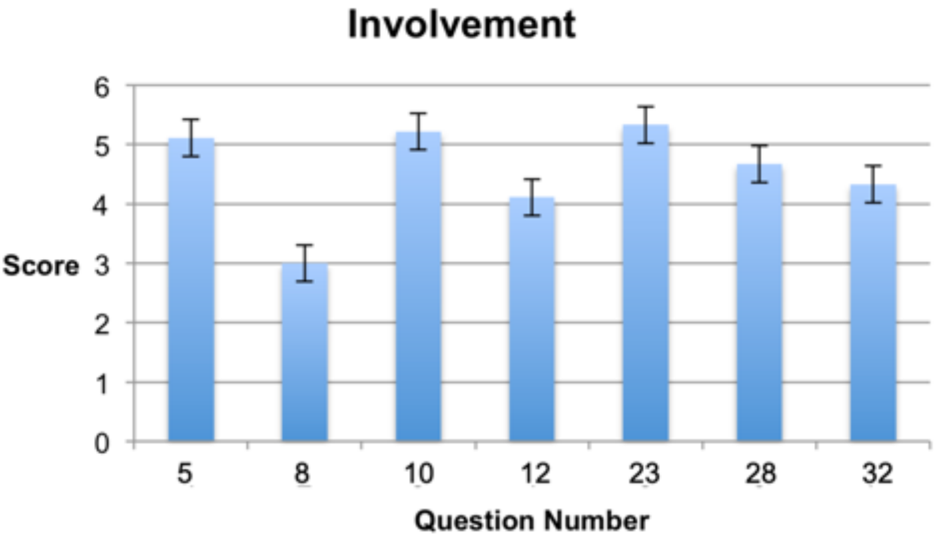


Figure 31: Bar chart – involvement

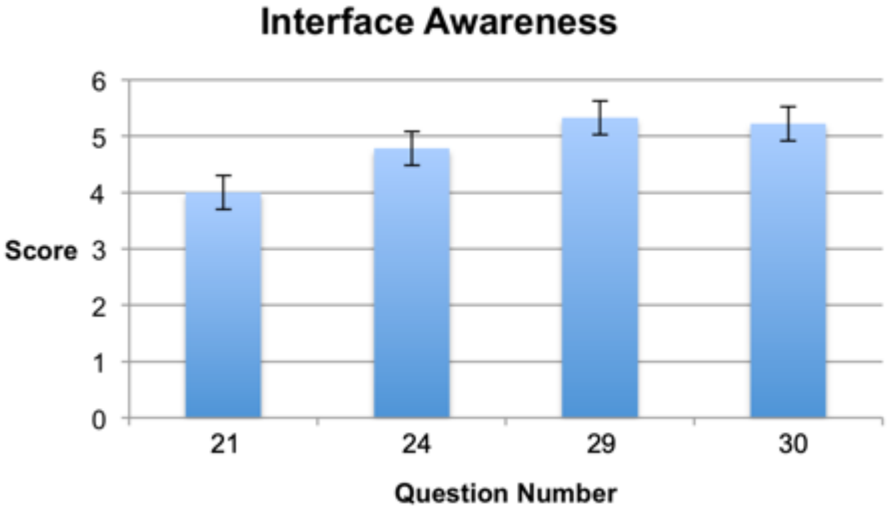


Figure 32: Bar chart – interface awareness

6.6 Discussion

6.6.1 Overall summary of results

6.6.1.1 Feasibility and acceptability

6.6.1.1.1 Recruitment and attrition

Below is a flowchart (figure 33), which outlines the recruitment process. 45 patients at EIP service in CWPT were approached to take part in this trial. 13 declined to take part, five were ineligible (did not speak English or were diagnosed with a moderate intellectual disability), 11 did not respond to our requests and so were deemed uninterested, 12 were no longer in EIP or were due to be discharged and four declined to take part because they did not have access to digital technologies. In total, there were 11 completers and 4 non-completers. Figure 34 provides more information on participant attendance.

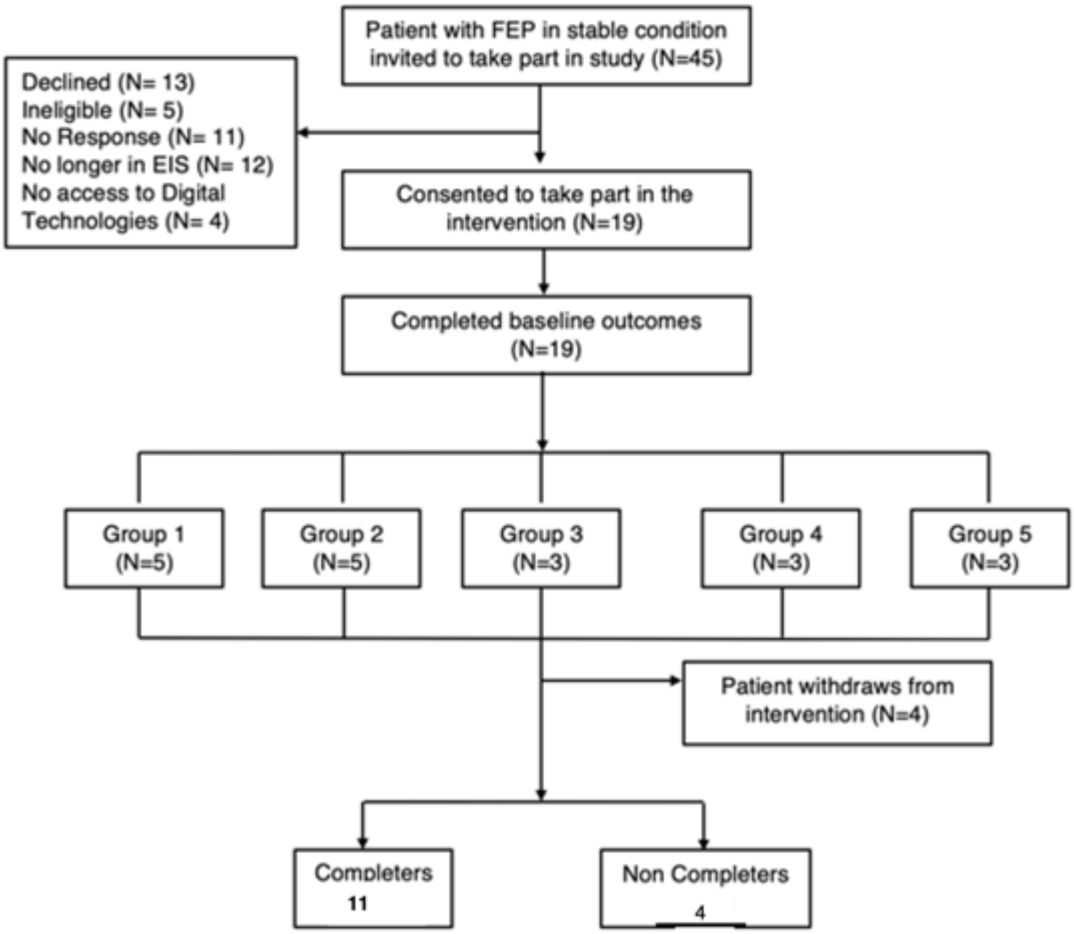
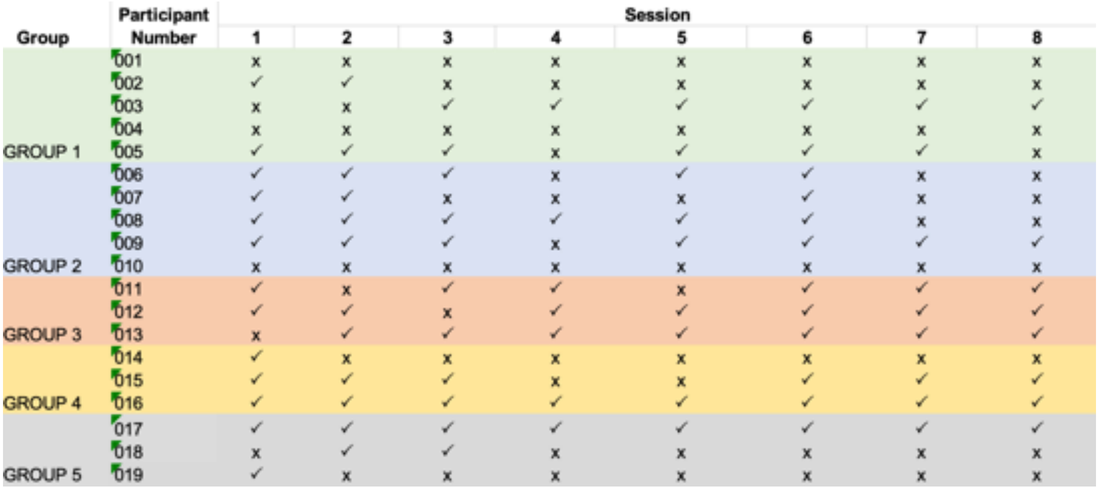


Figure 33: Trial outline and recruitment process



Group	Participant Number	Session 1	2	3	4	5	6	7	8
	001	x	x	x	x	x	x	x	x
	002	✓	✓	x	x	x	x	x	x
	003	x	x	✓	✓	✓	✓	✓	✓
	004	x	x	x	x	x	x	x	x
GROUP 1	005	✓	✓	✓	x	✓	✓	✓	x
	006	✓	✓	✓	x	✓	✓	x	x
	007	✓	✓	x	x	x	✓	x	x
	008	✓	✓	✓	✓	✓	✓	x	x
	009	✓	✓	✓	x	✓	✓	✓	✓
GROUP 2	010	x	x	x	x	x	x	x	x
	011	✓	x	✓	✓	x	✓	✓	✓
	012	✓	✓	x	✓	✓	✓	✓	✓
GROUP 3	013	x	✓	✓	✓	✓	✓	✓	✓
	014	✓	x	x	x	x	x	x	x
	015	✓	✓	✓	x	x	✓	✓	✓
GROUP 4	016	✓	✓	✓	✓	✓	✓	✓	✓
	017	✓	✓	✓	✓	✓	✓	✓	✓
	018	x	✓	✓	x	x	x	x	x
GROUP 5	019	✓	x	x	x	x	x	x	x

Figure 34: VEEP session attendance

Therefore only 42.2% of those who were approached (19 out of 45) to take part in the VEEP trial, consented. Whilst this is a low number, this is supported by prior research. Polillo et al.'s (2021) study into the update of digital tools to engage with patients with provisional psychosis as well as their families, found that 48.3% of those patients who were approached, consented to take part.

73.3% of participants who began the intervention, completed the trial (11 out of 15). These completion and attrition rates are supported by previous trials and studies, which have delivered social cognition training for those with psychosis (Horan et al., 2018; Kanie et al., 2019; Mediavilla et al., 2019; Roberts et al., 2017; Taksal et al., 2016).

The original aim was to recruit four groups of five participants; however, due to delays in recruitment, each group contained a different number of participants. Therefore it is not easy to assess whether it is feasible to deliver VR social cognitive therapy to those with FEP, to groups of five specifically. Additionally, attendance was sporadic for some participants, leading to groups of one-two participants for some sessions. Thus, future VR trials should focus developing more efficient retention strategies to consider drop out and non-attendance rates (Liu et al., 2018).

6.6.1.1.2 Participant feedback

The VEEP feedback forms indicated that participants provided positive feedback on all aspects of the intervention. Scores ranged from 88-94% favourability. The positive feedback was consistent throughout the eight sessions as well (87 – 96%). These results indicate that the VEEP intervention was feasible and acceptable to deliver to improve social cognition deficits in those with FEP.

However, the completion rate for the feedback forms was low for each session. Thus, these findings may not represent all the participants who took part in the VEEP intervention. There could be multiple reasons why the completion rate was low: participants would have to go to the VEEP intervention website and complete the form online. Thus, participants may not have felt they had the time to complete this. It is possible that some participants avoided completing the feedback forms because they did not want to provide negative feedback. Therefore, future VR therapists should ensure that participants complete feedback forms when asked to do so.

6.6.1.1.3 Comparison between completers and non-completers

A comparison of post-intervention outcomes for completers vs non-completers indicated no significant differences at T2. Similarly, a comparison of pre and post-intervention outcomes for completers indicated that there was no significant differences between T1 and T2. The descriptive statistics for pre and post-intervention outcomes for non-completers indicated that there were improvements for the following outcome measures at T2; BPRS (total score as well as the depression subscale), SCSQ (total score as well as the schematic inference and verbal memory subscales) BLERT, CSQ-SF (total score as well as the stability, negative consequences and self-worth implications subscale), EuroQual-VAS, TDF-4, TDF-8 and the TDF-9 (total score as well as the group subscale).

Nevertheless, future research should collect data at pre-intervention, midpoint, post-intervention and follow-up to see if there are any significant improvements and whether they are sustained (Hill et al., 2017). Dropout rates and attrition are complex issues. Varied and inconsistent findings in research are partly due to how the term ‘drop out’ is defined and at what stage it occurs.

Thus, future studies must distinguish between what phase of engagement is being assessed (Pellerin et al., 2010).

6.6.1.1.4 Presence

The results indicated that participants experienced a moderate degree of presence in the virtual world intervention. This can be supported by previous research, which indicates that the Second Life® virtual world can create a degree of presence for users (Ata, 2016; Girvan, 2018).

6.6.2 Strengths and limitations

6.6.2.1 Methods and methodologies

There are several limitations; the small sample size may have led to insufficient power to detect differences between groups on secondary outcome measures.

Second, although this was a feasibility trial, the patients who consented to participate were high functioning as assessed by their baseline scores.

Third, there was no control over whether participants were attending other therapies or interventions. Therefore, there could have been some confounding effects. This could explain why some participants who dropped out still showed some improvements.

Fourth, this study only collected self-reported outcome measures and there was no follow-up period. Thus, future VR trials should recruit larger sample sizes along with a CG, with an extensive follow up period.

Fifth, adherence was not measured in this trial. One method of achieving this could have been to monitor the frequency and duration at which participants logged into the therapy website in between sessions. A similar method was conducted in a trial conducted by Roberts et al. (2017), where adherence was tracked through in-home treatment via an iPad finger-stroke activity. Therefore, future VR trials should consider adopting these types of methods.

Sixth, the candidate delivered the intervention and collected the feedback from participants. Therefore, it is possible that some participants may have not been entirely honest in their feedback.

6.6.2.2 Self-reported outcome measures

6.6.2.2.1 Feedback forms

There are many advantages to using end of session feedback forms to collect participants' experiences of participating in the virtual world. These forms were easy to use and quick to implement, thereby reducing participants' time to complete them. The anonymity participants had when completing the forms may have encouraged them to be more honest with their feedback.

However, there were some limitations to collecting feedback using this method. These forms only provided a brief overview of participants' experiences and opinions and did not provide in-depth feedback. Although participants would have had the option of providing in-depth feedback in a semi-structured interview post-intervention, they may have also wanted to do this immediately after each session. Furthermore, results from participant feedback forms cannot be used alone as a quality indicator. This is because these forms do not necessarily align with other measures of the intervention safety and quality and there was no pre-defined threshold of acceptability.

The aim was to develop a quick, easy-to-use feedback form, which participants could complete immediately. Although this was achieved with the number rating system, some of the form's statements were vague and could have been misinterpreted and overlapped with other statements. For example, 'suitable level of content (e.g., easy to understand)' and 'relevance and value of the content' could have been misinterpreted as meaning the same thing. Furthermore, these statements could have been perceived as meaning different things. For example, 'suitable level of content (e.g., easy to understand)' could be inferred as to whether the information is easy to understand or whether there was enough content covered in each session. Therefore questions should have been tested prior to the trial, to resolve any ambiguity.

Additionally technical difficulties, which led to feedback forms not being accessed and/or submitted. Two participants struggled to log into the website (where the feedback forms were located). Therefore, physical copies of their feedback forms were mailed to them, which they could complete. However, due to the time delay, they may not have been able to provide accurate feedback. All participants were asked to complete their feedback forms at the end of each session. However, when the feedback form data was collected at the end of the intervention, some participants had not submitted their feedback forms. Therefore, there was some missing data.

6.6.2.2.2 Presence questionnaire

Due to administrative errors conducted by the research team, the presence questionnaire was only administered to nine participants out of the 15 (60%), who took part in the VEEP intervention. Therefore, whilst participants reported a moderate degree of presence, findings need to be treated cautiously (Murad et al., 2018).

6.6.3 Conclusion

The results discussed in this chapter indicates that it is feasible and acceptable to deliver social cognition therapy in a virtual world to those diagnosed with FEP. Future trials require randomisation, a larger sample size with a longer follow up period and a control group. This would help to assess whether VR interventions can lead to significant improvements in emotion recognition, behaviour and functioning.

7. Study 4a - patient and public involvement (PPI) to assist with the design of the interview schedules for the VEEP trial

7.1 Introduction to the chapter and rationale

The results for this PPI study are provided below, followed by the discussion and conclusion.

PPI in research represents the active involvement between researchers and patients/lay individuals. In this study, participants contributed to the design stage of the interview schedule research process. The advantages of PPI included gaining insights into individuals' attitudes and beliefs about the VEEP intervention. Therefore this enhanced the ecological validity of the research (Brett et al., 2014). Virtual worlds such as Second Life® have not been specifically developed for clinical purposes. Thus, it was important for the researchers and healthcare professionals to develop protected environments, which target the clinical needs of those with FEP (Gorini et al., 2008).

7.2 Results

Further information about the rationale, aims and methods can be found in the Chapter 3: Methods and Methodologies. Two participants were recruited and consented to take part in this study. Below are brief vignettes about participants Sophie and Ellie. They are written in present tense.

Vignette: Sophie

Sophie is a 27-year-old female who has various experiences working and volunteering for mental health services and charities. Sophie had taken part in the VEEP codesign process, before this PPI research study began.

Vignette: Ellie

Ellie is a 24-year-old female who has prior experience accessing child and adolescent mental health services in the UK. Therefore, as she is an expert by experience, she has contributed to the design and development of many mental health research studies that target children and young people. Ellie had taken part in the VEEP co-design process, before this PPI research study began.

Table 26 highlights the results in the form of categories, subcategories, and complete examples. The feedback was provided during the workshops and collated between the participants and the PPI facilitator (the candidate). Table 27 and 28 provide the changes that were subsequently made to the interview schedules.

Category 1: Thorough questions covering all aspects of the treatment process

Sophie and Ellie provided positive feedback on the interview schedules and stated that the questions covered all aspects of the intervention. Participants were going to be asked about their prior experiences of group therapy and technology. They were being given the opportunity to give feedback on both the virtual world environment and the therapy itself and provide feedback on whether the treatment impacted on their mental health. Participants would be asked about the benefits and disadvantages of taking part in a novel intervention and discuss whether it could be implemented sufficiently into daily life. Participants would also be asked to mention and expand on whether any improvements could be made.

Category 2: Prior experiences of group treatment

After discussions with the PPI facilitator, Sophie, and Ellie both suggested that further questions be asked about participants’ prior experiences of attending group therapy. This would allow the interviewer (the candidate) to understand participants’ prior experiences of engaging with a group, the impact they felt it had on their therapy, and how it compares to their participation in the VEEP intervention.

Category 3: Digital expertise and the preconceptions of the VEEP treatment

Sophie and Ellie both stated that it was important for the interviewer to collate feedback on participants’ perceptions of technology usage and how it compared to those individuals they know. Furthermore, it would be vital to assess whether participants had used technology to assist with their mental health and wellbeing before taking part in VEEP.

Category 4: Experiences of the VEEP treatment

Sophie and Ellie provided detailed feedback on the improvements and alternatives that could be made to the interview schedules. They suggested that more clear and concise questions should be implemented to gather more information about participants’ prior experiences and opinions of group therapy and technological treatment. This is because it would take into consideration the nuances in participants’ responses to the VEEP treatment. As a result, patterns could emerge, and connections could be made. Sophie and Ellie also suggested that many questions needed to be rephrased, made clearer with ‘jargon’ being removed. This is important so that participants are aware of what has been asked of them.

The below table provides further detail on the categories discussed in the PPI sessions with two participants.

Table 26: PPI results for the VEEP qualitative interviews

Categories	**Explanations**
Specific questions covering all aspects of the treatment process	1. Series of questions asking participants about their experiences of group treatment prior to the VEEP treatment. 2. Series of questions asking participants about their digital expertise and preconceptions of VR prior to the VEEP treatment. 3. Series of questions asking participants about the VEEP treatment, which includes their opinions of the Second Life® environment itself, the treatment, and the use of avatars to attend and receive treatment. 4. Series of questions about how the VEEP treatment fit into participants' daily routine. 5. Series of questions asking about the impact the VEEP treatment had on participants' ability to manage their mental health. 6. Series of questions about the overall benefits and disadvantages (if any) of taking part in this intervention.

	7. Series of questions asking participants about what improvements could be made (if any) on the VEEP treatment. This includes asking participants whether they had concerns about their privacy.
Prior experiences of group treatment	1. Participants should be asked more detailed questions about their prior experiences of being in group therapy. They should be prompted on the following: • When they attended therapy • The length of the duration • The size of the group • The dosage of the intervention
Digital Expertise and the preconceptions of the VEEP treatment	1. Participants should be asked whether they believe they use technology more than their peers or not. 2. Participants should be asked whether they have used technology to use or monitor their mental health prior to the VEEP treatment.
Experiences of the VEEP treatment	1. Expand on the question and ask participants about whether they had any technical difficulties throughout the VEEP treatment. 2. Expand on the question and ask participants if they also received the relevant tools to use the Second Life® environment. 3. The question about Second Life® should be rephrased, and participants should be asked about what features they did like and did not like.

	4. Another question about Second Life® should be rephrased, and participants should be asked about what aspects of Second Life® had a positive impact and what aspects of Second Life® had a negative impact (if any). 5. Participants should be asked about their experiences of using Second Life® to attend therapy. 6. Participants should be asked about whether they feel connected to their avatar or not and why. Here participants should be prompted on specific visual representation, movement and facial expressions of the avatars and others. 7. The words about vividness and realism regarding Second Life® should be rephrased, as participants may not understand what that means. Instead, participants should be asked about whether they liked the computer-generated aspect of Second Life® and whether it was too realistic or not. If it is or not, how did that impact their experiences? 8. Participants should be asked about the movement, style, and physical appearance of the avatar and its impact on their connection with the avatar.

Tables 27 and 28 below provide the changes that have been made to the interview schedules.

Table 27: VEEP semi structured exit interview guide (completers) updates

Interview Section	Original Question(s)	Updated Changes
Interviewer instructions		a) Explain that they can stop and take a break at any point in the interview (if they would like). b) Explain that they do not have to answer a question if they do not want to. c) "It is important for us to learn from people's experiences of using the VR environment in order to assess whether or not using the 'environment' can be useful in supporting people with mental health problems."
Perceptions of the group	a) If you have what were your experiences of it? (Prompts: did it work for your or not? What was good about it or not?)	a) If you have what were your experiences of it? (Prompts: did it work for your or not? What was good about it or not? How long was this group treatment? What was the size of the group? How many people were in the group?)

Digital expertise and prior thoughts of the treatment		a) How does your usage of technology compare to your peers? b) Have you ever used technology to monitor or improve your mental health? If you have, what are your experiences of it?
Virtual reality platform and treatment		a) How did you feel when the treatment ended?
Experiences of using a virtual reality platform	a) What aspects of the intervention had the most impact? b) What aspects of the intervention had the least impact? c) Did you feel like you were actually part of the virtual world? Can you describe how it felt? d) To what extent did you feel your avatar represented you? If it did, can you explain in what way? (Question on embodiment)	a) What were the most memorable parts of the treatment? b) What were the least memorable parts of the treatment? c) Did you feel like you were actually part of Second Life®? Can you describe how it felt? If no, then what improvements can be made? d) Did you feel your avatar represented you? Can you explain why it did or did not? (Prompts: encourage questions about the movement of

		the avatar, style, visual appearance, facial expressions).
Fitting in with everyday life	a) How well did using the VR environment fit into your everyday life? (Prompts: timing of the sessions, duration, dosage of the intervention). b) Have you shown it to anyone else or discussed the VR environment with anyone else?	a) How well did using the VR environment fit into your everyday life? (Prompts: timing of the sessions, duration, dosage of the treatment). b) Have you discussed the VR environment with anyone else?
Impact on managing mental health	a) Do you think you are aware of your mood and symptoms more / less now than before using the VR environment?	a) Are you coping better or worse since using the VR environment?
Benefits and problems		a) How did you find committing to this treatment?
What could be improved?	a) Is there anything else you would like to tell me that we've not talked about but might be important for me to know about how to improve the 'app'?	a) Is there anything else you would like to tell me that we've not talked about but might be important for me to know about how to improve the virtual world? Did you feel more or less confident in engaging with the therapy because

		it was in VR?
Concluding remarks	b) End interview, thank participant, explain what will happen to the information discussed, offer to provide summary of study findings when available.	a) Finally, may I ask how you have found being involved in this interview? b) End interview, thank participant (your responses are very useful and will help other individuals diagnosed with psychosis), explain what will happen to the information discussed, offer to provide summary of study findings when available.

Table 28: VEEP semi structured exit interview guide (non-completers) updates

Interview Section	Original Question(s)	Updated Changes
Interviewer instructions		a) Explain that they can stop and take a break at any point in the interview (if they would like). b) Explain that they do not have to answer a question if they do not want to.
Perceptions of the group	a) If you have what were your experiences of it? (Prompts: did it work for your or not? What was good about it or not?)	a) If you have, what were your experiences of it? (Prompts: did it work for your or not? What was good about it or not? How long was this group treatment? What was the size of the group? How many people were in the group?
How does technology compare to your peers?		a) What were your experiences / perceptions / thoughts of VR prior to beginning the treatment? (Prompts: have you heard of it before? If you have, what did you hear about it?).

		b) Have you ever used technology to monitor or improve your mental health? If you have, what are your experiences of it?
Virtual reality platform and treatment	a) Did you have any difficulties using the environment in the beginning? b) Do you feel you had enough information to help you to use the VR environment? What other information could have provided to help you?	a) Did you have any difficulties using the environment in the beginning? If you did, did these difficulties persist during the treatment? b) Do you feel you had enough information to help you to use the VR environment? Could we have provided any other information or tools?
Experiences of using a virtual reality platform	a) What are your views on the Second Life® environment to deliver the intervention? b) What features (if any) of Second Life® did you respond well to? (Prompts: what did you think about the different therapy rooms, the beach relaxation area, the cinema, the café etc.) c) What aspects of the intervention had the most impact?	a) What are your views on the Second Life® environment to deliver the treatment? b) What features (if any) of Second Life® did you like or not like? (Prompts: what did you think about the different therapy rooms, the beach relaxation area, the cinema, the café etc.) c) What were the most memorable parts of the treatment?

	d) What aspects of the intervention had the least impact? e) Did you feel like you were actually part of the virtual world? Can you describe how it felt? f) To what extent did you feel your avatar represented you? If it did, can you explain in what way? (Question on embodiment)	d) What were the least memorable parts of the treatment? e) Did you feel like you were actually part of Second Life®? Can you describe how it felt? If no, then what improvements can be made? f) Did you feel your avatar represented you? Can you explain why it did or did not? (Prompts: encourage questions about the movement of the avatar, style, visual appearance, facial expressions).
Fitting in with everyday life	a) How well did using the VR environment fit into your everyday life? (Prompts: timing of the sessions, duration, dosage of the intervention). b) Did you miss being part of the intervention once you withdrew?	a) How well did using the VR environment fit into your everyday life? (Prompts: timing of the sessions, duration, dosage of the treatment). b) Did you miss being part of the treatment once you withdrew? c) Have you discussed the VR environment with anyone else?

	c) Have you shown it to anyone else or discussed the VR environment with anyone else?	
What could be improved?	a) What were your reasons for withdrawing from the intervention early? (Prompts: was there something about the intervention you did not like? Did it involve the intervention dosage/length of sessions?) b) Based on your reasons for withdrawing are there any ways in which the therapy sessions or the VR environment could be improved? (Prompts: what is your ideal number of sessions?) If yes, can you describe to me what your ideal VR therapy would look like?	a) What were your reasons for withdrawing from the treatment early? (Prompts: was there something about the treatment you did not like? Did it involve the treatment dosage/length of sessions?) b) Are there any ways in which the therapy sessions or the VR environment could be improved? (Prompts: what is your ideal number of sessions?) If yes, can you describe to me what your ideal VR therapy would look like? c) If you had the opportunity, would you like to begin another VR treatment? d) Did you feel more or less confident in engaging with the therapy because it was in VR? e) Do you feel it was the ‘right time’ for to engage

		in this treatment? Please explain why.
Concluding remarks	b) End interview, thank participant, explain what will happen to the information discussed, offer to provide summary of study findings when available.	a) Is there anything else you would like to ask, which has not been covered in the above questions? b) End interview, thank participant (your responses are very useful and will help other individuals diagnosed with psychosis), explain what will happen to the information discussed, offer to provide summary of study findings when available.

7.3 Discussion

In this discussion, the candidate outlines the contributions of the PPI workshops in shaping the VEEP service user interview schedules. The format of the workshops was efficient in collecting the opinions and feedback from both participants. Therefore, this ensured that the questions asked were more open ended and concise, and in a language understandable to participants. The improvements and alterations were implemented into the semi structured interviews.

Simplifying language and questions

Although reviewing participant documents and information is viewed as a common purpose of PPI, there are a limited number of publications on this (Furniss et al., 2016). In this PPI study, participants reviewed the semi structured interview schedules in detail and provided helpful feedback. One of the critical aspects was language; Sophie and Ellie highlighted the challenges with using complex terminology. Furthermore, they encouraged the candidate to provide full consideration to how service users may interpret expressions. An example of this was the use of the word ‘embodiment’ in a question. Whilst the candidate wanted to collect information on how the service users felt in using an avatar to attend therapy, both Sophie and Ellie highlighted that this word is academic and challenging to understand.

Answering the research question and gathering as much information

Table 27 and 28 provides the complete details about the changes made to the interview schedules before and after the PPI workshops. Both Sophie and Ellie reiterated the importance of ensuring that the questions gathered as much information from the service users. Therefore, this ensured that prompts were included under the question. This means that the candidate could tailor the questions depending on the outcome of the questions.

Prior to the PPI workshops, the questions solely focused on gathering information on the service users' experiences of attending the VEEP therapy. However, both Sophie and Ellie explained that it would be essential to put these experiences into context by asking further questions about their experiences and confidence in using technology.

7.3.1 Strengths and limitations

There are many strengths to the methods by which this PPI research was conducted. PPI participants adopted considerable responsibilities in this research. Furthermore, the editing decisions that were formulated, were based on the views and feedback of those young individuals.

PPI research needed to be conducted with flexibility to ensure that all of those who wanted to contribute could do so. Therefore, short sessions organised at a time that was manageable for PPI participants was vital. A designated quiet space was found at WMS to enable PPI participants to provide their contributions.

When considering the findings from this PPI study, it is vital to consider the limitations. It is generally acknowledged that PPI activities usually recruit a self-selecting group of individuals who are unlikely to represent the population (Andrews et al., 2015). NIHR INVOLVE does state that researchers should ensure that participants are representative.

Only two PPI participants were recruited and so, therefore, are not representative of individuals diagnosed with FEP. Furthermore, whilst PPI participants were reimbursed for their travel expenses, there were insufficient resources in their research budget to pay PPI participants for their time. This may have had a detrimental impact on the recruitment process, as some individuals may have decided not to volunteer to take part (INVOLVE, 2011). The PPI participants had worked on the previous co-design process in the development of the intervention. Therefore, they were experienced in PPI and were aware of the trial's aims and objectives.

Additionally, it may have been beneficial to recruit PPI participants who were healthcare professionals who could have provided feedback on the interview schedules for clinicians. Despite this, the healthcare professionals, and experts in the VEEP research team reviewed and provided feedback on the interview schedules.

7.4 Conclusion

Therefore, the findings collected from workshops provided valuable insights and were highly beneficial in improving the interview schedules for the VEEP intervention, thereby ensuring they were patient centred. Thus, PPI is meaningful and has led to an improvement in the quality of the study.

8. Study 4b - a qualitative investigation of the SCIT delivered via a virtual world for those diagnosed with FEP - the VEEP trial

A Feasibility and Acceptability Trial of Social Cognitive Therapy in Early Psychosis Delivered Through a Virtual World: The VEEP Study

Reference: Thompson, A., Elahi, F., Realpe, A., Birchwood, M., Taylor, D., Vlaev, I., Leahy, F., & Bucci, S. (2020). A feasibility and acceptability trial of social cognitive therapy in early psychosis delivered through a virtual world: The VEEP study. *Frontiers in Psychiatry*, 11: 219.

Author contributions

AT, SB, MB, IV, and DT wrote the grant application for this feasibility and pilot trial. AT, AR, DT, and **FE** were responsible for coordinating the design of the virtual world. AT, AR, and **FE** conducted the co-design workshops. AT, **FE**, FL, and AR undertook the trial. AT drafted the manuscript. **All investigators** have been involved in revising the report, and all authors have seen and approved the final version.

FE conducted the interviews and analysed the qualitative data reported in this doctoral thesis chapter. The above published paper on the VEEP trial published some of the codes and the quotes from the analyses.

8.1 Introduction to the chapter

This chapter provides further information on the participants, reports on the results and provides a discussion. The aims and methods are outlined in Chapter 3: Methods and Methodologies. The VEEP qualitative interviews themes are illustrated in figure 35.

8.2 Participant information

Below is a table which outlines interview participants' prior experiences with digital technologies. This information was gathered from the semi structured interviews. Most participants had access to at least one type of digital technology and internet access. Only two participants (13.3%) had previous experience with VR technologies.

Table 29: Participants' experiences of digital technologies prior to taking part in the VEEP Trial

Type of Digital Technology Use	Number of Participants (n=15)
Access to Digital Technologies	Smart Phone – 11
	Computer/laptop – 9
	Tablet – 8
Internet Access	11
Social Media	9
Video Games	8
Used Digital Technologies for Health	Apps – 4
	Internet Search – 1
	Online Forum – 1

	Digital Mental Health Interventions - 3
Prior VR Experience	2
Advanced Computer Skills (via education/employment/training)	3

Below are brief vignettes for each participant that completed an interview. The vignettes are written in present tense and are correct at the time of the interviews.

Table 30: Qualitative interviews participant vignettes

Name	Vignette
Emma	Emma is a 28-year-old British female. She has two children. She is currently prescribed Aripiprazole 400mg. She was a participant in group one and did not attend any sessions. As she had not formally withdrawn from the study, she was classified as a non-completer.
Stacey	Stacey is a 31-year-old British female. She has one child. She is currently prescribed Aripiprazole 400mg. She was a participant in group one and attended six out of eight sessions. Therefore, she was classified as a completer.
Amir	Amir is a 20-year-old British male. He has recently completed his A levels and is waiting to begin university in the next academic year. He is currently prescribed Aripiprazole 30mg. He was a participant in

	group one and had attended six out of eight sessions. Therefore, he was classified as a completer.
Nancy	Nancy is an 18-year-old British female. She is attending college (further education). She is currently prescribed Abilify Maintena 40mg. She was a participant in group two and had attended five out of eight sessions. Therefore, she was classified as a completer.
Susan	Susan is a 35-year-old British female. She has three children. She is currently prescribed Aripiprazole 10mg. She was a participant in group two and had attended three out of eight sessions. Therefore, she was classified as a non-completer.
Eric	Eric is a 25-year-old British male. He is unemployed. He is currently prescribed Aripiprazole 30mg. He was a participant in group two and had attended six out of eight sessions. Therefore, he was classified as a completer.
David	David is a 20-year-old British male. He is currently prescribed Aripiprazole 5mg. He was a participant in group two and had attended seven out of eight sessions. Therefore, he was classified as a completer.
John	John is a 25-year-old British male. He is currently prescribed Aripiprazole 400mg. He was a participant in group three and had attended six out of eight

	sessions. Therefore, he was classified as a completer.
Patrick	Patrick is a 24-year-old British male. He is currently prescribed Clozapine 275mg. He was a participant in group three and had attended seven out of eight sessions. Therefore, he was classified as a completer.
Stephen	Stephen is a 27-year-old British male. He is currently prescribed Aripiprazole 5mg. He has one child. He was a participant in group three and had attended seven out of eight sessions. Therefore, he was classified as a completer.
Luke	Luke is a 38-year-old British male. He is currently prescribed Aripiprazole 400mg. He has four children. He was a participant in group four and had attended one session only. Therefore, he was classified as a non-completer.
Eddie	Eddie is a 19-year-old British male. He is currently prescribed Olanzapine 10mg. He was a participant in group four and had attended six out of eight sessions. Therefore, he was classified as a completer.
Alex	Alex is a 27-year-old Russian male. He is currently prescribed Olanzapine 10mg. He had completed an undergraduate degree. He was a participant in group four and had attended all sessions. Therefore, he was classified as a completer.

Toby	Toby is a 39-year-old British male. He is currently prescribed a series of medications. He has one child. He was a participant in group five and had attended all sessions. Therefore, he was classified as a completer.
Rachel	Rachel is a 28-year-old British female. She is currently prescribed Quetiapine 600mg. She was a participant in group five and had attended one out of eight sessions. Therefore, she was classified as a non-completer.

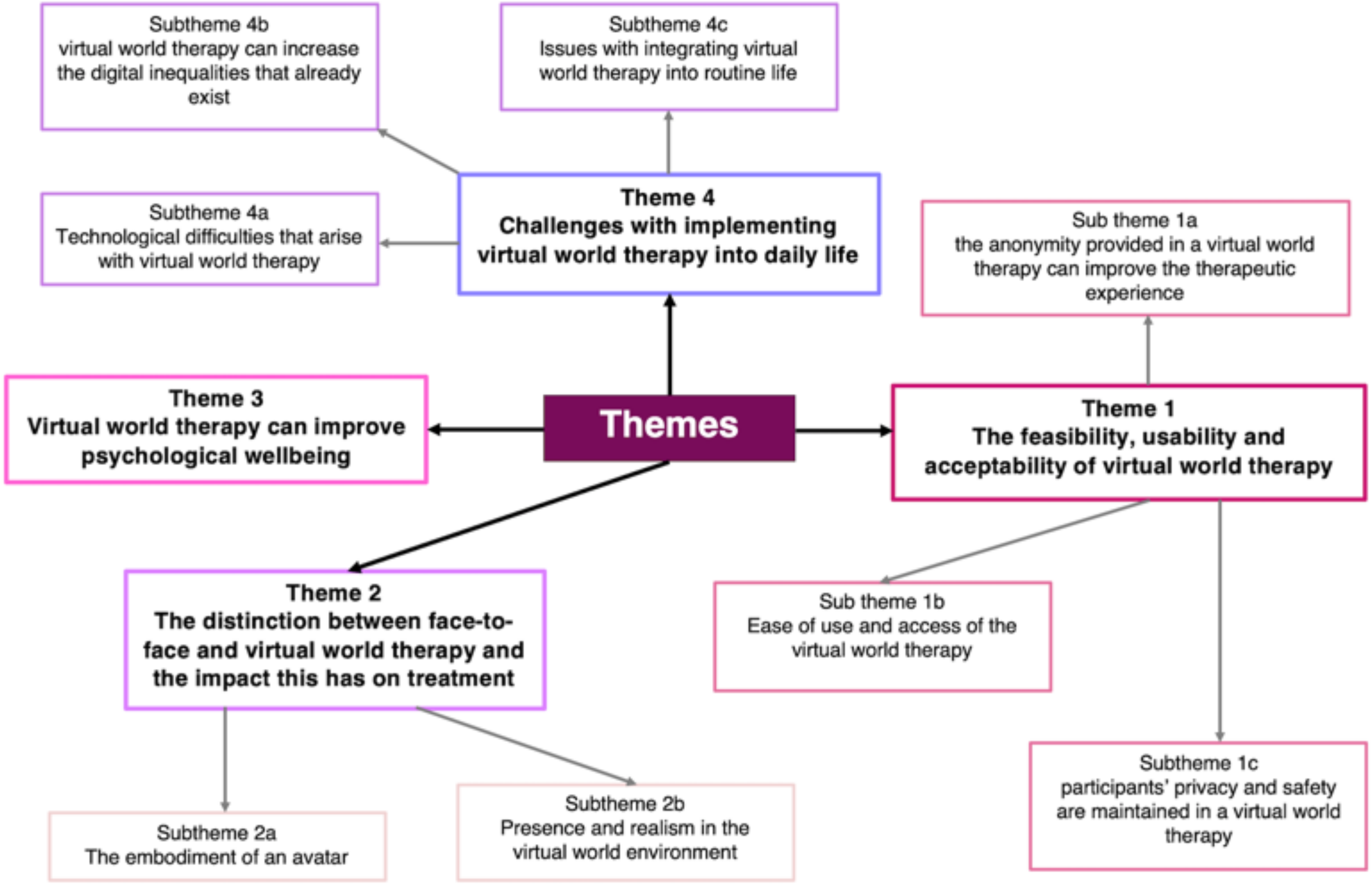


Figure 35: VEEP qualitative interviews themes

8.3 Qualitative results

Theme 1: The feasibility, usability and acceptability of virtual world therapy

Sub theme 1a: The anonymity provided in a virtual world therapy can improve the therapeutic experience.

Participants used avatars to interact with and communicate with one another in a virtual world, Second Life®. According to participants, one of the benefits of virtual world therapy was anonymity (Dilgul et al., 2021; Rehm et al., 2016) Those with FEP typically struggle with social anxiety and so, therefore, creating an environment where they are comfortable to engage with others is essential (Michail et al., 2017). Thus, the virtual world provided them with the freedom to express themselves (Dilgul et al., 2021; Rehm et al., 2016). This sense of anonymity was a motivation to attend this therapy because participants had a sense of invisibility and therefore felt they would not feel judged by others:

> "Cause I'm face-to-face, I know they can judge me so that's why I don't like doing it face-to-face? So it's better for it-it virtual reality" [Nancy, Lines 289-290]

Below, Amir suggested that the anonymity allowed them to control how to present themselves, which helped with their confidence:

> "You can-you can kind of pick who you want to be. Do you know what I mean? So you're not self-conscious. You're not thinking, you're not thinking…you're not thinking to yourself 'Oh what if this person's thinking this about me?'" [Amir, Lines 211-214]

Participants reflected on the challenges with being open about their feelings and difficulties in a face-to-face setting, due to their vulnerability of perceptions of being criticised and stigmatised by other attendees. Therefore, a virtual world therapy setting allowed participants to be open and honest, thereby disclosing details about their psychosis and wellbeing. This is known as dissociative anonymity, which is where participants can separate their real-world identity with their actions online (Anthony and Nagel, 2009; Suler, 2004):

> "Cause I didn't know them, I didn't think it would be too much of an issue. So I said some certain things about like my psychosis." [Amir, Lines 567-569]

The sense of anonymity allowed participants to feel they could be honest and disclose their feelings and emotions to others. This contrasts with face-to-face group therapy, where participants stated that they did not feel they could act in this manner. Furthermore, the virtual world created a barrier between participants, thereby minimising any hostility and negativity between one another:

> "Yeah I think it does, no I absolutely think it does because being anonymous you can say what's on your mind you know, erm being in a face-to-face group an' people know you, if you say something that's slightly controversial you're gonna get that negativity back from the rest of the people…" [Toby, Lines 346-350]

Anonymity also impacts the connections and friendships participants develop during group therapy. One of the benefits of group therapy is the peer support one receives from other individuals (Repper and Carter, 2011; Strand, Eng and Gammon, 2020). Here attachments do develop between participants. However, these friendships and attachments end when group therapy finishes, which can be difficult for participants to process (Barrett et al., 2008). It can be akin to loss (Rábu, Binder, and Haavind, 2013). Therefore, virtual world therapy can reduce the intensity of these feelings:

> “Its better to do this virtual reality an not see anybody, than not have it drag on for three months, like I’ve been oncourses in the past, nothing to do with mental health. You form relationships with people, little bonds and after that time’s up it’s done.” [Stephen, Lines 194-197]

Although virtual world therapy is not necessarily a substitute for face-to-face treatment, it can allow participants to access evidence-based psychological treatment, thereby improving access to care and extending choice.

Sub theme 1b: Ease of use and access of the virtual world therapy

Virtual world therapy provided participants with the opportunity to access interventions online, thereby overcoming well documented barriers such as finance, geographical location, and health (Dilgul et al., 2021). Therefore, it allowed them to participate in treatment in an area that was comfortable to them, without the challenges associated with travelling. Participants with FEP traditionally struggle with social anxiety, leading to difficulties in attending face-to-face group therapy. Here feelings of self-doubt, confidence and overthinking can disrupt the therapy process for these individuals. However, virtual world therapy appeared to reduce this barrier and was viewed as a motivation to attend:

> “Yeah the virtual aspect was really really helpful because you know like wh-when you’ve got psychosis you’ve not got a lot of confidence, so erm going into a real group therapy is quite hard? Erm its….’cause and you know like you’re really really self-conscious erm you know it-it’s very

> hard to turn up to a group therapy but ‘cause it was online ‘cause it was virtual it was a lot, it made it a LOT easier for me to like erm take part ina-ina- in a group therapy.” [Amir, Lines 74-79]

The virtual world removed them from a clinical setting and allowed them to attend therapy in their own homes, as a relaxing, less hostile, and comfortable environment:

> “Err….me pers-err..it’s probably better that for one, like I said before, grouping strangers all together in a room in reality you know is, is gonna be, is gonna be a lot more long winded because of just people’s personalities bouncing off each other. That’s just a fact.” [Stephen, Lines 139-142]

Stephen compares attending virtual world therapy with attending school, thereby highlighting the structured sessions and activities. Participants viewed virtual world therapy as a simple and interactive method to organise and work through the content, allowing them to develop their social skills and coping strategies. Here participants had the option to review content in between sessions and thereby work at their own pace. Participants were encouraged to take time, particularly between sessions, to review content if they needed to. They could access this via the library in the virtual world. This was particularly useful for those participants who may have missed a session. Therefore, this allowed them to feel empowered to take control and manage their learning in a way that was suitable for them:

> “Er in the first few sessions, I did look over the sessions in general and er like, I think…during the end of the previous session, I would look at the next session and see what the plan is to sort of have an idea, yeah.” [Alex, Lines 230-233]

Virtual world therapy was expressed by participants as a method to facilitate understanding of social cognition via clear and accessible information on topics such as social awareness, emotion recognition and how they perceive social scenarios (Didehbani et al., 2016; Kandalaft et al., 2013). This information allowed them to make connections between their psychosis and emotions, which allowed them to formulate patterns of behaviour further:

> "I think it is a good way 'cause of the..signal like looking at the faces and stuff like that, I think it's a good way 'cause you have to look at the...signs and their face" [Eric, Lines 175-177]

A common concern amongst VR therapies is that interventions do not go as in depth, when compared to face-to-face treatment (Baniasadi, Ayyoubzadeh and Mohammadzadeh, 2020). The SCIT contains a stepped care approach, where participants could practice their emotion recognition knowledge in planned scenarios. In face-to-face treatments, this would involve patients practicing their skills in real life. However, in the virtual world, participants experienced in vivo exposure, which allowed them to practice how they would systematically approach challenging situations. Therefore the participants felt that the therapist had the opportunity to monitor participants' development and provide feedback in real time:

> "As you went through it, you began-it became more like evident how err it was relevant 'cause I said when we first…" [Eric, Lines 312-313]
> "It-the like when we did the study at the start err….the study at the start where we had to recognise the facial expressions and stuff like that. That became more relevant how that was relevant towards the end if you see what I mean?" [Eric, Lines 317-320]

During this in vivo exposure, participants were given feedback in real time, which helped them develop.

Participants provided the virtual world therapists with positive feedback and felt that they were being taught efficiently. The sessions were structured with aims and objectives, and there was significant material that participants could access easily via the virtual world. This included PowerPoint presentations, videos, worksheets, and posters in the therapy room:

> “I think the the content was delivered...comprehensively during the the presentations, during the the the sessions, I didn’t feel I needed to go back and re-read anything.” [Toby, Lines 435-437]

This can be supported by comments submitted in the VEEP feedback forms:

> “(Candidate’s name) explained everything very well and clearly so I could understand what the course is about and what we be doing during the sessions.” [Rachel]

This contrasts with face-to-face treatment, where therapy rooms may not have a television screen or a computer that everyone can view. Thus, when organised efficiently, virtual world therapy is a rich resource that can assist individuals in contextualising and understand their experiences:

> “I thought it was easier to understand and it was laid out well enough that I could follow the course really easily and I never had any problems understanding what was happening or... yeah. It was perfect, I would say that yeah. In that way.” [Alex, Lines 177-181]

Sub theme 1c: Participants' privacy and safety are maintained in a virtual world therapy

Traditionally, one of the primary concerns of VR therapies is that participants' privacy and confidentiality may be compromised (Boeldt et al., 2019; Yellowlees, Holloway and Parish, 2012). This is because participants are disclosing information online. Furthermore, there are concerns that those other individuals could access this data and information. However, in this virtual world therapy, all participants confirmed that they felt safe, secure, and believed their privacy was being maintained:

> "I think it was safe yeah no I don't think erm I had any concerns of like you know people listening in who shouldn't be or (sighs) people able to access (sighs)..." [Toby, Lines 523-525]

One of the reasons why participants did not have any concerns is that the therapists and RA provided participants with detailed training on using Second Life®. Second Life® data privacy and security regulations were discussed with participants, and the research team implemented further regulations. An example of this was that participants were provided with their usernames and logins, which were anonymised. Furthermore, participants were also provided with options to further maximise their privacy; participants were told that they should not provide personal information, if they wanted to use text chat. Participants also had the option to use a pseudonym when introducing themselves to others:

> "Yeah you you gotta take part so you have like the code or username and stuff like that" [Toby, Lines 325-326]

Providing participants with options led to a sense of empowerment and control over the therapeutic process, which enhanced their experience.

Theme 2: The distinction between face-to-face and virtual world therapy and the impact this has on treatment

This theme discusses the unique qualities the virtual world therapy has on participants' treatment experiences and how this contrasts with face-to-face.

Sub theme 2a: The embodiment of an avatar

This sub theme represents participants' process of choosing their avatar, connection with their avatar and the extent to which they felt it portrayed them in the virtual world.

Within Second Life®, users create self-avatars, which are 3D representations of themselves, which allow them to socialise and explore this 3D virtual world. During the pre-intervention sessions, participants were asked to select an avatar. Participants were instructed not to choose extravagant avatars such as a vampire for example. All participants abided by this.

Furthermore, all participants maintained a consistent identity in the virtual world. This meant that they kept the same avatar throughout the treatment and avoided changing their appearance. This consistency allowed participants to establish a stable connection with the virtual community and become familiar with themselves.

Selecting and modifying a self-avatar involves making judgements on the avatar's aesthetics (such as appearance); participants' personality and aspirations can influence these decisions (Aymerich-Franch, Kizilcec and

Bailenson, 2014; Gottschalk, 2010; Mitra and Golz, 2016). However, participants provided mixed responses as to whether they were active or passive in their choice to avatar, and whether they chose an avatar, that was an extension of a physical self. Many participants did not think it was essential to create an avatar that accurately represented their physical appearance.

Susan and Eddie stated that they used the avatar that appeared to be the default avatar and did not appear to give much thought to its appearance:

> “I think it when I went on, it was already the one that was on it so yeah I just stayed for that one” [Susan, Lines 215-216]

> “I think I just put it as one of the default one’s I guess from the standard one’s, and I just left it I suppose” [Eddie, Lines 182-183]

Amir claimed that the physical representation of the avatar was not an essential factor to consider in virtual world therapy. This indicated that this participant felt very physically disconnected from their avatar and merely saw it as a virtual body. Furthermore, they did not want their avatar to physically represent them because they felt that it would increase their vulnerability by opening them up to criticism:

> “Yeah I was quite happy with the default but…but at the same time, I probably would pick one that didn’t represent me because I didn’t want to be judged.” [Amir, Lines 288-289]

Other participants felt differently and did choose an avatar that they felt closely represented them as much as possible, and therefore was an extension of the physical world. They wanted other participants to understand what they looked like and thus understand and identify with them more. Stacey believed that the visual representation of the avatar influenced how other participants may perceive you:

> “You kind of got a jist of what I looked like and...what I was about” [Stacey, Line 198]

Although Stephen did not select an avatar that physically resembled themselves, they subconsciously picked an avatar that resembled other avatars they had used previously. This indicates that they may have wanted to maintain a connection with their avatar:

> “Yeah he actually had ginger hair, anything I’ve ever used in my life as an avatar has got ginger on it or in the name. I don’t know why.” [Stephen, Lines 340-341]

Thus, this indicates that the participant’s experience of creating an avatar is individual and personalised to them. Nevertheless, there was continuity and consistency with all participants choosing to keep their avatar throughout the treatment. Therefore, this represents an attachment to the avatar.

Sub theme 2b: Presence and realism in the virtual world environment

This sub theme represents the extent to which participants experienced a sense of presence and realism in the virtual world and their impact on their therapeutic experience.

Participants provided mixed responses on their feelings of presence and realism in Second Life®. The aim of the virtual world therapeutic environment was to provide a simulation of reality. Therefore, participants were asked to avoid choosing extravagant avatars (i.e., vampires), and this is why certain functions were disabled (i.e., the ability for avatars to fly or jump off buildings). For some participants, they felt like they were in a real-world setting, which had a positive impact on their treatment experience:

> "Was really good, meant to feel like I was actually in the world and all that so." [Nancy, Lines 245-246]

Similarly, other participants felt that the feeling of immersion in the virtual world enhanced their sense of realism. Subsequently, this allowed them to feel like whatever skills they could learn and practice in the virtual world could be applied to real world settings. Thus, participants recognised that their reactions in the virtual world were very similar to what it would be in the real world:

> "It may-may have made me feel like I was in more of a real life setting and which would've been oh-okay because it would've got me out of my comfort zone." [Amir, Lines 369-371]

However, some participants felt that the virtual world did not represent reality, which subsequently reduced their sense of presence. They claimed that this was because the graphics of the virtual world were not realistic enough, and so therefore, the avatars were not realistic representations of participants. This may have led to a lack of investment in the virtual world and its ability to impact on reality:

> "That's why I'm saying it was quite disconnected from reality because even though there have been several er characters which were representing people that were saying things bec—because of the graphics and the quality there were, all I could hear was the voice being played." [Alex, Lines 354-357]

Alex referred to the artificial avatar characters, ‘My Fault Mary,’ ‘Easy Eddie,’ and ‘Blaming Bill’ (see appendix 34 for more information). The emotions on the characters face combined with their pre-recorded voices reduced their sense of realism. Therefore, according to some participants, they ended up being viewed as video game characters. Similarly, Susan and Eric felt that the restriction in the avatar’s movements and the absence of complex facial expressions reduced presence:

> “Yeah I thought they were really good, erm their body movements. I struggled to get ‘em to sit down but erm I’m sure if someone like showed me again I’d remember.” [Susan, Lines 228-230]

> “Ermmm, they didn’t really have facial expressions. I thought they were good in terms of walking around, being able to walk around and just stuff like that. Yeah I thought that was good.” [Eric, Lines 263-265]

These thoughts can be supported by further research, which stated that presence could be increased by avatars, which provide synchronous visual-tactile feedback, leading to a full-body illusion (Kooijman, Happee and de Winter, 2019; Neo, Won and Shepley, 2021).

Participants also discussed how the virtual world lacked ‘nonvisual sensory information’ such as haptic feedback and other sensory contents (Ledoux et al., 2013). An example used in interviews was how participants could move their avatars to sit down in the therapy rooms. This was achieved by participants using their computer/laptop mouse and clicking on the chair resulting in the avatar sitting in the chair instantly. However, this does not include real elements, such as avatars walking towards the chair, moving the chair with their hands, and bending their knees to sit down. Therefore, this can hinder their sense of presence (Neo et al., 2021; Shi et al., 2019).

Alex felt that the lack of realism was attributed to academic teaching. Therefore, they thought that a lot of content was taught, but there were limitations in being able to apply this to the real world:

> "Well just the methods that we used to, I thought that they were not as closely connected to reality as they could be, 'cause 'cause some methods of behaviour and recognising different behaviours, was explained but er in real life its err obviously going to be very different. Like er the way it was explained it was a more academical level to understand the, just how to go about dealing with root causes of emotions etc. but in real life it's very different so." [Alex, Lines 94-100]

Furthermore, nonverbal communication is absent in interactions which can disconnect participants from the virtual world:

> "I don't know you can't like...I don't know. You just...face-to-face, you can understand people, like I can read people do you know what I mean? Body language and things like that. But you don't get none of that through virtual reality so I dunno, it's different for me like you can't...tell how what someone's, not what they're thinking but what how they react to certain things do you know what I mean?" [John, Lines 443-447]

The mixed responses to the virtual world's realism and presence may be due to various reasons. Presence can be considered a subjective experience influenced by the avatar, virtual world environment and gestures. There is a lack of awareness and understanding as to how these features collaborate to enhance presence. Features such as proximity, embodiment, eye contact and other non-verbal communication are utilised in intuitive and subjective ways by participants.

For some participants, hearing other people's voices in real time was enough to experience a sense of presence. For others, they wanted graphics to be as realistic as possible. Furthermore, there was some uncertainty about whether an increase in presence and realism improved their experience of virtual world therapy. Some participants stated that the graphics could be improved but did not explain what impact this would have on the treatment and wellbeing. As Stephen discussed, improving the graphics would not have made a significant difference to their experience:

> "Err I don't think you really need to. The the graphics and err everything that's using on that seems pretty good for the you you know for how old it is realistically. The only thing that you could do is use a, use a newer…a newer programme to just update it, the graphics and that, but then that's, there's no point to that really, that's not gonna increase anything. You can move around, you can talk, you can do everything, which is just fine you know." [Stephen, Lines 406-411]

These findings are supported by previous research, which has suggested that there is a mixed relationship between perceptual metrics and realism. For example, whilst some findings indicate that increased realism can increase the sense of presence (Gorisse et al., 2019; Slater et al., 2009), other studies have not (Vinayagamoorthy et al., 2004). Therefore, future research should focus on exploring the visual characteristics of VR and its impact on users' experience.

Theme 3: Virtual world therapy can improve psychological wellbeing

This theme represents the positive impact virtual world therapy had on participants' psychological wellbeing during and after the treatment. Many participants discussed how beneficial it was to connect with other individuals in similar circumstances, thereby receiving support and improving their confidence. This developed a sense of shared understanding:

> “Like in terms of my confidence I knew it was gonna boost my confidence. It was gonna give me something to look forward to. It had a positive impact on my mood ‘cause of that” [Amir, Lines 525-527]

For Amir, attending sessions had a positive impact and subsequently elevated his mood. Thus, virtual world therapy provided him with a sense of empowerment and confidence in taking responsibility for their wellbeing. The fact that this participant felt that this was something positive to focus on highlights the potential gap in treatment that is provided in EIP.

Like face-to-face treatments, some participants found that the peer support and social aspect of taking part in group therapy were valuable to their wellbeing. Many participants struggled to interact with others and felt extremely isolated in their physical lives. This virtual world therapy normalised their experience of psychosis and empowered them to develop their social communication skills. Participants thought they were able to socialise and establish bonds with other participants within a virtual environment:

> “The benefits of taking part were the social aspect of it. Socialising aspect of it” [Eric, Lines 466-467]

Many participants also chose to take part in this therapy because they wanted to improve their social cognition skills. They understood the therapy rationale, content and understood what to expect in the eight sessions. They understood that they found it personally challenging to interpret emotions and understand people’s behaviour. During their interviews, the emotion recognition session was frequently highlighted by participants as one of their favourite sessions.

This is because they were taught how to interpret facial expressions. For some participants, it was found to help them and offer benefits in their interaction with others:

> “Yeah the benefits would be finding out different aspects err of your emotions and how to deal with them and how to interact with other people, and interpret those emotions and this err course, all of this treatment gives you a very good overview of how to analytically pick out every situation and not just you know, follow your instincts perhaps or emotions and not get carried away.” [Alex, Lines 455-460]

However, for some participants, emotion recognition lectures helped them to think about how others were perceiving them. Thus, it has provided them with the skills to manage their own emotions further, which can subsequently improve social relationships and interactions. This can be supported by the ‘objective self-awareness theory’ (Silvia and Duval, 2001). In the context of virtual worlds, users are encouraged to focus their attention on themselves, thereby leading to a comparison between their ideal and actual selves. Here, for example, Nancy implies that their prior struggles with managing their emotions were having an impact on their socialisation:

> “Its changed my difficulties because like erm I know how to cope with if I’m angry or if I’m upset and like they could tell by my-my emotion that what’s up with me, if I’m angry or I’m-or I’m-or if I’m upset or happy” [Nancy, Lines 334-336]

Another significant part of the virtual world therapy was teaching participants about jumping to conclusions in social situations. Many individuals with FEP struggle with assessing social scenarios and jump to conclusions about why something has occurred and will have a specific view. The therapy encouraged participants to understand that jumping to conclusions derives from social cognition deficits and that there may be many reasons as to why something has occurred:

> "About...you know...what people, what you think they might mean and what they actually mean. You know like with facial expressions, you-you can come up and say, 'Oh were they were they giving me a dirty look?' When actually if you think about it they may be having a bad day or there maybe other reasons so...yeah I found that useful" [Susan, Lines 332-336]

For Susan, the virtual world therapy helped them acknowledge that there is a distinction between one's perception and reality. Feelings of anxiety and paranoia in those with FIP, combined with their vulnerability to jump to conclusions, means that often individuals may feel like they are responsible or are to blame (Brown, Tas and Brune, 2012; Thompson et al., 2012). This is what the 'My Fault Mary' character represents in the SCIT treatment. However Susan and many others, felt that the treatment helped them reduce their anxiety, self-doubt, and improve their confidence.

These findings can be supported by the comments submitted in the VEEP participant feedback forms:

> "Learned more about jumping CONCLUSIONS and guessing ☺." [David]

Stephen felt that the VEEP treatment allowed them to understand their thoughts and emotions more thoroughly, as well as a focus on what needs to be improved:

> "Err well just it just per-makes you evaluate things and yourself, you know? I'm always thinking, I spend all night thinking about what I'm gonna do, how I'm feeling, what I'm thinking, so...err it just helped towards that you know? Understanding things a bit better an everything else and what I need to work on an-an-an stuff like that." [Stephen, Lines 245-249]

Therefore in vivo exposure to social scenarios in the virtual world, helped participants improve their knowledge and skills. This can be supported by a Proteus Effect (Yee and Bailenson, 2007). This is when users form inferences about their expected characteristics from their avatar's appearance and behaviour and then adhere to these expected behaviours and attitudes.

Theme 4: Challenges with implementing virtual world therapy into daily life

Although there are several benefits of virtual world therapy for FEP, there are a series of challenges and difficulties with taking part in virtual world therapy.

Sub theme 4a: Technological difficulties that arise with virtual world therapy

Most participants experienced technical difficulties whilst taking part in the virtual world therapy. Table 31 illustrates the main technological challenges that participants experienced:

Table 31: Participants' technological difficulties during the VEEP intervention

Issue	Affected Users	Solution

Videos not playing on outdoor cinema screen	All	Participants asked to log into VEEP website and watch there or provided with direct link to video
Mic not working	Various	Change preference settings for audio input and output and re-start Second Life®
Unable to log into VEEP website	Susan, Patrick	Reminders of login details sent. However, some participants still unable to log in
Laptops shutting down/updating during session	John, Toby	Wait for laptop to restart and re-join session
Second Life® frozen with not responding error message	Stephen, Toby	Stephen – listened into session Toby – re-started laptop and re-joined session
Second Life® login failed or frozen/computer crashed	Patrick	Re-start computer and re-join session

Some of these technical difficulties could be considered ‘human errors,’ which meant that participants might have made errors using the technology. For example, a standard error was that many participants struggled to sync their microphone (where they could participate in a group chat) with the Second Life® programme. As a result, there were voice chat communication difficulties. The therapists were able to gather information about the most common forms of technological difficulties and provide prompt responses when these occurred. These issues were typically resolved immediately:

> “Not much. Literally not much. Everything (Research Associate’s name) set up perfectly. Like she put it on and all I had to do ‘cause she even

> saved my login details so I didn't even have to put them in once." [Amir, Lines 157-159]

> "Yeah. Err I when I couldn't get the links property they were sent straight away." [Stephen, Lines 128-129]

However, many technological issues were beyond the participants' control. Some participants experienced difficulties with using the Second Life® programme when the session was ready to begin:

> "The the system like whatever it was, I was, I don't know what was wrong with it. I post-I had to postpone the update" [Stephen, Lines 120-121]

Furthermore, technological difficulties were spontaneous, unexplained and had a detrimental impact on their attendance:

> "I would log in five minutes before the session, my computer would crash, and I would spend the next ten minutes trying to login, and I'll be five minutes late" [Alex, Lines 277-279]

It is more challenging to resolve technological difficulties when they were unexplained, such as what Toby experienced:

> "Oh yeah all the time erm it was def—it was hard to login, erm server wasn't recognised, world wasn't recognised, the avatars had different heads on" [Toby, Lines 247-249]

This uncertainty and lack of support can impact participants' experiences of taking part in the therapy. It led to feelings for some that the virtual world therapy is unreliable and inconsistent:

> "It was very frustrating, yeah a couple of times I thought about do you know what, you know I'm doing this…for you know, I'm volunteering to do this, and this is just stressing me out because you know you've got, you want to be on time, you don't want to be late…" [Toby, Lines 267-270]

However, many participants acknowledged that technical challenges do occur and are not within the control of the developers or therapists. For example, the therapist was not responsible for whether participants had a slow WiFi connection or whether the Second Life® viewer took a long time to load up. Nevertheless, future studies should provide participants with technical training on how to resolve the common difficulties.

Sub theme 4b: Virtual world therapy can increase the digital inequalities that already exist

One of the most prevalent barriers is related to the 'digital divide' (Elahi, 2020; Van Dijk, 2005; Van Dijk and Hacker, 2003). Some participants declined to participate in the trial because they did not have access to the relevant technologies. For those participants who did take part, some did not have access to a computer, laptop or a WiFi connection. Therefore, they were disadvantaged in taking part in VR therapy. For one participant, they had to travel to their mother's house to access a computer:

> "Because I haven't got internet at home, so I was having to travel from take my son to school, travel all the way to my mum's for eleven fifteen,

> and it was just a bit, it just the time and that's the only problem I have with it." [Rachel, Lines 82-84]

Thus, virtual world therapy can further marginalise individuals, instead of enhancing access, thereby contributing to the 'digital divide.' This is when a divide is created between individuals who have digital skills and access, and those who do not. Furthermore, even if participants were given access to the relevant digital technologies to take part, this does not mean that they have the digital skills to utilise the technology efficiently (Elahi, 2020). Thus, this could have an impact on their ability to navigate confidently through the Second Life® programme.

However, therapists and researchers worked efficiently to reduce this divide as much as possible. Two sessions were organised before the treatment, where the RA would meet with participants and train them into using Second Life®. All participants were provided with a headset to use voice chat, and those who did not have access to a laptop were provided with one.

Nevertheless, this raises broader concerns about how to improve access for those experiencing digital poverty.

Sub theme 4c: Issues with integrating virtual world therapy into routine life

One of the benefits of virtual world therapy is that participants would attend treatment at home. Therefore, there is an assumption that there is flexibility with when sessions are organised and can be integrated into routine life. However, despite this, some participants discussed that there are challenges with achieving this. This is because some participants' employment and/or childcare responsibilities prevented them from engaging with therapy.

To decide the most appropriate times for sessions, the therapists asked all participants in each therapy group about their availability. However, finding the time and date that all participants could attend was difficult:

> "Cause the times they were aren't ermm like you said yeah I think evenings maybe better for some people. Depending on you know, I suppose age and whether they work or not." [Susan, Lines 279-283]

> "Err half five in the afternoon, I understand that it's cause people working and that, but its not a bad time to do things you know cause It's only six, six fifteen afterwards so you can get on with the rest of your evening, but er..no its fine…." [Stephen, Lines 182-185]

Therapy groups were organised based on when participants consented to take part in the therapy. However, based on participants' feedback, it may be more appropriate to classify participants into groups based on their commitments and availability. For example, individuals who work full time or are in education full time may benefit from treatment sessions in the evenings. Full time parents, however, may benefit from sessions during the day.

This can be supported by comments submitted in the VEEP participant feedback forms:

> "Like I said earlier in the session the daytimes I have are usually really good maybe a little bit manic. Its just when I go to bed and wake up is when I struggle the most." [Participant 018]

Sessions were originally advertised as lasting from 45 minutes to one hour long. This duration is quite like face-to-face group therapy sessions. However, participants discussed that in a virtual world setting, some sessions were over one hour, which impacted on engagement:

> “But erm..an hour was perfect ‘cause it got you you’re-it-it enables you to get enough information and interact. But after an hour you start to get tired?” [Amir, Lines 337-338]

8.4 Discussion

This study aimed to assess the acceptability and explore participants’ experiences of taking part in the VEEP intervention. This study is thought to be among the first to investigate the use of VR therapy to improve social cognitive deficits in those with FEP.

Most participants found the VEEP intervention to be an accessible, relevant, and positive experience. This is because the experience had a beneficial impact on their mental wellbeing and therefore was found to facilitate positive change. When asked, participants did say they would take part in the intervention again when given the opportunity. Common reasons for these opinions included the chance to take part in a novel treatment, receiving evidence-based treatment away from a traditional clinical setting and enhancing their knowledge and skills. The accessibility of taking part in the VR intervention in any location was also appealing to those with FEP, along with the structured psychoeducation sessions and stepped care approach to treatment.

Alternatively, the VEEP treatment provided a possible ‘unmet need.’ Most of the participants stated that they were willing to participate in this intervention because it was one of the first opportunities to receive psychological therapy. This can be supported by previous statistics. Although CBT for people diagnosed with schizophrenia has been part of the UK guidelines since 2002, the implementation of this is variable (Switzer and Harper, 2019). According to a recent survey in the UK, individuals with psychosis were much more likely to access antipsychotic medication (88%) compared to CBT (10%) (Carter et al., 2018).

An important finding was the personalisation. Most participants valued taking part in activities and scenarios that addressed their social cognition deficits, as well as having discussions about their thoughts. These illustrated the therapeutic concepts and allowed participants to apply it to their own situation and lives. However, participants who criticised the treatment did so because the intervention was not targeting the specific issues enough, that they were struggling with. Therefore, a one size fits all treatment is not appropriate for patients with FEP. Although the VEEP treatment attempted to personalise the treatment using various activities, discussions and the ‘checking it out’ stage at the end, future studies should focus on adapting the environments, scenarios and avatars to suit the individuals’ needs.

Indeed, previous research into personalisation and ehealth has indicated that altering treatment to suit individuals’ needs can lead to more positive outcomes (Kaptein et al., 2015; Lentferink et al., 2017). One of the benefits of VR treatment is that it is possible to tailor treatments to suit individuals’ needs. However, further research is required to assess the benefits and impact of personalised VR treatment on mental health. Furthermore, evaluation studies should focus on analysing what types of patients are more suited to personalised treatments.

Despite having seemingly objective adherence measures such as attendance, feedback form completion and interview completion, it is still difficult to determine the effect of adherence on outcomes. This is because it is still challenging to assess the level 'dosage' of an intervention. This effect is likely to be influenced by cognitive and reading abilities, processing speed and familiarity with computers (Donkin et al., 2011). Furthermore, the candidate was unable to get data on the number of times participants logged in between sessions.

One of the key characteristics of a virtual world environment is the sense of presence and immersion it provides. In terms of presence and immersion, there are four different forms of interaction between the participant and the virtual world (Oh, Bailenson and Welch, 2018):

1. The sense of presence in using the avatar in the virtual world.
2. The role the virtual world plays in the development of relationships between participants.
3. The experience of interacting with the virtual world and its technology.
4. The transference of experience between both the physical and psychological world.

Immersion in the virtual world is facilitated in various ways. The interaction in the virtual world can absorb participant's time and energy. Furthermore, participants were interacting with one another. However, this is mitigated on the quality of the technology; the quality of the Second Life® graphics influences the level of immersion one experiences (Boulos, Hetherington and Wheeler, 2007).

Participants in this study stated that they felt immersed in the virtual world. Nevertheless, this experience is mediated by the virtual world and technology. Therefore, whilst participants interact with an interface that allows them to utilise their avatar to engage with others, the experience also requires a variation of message boxes, onscreen actions that may obscure the avatar.

Thus, being immersed in the virtual world does not mean being absent from the physical world. The physical world setting can affect experiences within the virtual world. Therefore, any changes in the physical environment can influence the virtual world experience (Hew and Cheung, 2010; Gottschalk, 2010).

This form of multiplicity can lead to a disconnect; whilst some participants may have found it challenging to interact with the virtual world efficiently, other participants were trying to interact with an avatar that may have been abandoned by someone who is both physically and psychologically disconnected from the virtual world. This impacts on participants' relationships that are developed in the virtual world (Anstadt, 2013; Boellstorff, 2008). Furthermore, if the first person camera view was chosen by participants in Second Life®, this meant that they may have not been able to view other avatars. Participants in virtual worlds must work hard to maintain the sense of presence and immersion since it is impacted on by the internet connection, Second Life® graphics and technical issues (Sarac, 2014; Sponsiello and Gallego-Arrufat, 2015).

Prior literature tends to emphasise avatars' appearance; Vasalou et al. (2008) stated that participants choose avatars, which resemble their physical world appearance. These ideas are supported by Suh, Kim and Suh (2011) and Ratan and Dawson (2015), who stated that avatars are an extension of an individual's identity. Ducheneaut et al. (2009) stated that participants use virtual worlds as an opportunity to create a more idealised version of themselves. Thus, this highlights the complexity and nuances of avatar development. These can be used to explore and experiment with behaviours and appearances that are not always easy in the physical world for individuals with psychosis.

These findings can be supported by the 'Uncanny Valley' theory (Mori, MacDorman and Kageki, 2012). This theory suggested a nonlinear association between the appearance of an avatar and how the user perceives it. Specifically, this theory stated that avatars, which do not look quite like humans are viewed as uncanny and, therefore, aversive. Other studies have suggested that this is particularly true of those avatars, which contain a combination of a human and robotic appearance (MacDorman, 2006). It may be because there is a disparity between a realistic looking avatar, which moves in an uncharacteristic manner (de Borst and de Gelder, 2015; Saygin et al., 2012). The avatars provided in Second Life® matched this description. This could have had an impact on users' sense of embodiment and realism. Therefore, this reinforces the importance of ensuring the avatars are realistic and can be personalised to span many communities and cultures.

This theory can be extended to virtual worlds. Dickinson et al. (2020) stated that it is possible that very high levels of realism can increase the complexity associated with VR environments. This is because it can lead to users developing high expectations for the nonvisual and tactile aspects of the VR environment. For example, previous research has shown that the third person overhead perspective that users have of their avatar, does not always lead to an inferior experience (Black, 2017; Lim and Reeves, 2011). Therefore, a co-design process must be conducted when developing a VR intervention with a particular target group.

Participants' experiences of the virtual world may be considered in the context of their experiences in the physical world, the amount of prior experience they have had with virtual worlds and technology, and indeed the opinions other may have of virtual worlds (Bulu, 2012; Diemer et al., 2015).

8.4.1 Strengths and limitations

This is believed to be one of the first studies to explore early psychosis service users' views on VR. Participants highlighted essential factors that researchers and developers may wish to consider when designing and developing VR treatments for psychosis or indeed other types of mental health support.

One of the primary benefits of implementing a treatment into Second Life® was the RA's pre-intervention session. Here the participants were allowed to view Second Life® before their treatment, develop their skills, become more familiar with the technical details, and ask any questions they may have. They were also given instructions to avoiding creating avatars, which were unrealistic (i.e., a superhero or a vampire) and strategies to rectify common issues such as audio dysfunction. This helped to improve participants' confidence in using Second Life®.

From an economic and service context, the VEEP treatment can assist in reducing costs for services. This is because the VEEP treatment is more readily accessible for individuals who struggle to attend face-to-face treatment due to economic, social, geographic, mental and/or physical health needs. Therefore, it can help to reduce the number of patients on waiting lists and provide them with a short-term intervention before they receive their routine face-to-face treatment in EIP (Gaebel et al., 2020; Rus-Calafell and Schneider, 2019). Indeed, most participants agreed to take part in the VEEP treatment because it was made available to them. However, future research should be undertaken to assess whether a treatment such as VEEP can be developed into a stand-alone low intensity intervention or whether it is more appropriate to create a blended treatment approach (face-to-face treatment combined with the VEEP treatment).

Feasibility and acceptability trials have indicated that VR interventions can be utilised by those diagnosed with various psychiatric disorders (Cieślik et al., 2020; Clus et al., 2018; Otkhmezuri et al., 2019; Pallavicini and Pepe, 2020). Despite the evidence however, such findings have seldom been implemented into practice (Gilbody et al., 2015). Many interventions have not actively involved service users in designing and developing such interventions (Slay and Stephens, 2013). This is where the VEEP trial differs from most of its VR intervention counterparts. The thorough co-design process ensured that the research team developed an environment and intervention which would be engaging and user friendly to individuals with early psychosis (Realpe et al., 2020).

However, there may be some limitations with regards to the exposure exercised through Second Life®. Participants were limited in their ability to analyse the facial expressions and body language cues in avatars. This could impact the authenticity of role plays, which could have a detrimental impact on their engagement. Furthermore, participants cannot receive feedback about their nonverbal social skills, such as facial expressions and eye contact. Therefore, future research should use facial tracking of emotions, where participants will be able to implement their feelings onto their avatars.

In face-to-face treatment, patients are required to talk to each other directly. In VR therapy, participants have the flexibility to use either audio or text-based communication. Although participants were encouraged to use audio-based communication, they could use text chat if they felt more comfortable. This flexibility and autonomy reduced communication barriers and encouraged participants to interact in the environment. However, one of the disadvantages of providing therapy virtually was that this could lead to disconnectedness, which could reduce the development of a group and therapeutic alliance (Allan et al., 2021; Bucci et al., 2019; Tremain et al., 2020).

The most common limitation identified by participants in this study related to accessibility. A certain percentage of participants did not have the adequate IT equipment to access Second Life® in their homes. For example, they did not have access to a computer/laptop, or Second Life® could not be downloaded. Although these participants were loaned the appropriate IT equipment, these were limited in resources. Thus, this could create further divisions and exacerbate digital exclusions in this population (Liberati et al., 2021; Spanakis et al., 2021).

Furthermore, some participants had issues with logging into Second Life® at the beginning of sessions due to programme or computer updates, which resulted in delays. Other technical difficulties involved voice chat not working. Therefore, these technical difficulties should be taken into consideration in future studies with a larger number of participants. Possible solutions include technical skills training and access in community settings. A technical support worker could be employed by services to ensure that participants have the relevant support.

When conducting treatments online, technical difficulties can be experienced which are outside of the users' control. However, the second facilitator was prompt in contacting the participant when there were any difficulties during the sessions. This helped maintain the therapeutic alliance and provided participants with the confidence to receive prompt support. If there were any ongoing issues, then the RA would contact the participant to rectify this.

The Second Life® viewer acts in conjunction with the participant's computer and WiFi connection. This means that the sense of presence and immersion is unstable, dependent on the ability of technology to deliver this experience.

Clinical professionals could also experience technical difficulties. This is because there are firewall blockers, which prevent Second Life® from being accessed in the NHS. Therefore, this led to the option of VEEP being conducted in a private setting at WMS. Thus, in the future, clinical professionals will need to contact their hospital on a case-by-case basis to request access to Second Life®.

The VEEP recruitment strategy led to recruiting individuals who were more likely to adhere to the intervention. Therefore, the intervention may lack external validity. Going forward, it is essential to reflect on how researchers can deal with recruitment challenges. When researchers struggle to recruit service users to participate, the next step is to open the recruitment sources (Frampton et al., 2020).

There is a chance of bias occurring in research, mainly qualitative research. This can impact the results. Prior experiences with digital technologies and their experiences and opinions on mental health services, could have all influenced participants' views (Cheung et al., 2017). For example, both the researcher and the participants may have experienced a 'halo effect' towards the VEEP treatment (Nisbett and Wilson, 1977). Participants were optimistic about the VEEP treatment and, when prompted, revealed areas in which the treatment could be improved.

Furthermore, during the interviews, participants were aware that the therapist of the VEEP treatment was interviewing them. Therefore, this could have led to bias in their responses, as some participants may have wanted to provide favourable responses. Nevertheless, as the interviewer was aware of this, measures were made to reduce bias collusion before conducting the interviews. For example, the researcher discussed potential bias with the research team, where they discussed questions to draw attention to potentially harmful aspects of the VEEP treatment.

However, participants were reminded at the interview's opening, that honest responses to questions were required to improve the treatment for future participants. Therefore, the openness to find potentially negative aspects of the VEEP treatment helped reduce the confirmation bias (Rabin and Schrag, 1999).

Table 32: Summary of advantages, barriers and solutions regarding virtual worlds

Main Theme	Results	Actions/Solutions
Advantages of using virtual worlds	• Utilising virtual world treatments saves travelling time. • Due to technological advances, there is an ease of use. • Virtual world treatment can be used to support blended treatment (face-to-face and online). • Virtual world can be used to explore behaviours and scenarios in a safe and controlled environment. • Virtual worlds provide anonymity and therefore allows participants to express their views more freely. • Virtual worlds can be viewed as 'enjoyable.'	• Usability of virtual worlds may mean higher engagement. Thus it may be useful to gather data on the usability of the intervention. • Virtual worlds can be used to enhance communication and group dynamics. Future research should focus on assessing this and looking for ways to alter and improve these factors. • Virtual worlds can be used successfully to improve therapy via simulation of tasks. • Virtual worlds can be used to collect data on sensitive issues from participants who are usually deterred from contributing in face-to-face settings.

Barriers to using virtual worlds	• Many individuals are unaware of using virtual world software and so need training to utilise it efficiently. • Virtual worlds can contribute to the growing digital divide in the UK: those who are digitally excluded may not be able to take part. • There is an absence of non-verbal communication, due to participants not being able to read facial expressions and body language. This can lead to emotionally distant communication. • Technical difficulties can be difficult to resolve and can have a detrimental impact on the treatment experience.	• Technical support that is available throughout the treatment process, is important to implement. • Furthermore, technical support may be managed depending on those who require it the most. For example, those who have the digital skills and digital infrastructure in place may be able to resolve technical difficulties on their own. • As seen with the Second Life® environment, continuing to design virtual worlds with the view of directing participant's attention to the presentation and content of the meeting is important. • Whilst technical difficulties may not be completely eradicated, it is important that those participants who experience disruption to their sessions, can catch up.

8.4.2 Conclusions and future recommendations

This study provides a unique and informative exploration of participants' views of taking part in the VEEP trial and discusses the possible facilitators and barriers to implementation that should be considered during VR development. Firstly, this study highlighted that VR interventions are acceptable to those with FEP due to their novel approach, ease of use, and treatment structure. It cannot be specifically concluded that VR was the key element in achieving these results since there were multiple components to this novel treatment programme.

VR treatments require ongoing monitoring and updating to ensure the programme and treatment complement each other. Both clinicians and patients need to be aware of the technical difficulties associated with online interventions. For many individuals, online interventions may be more affordable and available and will reduce waiting times compared to face-to-face interventions (Marks et al., 2003; Wright et al., 2005). This becomes particularly apparent during the coronavirus disease 2019 (COVID-19) pandemic, where the importance of developing and delivering accessible and sustainable online therapies is vital (Feijt et al., 2020).

Further consideration should be given to individuals' access to computers, the internet and other necessary technological equipment. Therefore, future studies should consider options such as laptop loan schemes and other opportunities for funding to ensure that eligible participants can participate (Martinez-Martin et al., 2020; Wood et al., 2020). Finally, future research should assess whether such VR treatments can be utilised for other service user groups.

9. Study 5 - a qualitative investigation into the SCIT delivered via a virtual world from clinicians' perspectives - the VEEP trial

9.1 Introduction to the chapter and rationale

This study is a qualitative exploration of clinicians' views of virtual world treatment for people with FEP. To the candidate's knowledge, this is the first study to do so. The results are provided in detail, followed by the discussion and conclusion. The VEEP focus group themes are illustrated in figure 36.

Whilst there are a limited number of studies that have focused on collecting clinicians' views on DHIs, these have been directed at mental health problems more generally (Berry, Bucci and Lobban, 2017; Jonathan et al., 2019; Schueller, Washburn and Price, 2016; Sinclair et al., 2013; Vigerland et al., 2014). Bucci et al. (2019) published a qualitative study exploring clinicians' views of using digital tools in EIP services in the West Midlands, England. Findings showed that whilst staff found digital tools to be acceptable for specialist services, there were concerns regarding implementation and delivery.

9.2 Participant vignettes

Table 33: Focus group participant vignettes

Name	Vignette
Heather	Heather is a care coordinator at North Warwickshire EIP for service user Amir.
Jenna	Jenna is a care coordinator at North Warwickshire EIP for service users, Emma, and Eddie.
Caitlin	Caitlin is a care coordinator at North Warwickshire EIP for service users Stephen and Luke.
Madeline	Madeline is a care coordinator at North Warwickshire EIP.
Kathryn	Kathryn is a care coordinator at North Warwickshire EIP for service users Stacey and Patrick.
Bradley	Bradley is a care coordinator at North Warwickshire EIP for service user Connor.
Nikesh	Nikesh is a care coordinator at North Warwickshire EIP for service users Ali and John.

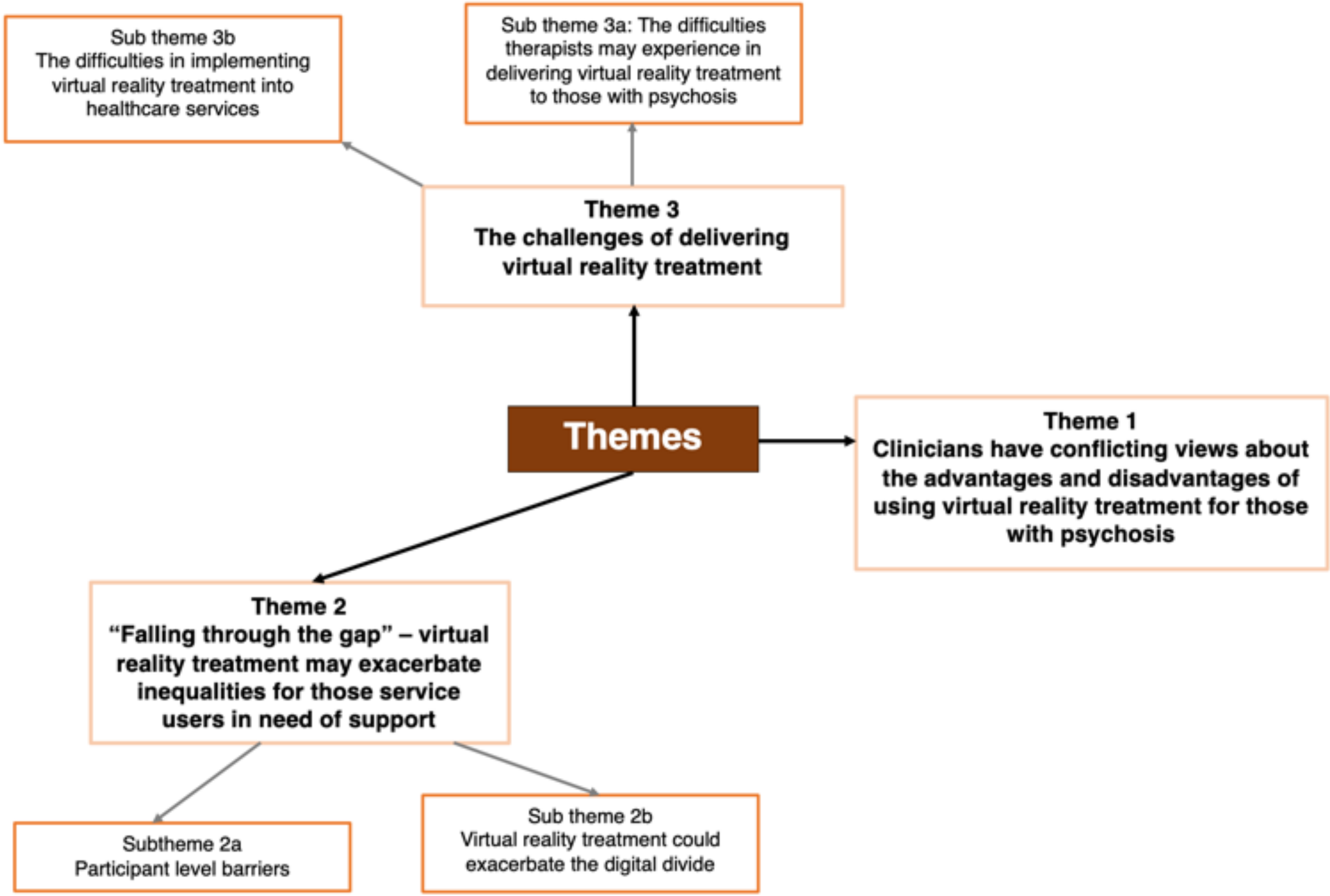


Figure 36: VEEP focus group themes

9.3 Results

The care coordinators who responded to the recruitment email (n=7) varied in their experiences of technology and their understanding of the VEEP treatment. Nevertheless, their responses were consistent. Apart from using patients' health records to document notes, care coordinators did not report using other forms of technology within healthcare. As a result of this, the interview probes focused explicitly on the VEEP treatment and engagement. The questions were developed to understand the ability to integrate the VEEP treatment into routine treatment.

Theme 1: Clinicians have conflicting views about the advantages and disadvantages of using VR treatment for those with psychosis

Overall, clinicians welcomed the opportunity to provide therapy to those service users who needed support to assist with their social functioning and anxiety. VR interventions were perceived as modern, relevant and contemporary. However, clinicians believed that VR therapy's prior success with other service user groups was a result of its novelty and uniqueness:

> "I think it's just keeping in with the trend of technology because VR is a big thing at the moment…" [Heather, Line 40 – 41]

This clinician implied that the success of VR is a temporary trend that may disappear in the future. Furthermore, another clinician stated that the appeal of the treatment was exclusive to young individuals due to their interest in video games and the fact that they belong to the so-called 'digital native' generation (Cowey and Potts, 2018):

> "It was about how young people will be getting into it in terms of gaming and how other youngsters.." [Caitlin, Line 112 – 113]

This highlights that some clinicians viewed VR treatment in a superficial way and could not connect the interface with the SCIT treatment, which is an evidence-based treatment.

Some clinicians expressed concerns that VR may worsen young people's social anxiety and negatively impact their wellbeing. Therefore, it would do the opposite of what the therapy intended to do. This is because they felt it could encourage people to remain isolated at home and, therefore would not improve their social functioning. Thus, VR treatment is removing one of the only opportunities for some patients to receive face-to-face support and communication:

> "Because they're doing so much just chatting online and things, if you have that conversation face-to-face in real life, it's a lot more difficult." [Heather, Line 66 – 67]

Another clinician stated that the only way participants could improve their social functioning is to interact with others and participate in social situations. Therefore, the VR treatment may not be appropriate:

> "Well I actually think it's erm the wrong way to go, I think it's encouraging young people to go on the internet and not go out of their homes. You don't do anything for the actual err social networking, going out and about and meeting people 'cause that's actually what they're frightened of, not computers, so I think it's actually a waste of time sorry." [Kathryn, Line 55 – 59]

Other healthcare professionals have reiterated these concerns. This is particularly the case during the COVID-19 pandemic when many mental health services have had to provide online therapy. According to a recent survey completed by 335 psychotherapists, 24% were concerned about reducing interpersonal cues during online therapy (McBeath, du Plock and Bager-Charleson, 2020). Feijt et al.'s (2020) survey found that some practitioners felt that online therapy was less suited for those with complex needs, such as family trauma, psychosis and social anxiety.

Additionally, VR therapy was thought by this group of clinicians, to act as a barrier between service users and physical reality. Therefore, according to some clinicians, some service users may not act authentically during the therapy. As a result, there was a concern that whatever the participant has learned virtually may not be applicable in reality:

> "You can get that kind of keyboard warrior effect where people hide (discussion in the background) behind the screen whatever, where they're more braver on the outside than they are so I do think it has it's place and things because I know it's being used err in (inaudible) Oxford and things like that.." [Madeline, Line 75 – 78]

As well as the "keyboard warrior" effect, some clinicians questioned whether the VR therapy was realistic and practical enough to teach service users long lasting skills on managing social situations. The clinician below referred to the example of one of the scenarios service users took part in during the VEEP trial; this is where they were asked to observe a scenario at a bus stop where a woman was in distress and crying (please see appendix 35 for a vignette). After this, they would be asked questions about what they thought was happening. Whilst the scenarios are designed to be as realistic as possible, according to the below clinician, it may not be enough to help service users in coping with these situations in reality:

> "That's the thing whether they, what they learned on that on the study where they transferred that then into live situations, 'cause I think I heard erm about the scenario where there is a woman at the stop crying

> and it’s how they then deal with that on the game but actually whether that they would be able to transfer into a real life situation if that was happening.” [Jenna, Line 83 – 87]

Although some clinicians expressed concerns about the effectiveness of VR therapy, others suggested that there were some tangible benefits to delivering therapy in this manner. One clinician remarked that one of her service users, who usually struggled to attend face-to-face therapy, participated at the VR therapy throughout:

> “actually the person I didn’t know was doing it, I really didn’t think he’d ever do anything like this so for me it’s an ama-amazing that he actually went through with it ‘cause I never thought he would do it…” [Kathryn, Line 261 – 264]

Therefore, this showed that the VR therapy appealed to a service user who commonly struggled to attend traditional therapy. Furthermore, the stepped care approach to providing therapy in a virtual environment allowed the therapist to view the interaction in a controlled environment. This can provide benefits to the therapeutic relationship and the participants’ learning experiences:

> “I guess it could be a good thing that you could reflect with them on what you saw as a therapist or so as a supervisor, as opposed to what they saw in the virtual reality so say if it was in public they might not be able to say a member of the public they might get might get assaulted verbally by by the patient experiencing the paranoia so it might then you you could coach them on what you saw as a therapist, as opposed to what they view as as a danger or fear, it it could be very skilled and very well controlled isn’t it, so it could work with someone who’s paranoid,

> who psychotic to the point where they haven't got any insight." [Bradley, Line 459 – 466]

Theme 2: "Falling through the gap" – VR treatment may exacerbate inequalities for those service users in need of support

Sub theme 2a: Participant level barriers

Some clinicians expressed concerns that the VEEP therapy was inadvertently targeting those service users who were already on the journey to recovery and mentally well. Therefore, those individuals who required urgent intervention were unlikely to take part. Whilst the VEEP therapy team viewed the therapy as having an essential role in routine treatment, some clinicians thought otherwise; instead, they viewed the VEEP intervention as an adjunct to their standard treatment. Therefore, those service users who were beginning their treatment in EIP would not be able or suitable to take part in VEEP trial. Thus, those positive outcomes that service users experienced post VEEP intervention were partly because such service users were well enough to take part:

> "It will be interesting to look at people that you have on the list for your study to see where abouts they are in their life to be able to take part, because I doubt you'll have many people that have actually just started or even in the first year, most of yours will probably as [Consultant Psychiatrist's name] said, they coming from a position where they are feeling a lot better and maybe more er less (inaudible) less isolated an- and more well and in their mental health." [Heather, Line 441 – 446]

When some clinicians had tried to approach some service users who would benefit from additional social cognition therapy, they were met with resistance and fear:

> "'Cause the people like the particular client was asked to do it and he was like 'oh no no I can't do that oh no no I can't do that,' and so therefore you lose people that actually can't even engage with that." [Jenna, Line 348 – 350]

As this quote shows, some service users were so unwell and so socially anxious that attending virtual therapy was too challenging. Although the VEEP trial took place virtually, the pre-intervention session took place face-to-face. This was so the service user could provide consent to complete outcome measures and have their computer/laptop set up Second Life®. However, this face-to-face session could inadvertently exclude those service users from taking part in virtual therapy due to their extreme social anxiety:

> "My client who er I said absolutely categorically not erm I managed to get him to meet [Research Associate's name] and he said 'I'm not going to do this, I'm not going to do this,' I said 'you've got to meet [Research Associate's name] and discuss it,' and he's like 'no I'm not going to do this, I don't want to do virtual reality no no I'm not doing that,' and he-he-he just…" [Kathryn, Line 532 – 536]

Kathryn experienced such severe social anxiety that they could not meet with the RA to discuss taking part in the VEEP trial.

Although some clinicians expressed concerns that the VEEP therapy was not targeting those service users who needed it the most, some clinicians did not feel confident enough that their service users would benefit from it:

> "One of mine that was asked erm to take part has actually got a learning disability and-and we know that now but at the time we were we er suspected that he had erm but [Consultant Psychiatrist's name] said that would still be ok, but I was concerned that he-he would've really

> struggled actually erm he actually would refused, I think he did speak to [Research Associate's name] erm and then he decided not to take part anyway but I think just left to it to get on with it by himself he would've really struggled…" [Madeline, Line 538 – 543]

Although this clinician acknowledged that the therapy was suitable for their service user with a learning disability, they still did not feel comfortable allowing them to participate. This highlights their lack of confidence in the therapy to improve social cognition deficits in those with FEP.

Sub theme 2b: VR treatment could exacerbate the digital divide

Clinicians discussed how many service users could not take part in the VEEP trial due to their inability to access the digital technologies and/or WiFi needed. This is because many service users live in poverty and so are unable to purchase the necessary equipment:

> "So we're in a fairly deprived area as well so a lot of our clients (inaudible) don't really think about computers (inaudible)." [Bradley, Line 279 – 280]

Other clinicians highlighted that digital poverty was something that most service users experienced. Therefore, high levels of attrition in virtual therapies require a systemic change to allow service users to participate. Although the VEEP research team tried to implement temporary solutions to allow those who are digitally excluded from taking part, it may not be enough:

> "And then I think one-to-one with [Consultant Psychiatrist's name] he said that this person could go to uni but there's no way that this person would go to uni, they're too anxious (inaudible) so that wasn't an option really…" [Madeline, Line 286 - 288]

Here this clinician stated that although service users could travel to the University of Warwick and log in to a computer there with the therapist's support, many service users would be unable to travel this distance due to social anxiety. Another temporary solution was to allow service users to borrow a laptop to attend the VEEP trial. Although this solution was beneficial for some, there were some unseen consequences:

> "He thought it was something he was doing wrong and that made him worse and then they gave him another laptop and said actually it's not you it's the laptop and he's been okay since but just that initial time to log on and 'cause you've got nobody there with you to do it then you-it is very much you know when you go online you do it yourself don't you?" [Jenna, Line 305 – 309]

The above service user had the opportunity to borrow and use a laptop to take part in the VEEP trial. This was a service user who lacked the digital skills and confidence in using a laptop. Therefore, difficulties in logging into the laptop combined with service user's social anxiety and lack of confidence, led to what the clinician described as a "meltdown." This "meltdown" could have a detrimental effect on their perception of the VR treatment. Furthermore, it was difficult to immediately resolve the issue as the service user is alone.

> "'Cause as researchers who are controlling the therapy, obviously this is a bit different, there are always some barriers, the technology and then if you look at the more capable more affluent members of our caseloads, it's a bit biased who is more widely going to have better outcomes anyway 'cause they don't actually resent it they are more capable compared to those who are deprived socially (inaudible)." [Bradley, Line 390 – 394]

Here, Bradley has stated that the socioeconomic background of patients has an impact on whether they benefit from the VR therapy and have better outcomes. He felt that those from more deprived background would dislike attending VR therapy due to their lack of access to resources and lack of skills, when compared to those from more privileged backgrounds.

Theme 3: The challenges of delivering VR treatment

Sub theme 3a: The difficulties therapists may experience in delivering VR treatment to those with psychosis

Clinicians expressed concerns with the expertise of the VEEP therapists and felt that only those therapists with a recognised clinical qualification should be able to deliver the therapy. This is because FEP is a complex condition, and many service users have various needs and symptoms. Additionally, clinicians queried whether therapists who did not know the service users well, would be able to support them in a period of crisis. Thus, clinicians felt that the absence of an authentic therapeutic alliance combined with a digital treatment would lead to ineffective outcomes.

One clinician discussed how it was essential to recognise service users' triggers and respond appropriately and effectively:

> "So if there's something that triggers their fight or flight mechanism, then you'll need to be able to calm them down, de-escalate them, talk through and hopefully find some reason as to why their their acting in that way, that's useful information to work out what triggers them." [Bradley, Line 475 – 478]

If the therapist is unable to de-escalate a conflict or a difficult situation, then it can lead to a dangerous situation for the service user:

> "The procedure to de-escalate something that potentially is very dangerous when you've got a psychotic client possibly within that virtual room and what have you got a plan to de-escalate that situation, it could be quite potentially dangerous to somebody who is mentally ill…" [Bradley, Line 490 – 493]

Although the candidate had explained that both therapists had a rigorous risk assessment in place to ensure that service users were well supported throughout the therapy, some clinicians felt this was not enough. This is because a therapist was not physically present with the service user if a difficult situation arises. Therefore, they felt there was a risk with regards to safety for the service user:

> "It should, it should be safe but then (background noise of objects moving) there's no one there but you're equally stressing as well for them if they do get upset about something depending on what you're doing, because what you're try-what you're trying to do, what are you trying to work on if you think they're experiencing these emotions, who's there to support these matters and talk it through, there's no one there." [Caitlin, Line 126 – 131]

Therefore, clinicians felt that real-time face to face monitoring was required to ensure patients are safe and secure. They thought that this was adhering to their professional responsibility.

Sub theme 3b: The difficulties in implementing VR treatment into healthcare services

One of VR therapy goals is to support those service users who struggle to attend face-to-face therapy. However, some clinicians felt that VR therapy may still face similar difficulties that face-to-face therapy experience. For example, some clinicians felt that attending VR therapy would be difficult for some service users, as they may not remember to log in to their computer:

> “The other issue I think as well is that there’s a certain time isn’t it, you want people to log on at a certain time and I think that’s very difficult for some of our clients as well to actually have a mind to log in at that time…” [Kathryn, Line 324 – 326]

Therefore, this would mean that service users would be missing essential therapy appointments. Thus, whilst VR therapies may be viewed as a solution to those who cannot attend face-to-face therapy, barriers such as motivation and attendance remain.

Although VR therapy may benefit service users, it would be challenging to implement this therapy into routine healthcare services. This is because it would require significant investment to ensure that service users have access to the technology. Therefore, this needs to be considered:

> “Err long term, that’s erm that’s part of it erm it depends because we work in the NHS at the end of the day so financially trying (inaudible) will be very very costly. It always comes down to how you distribute how these wonderful headsets or whatever to individuals and affordable costs, I think it’s going to be quite difficult trying to recruit people in to that…” [Heather, Line 49 – 53]

One clinician expressed that as they had not directly been involved in developing the VEEP therapy, they were not confident that it would be effective for all their service users. They suggested that it was difficult for them to support their service user whilst taking part in the VEEP therapy because they were not part of the process and did not know enough about it. If this therapy were to be implemented into the NHS, they would have more autonomy over the process and feel like they could guide service users through it. Not only would it benefit the clinicians, but it would benefit the service users:

> “So I just think there’s an acceptance that you will recruit a certain peo- a certain group of people and maybe the word might get out that it’s fantastic and it might help those people and also if actually it became something that was delivered within the NHS, we might have a little bit more confidence in it rather than something we’re not really involved in it erm if we because of treatment that we can invest-can invest in erm advertise ourselves we would extend but it might be hard, it’s hard to support somebody who’s so socially anxious that they’re terrified of doing that with something that really don’t know anything about and perhaps not that erm confident in yourself.” [Jenna, Line 368 – 375]

As Jenna stated, it is particularly helpful for those service users who are socially anxious and may find it difficult to take part in an innovative therapy. The above quote highlights how different approaches are required to help service users take part in VR therapy.

9.4 Discussion

As part of the VEEP trial, care coordinators at North Warwickshire EIP service took part in a focus group to provide their thoughts and opinions on the VEEP trial. The clinicians were questioned about their opinion on the future use of VR interventions alongside traditional face-to-face treatment. Clinicians expressed a positive attitude towards a new novel treatment that could engage with groups but were also apprehensive about the possibility of it replacing traditional face-to-face treatment.

Clinicians accepted that VR psychological treatments could provide novel, acceptable, modern, and relevant methods of supporting a hard-to-reach group of service users. These views are supported by the opinions expressed by clinicians regarding digital health technology more broadly (Gagnon et al., 2015). Some clinicians felt that younger generations might prefer to use VR treatments to receive therapy, when compared to face-to-face treatment.

Furthermore, clinicians claimed that there should be more investment in supporting them to manage their patient caseloads. This, in turn, may help them to provide more routine psychological treatment to service users (Torous and Hsin, 2018). These concerns that VR treatments are being used as a potential cost-cutting measure to avoid providing adequate psychological treatment is supported by previous research (Segal, Bhatia and Drapeau, 2011).

However, findings from this study suggest that clinicians perceived VR interventions to be complex to implement and use in routine treatment. Clinicians in this study stated they had a limited understanding and awareness of how VR interventions can improve the social cognitive deficits in those with FEP. Therefore, they felt this could have a detrimental impact on their clinical judgement. The Normalisation Process Theory can support the results found. This suggests that the successful implementation of e-health interventions is dependent on its alignment with the goals of both the healthcare organisation and the skills of the staff (May et al., 2009).

Due to the complexity of such issues, clinicians must receive adequate professional training. Clinicians must abide by boundaries, similarly to those in face-to-face treatment (Maheu et al., 2004; Maheu et al., 2017). Therefore, clinicians should maintain professional responsiveness (i.e., responding to emails in an appropriate amount of time) and triaging concerns (i.e. recognising suicidal concerns in service users in VR treatment and providing them with proper support). It also involves clarifying communication (i.e., if text chat is used in VR, certain symbols and terms should be refrained from use).

(Callan et al., 2017). There is no association between competent psychotherapists and proficiency in technology (Wells et al., 2007). Therefore, familiarity in utilising technology can lead to the adoption of these interventions in healthcare settings.

Furthermore, clinicians expressed difficulties in recruiting for VR treatments because their time and resources are limited. Therefore, building trust and confidence in digital technologies to complement and support treatment pathways, as opposed to hinder, are vital when implementing these in healthcare settings. These findings can be supported by previous research, where ease of use was found to be one of the primary factors to consider in implementing digital technologies into healthcare (Gagnon et al., 2015; Perski and Short, 2021).

Clinicians in this focus group discussed the importance of balancing face-to-face routine treatment with other forms of therapy, which included innovative VR treatments. This is because they felt that VR treatments are not effective in improving patients' social cognition and social anxiety as routine treatment. This is because they practice their skills in a VR environment, which may not have applicability to real life. Nevertheless, clinicians acknowledged that providing VR treatment allows some individuals to engage with therapy, which otherwise they are unable to access face-to-face. This could be considered a motivating factor, which could promote adherence to further treatment within the healthcare services (Halldorsson et al., 2021).

Blended treatment can be defined as a combination of digital and face-to-face treatment (Wentzel et al., 2016). However, previous research has indicated that digital and face-to-face treatments are often not integrated; instead, digital treatments are used as an addition to routine treatment (Meglic et al., 2010; Meyer et al., 2009; Robertson et al., 2006). Thus, future research should focus on the equal potential contribution both types of treatment provide to patients' care.

Indeed, blended mental health treatment may have advantages over traditional face-to-face treatment. This is because service users can continue with their treatment in between their face-to-face sessions, with the support of their clinicians. This may encourage service users to self-monitor and manage their wellbeing where required, as suggested by the core aspects of health (Huber et al., 2011). Furthermore, blended treatment may allow service users to receive a higher dosage of sessions, compared to face-to-face treatment. Thus, blended healthcare may provide treatment modalities to service users that are cost-effective and efficient (Wentzel et al., 2016).

Therefore, when considering VR interventions as a therapeutic tool, these findings highlight the importance of recognising the benefits to both clinicians and participants. These findings highlight the need to enhance clinicians' awareness of VR treatments and the evidence of the feasibility and effectiveness of these interventions (Ventura, Baños and Botella, 2018). Subsequently, clinicians can make well-informed decisions regarding which patients are most suited to these types of interventions. However, more insight is required into how VR treatment can be implemented alongside face-to-face treatment. These are vital issues to resolve as barriers to implementing of digital health lie with healthcare services (van Gemert-Pijnen et al., 2011).

Results indicated that clinicians queried the compatibility of VR interventions with the needs of some of their patients. For example, one clinician identified a patient who experienced severe social anxiety, which rendered them unable to take part in VR treatments. They reported that they perceived the VEEP treatment to presently lacking accessible features to meet the complexities of those individuals with severe social cognition deficits. Therefore, clinicians identified their role in being active and providing continuous support to patients taking part in VR interventions to ensure that their unique mental health and socio-emotional needs are being met. Thus, clinicians should continuously track patients' progress and allow them to assess the changes in their patients' knowledge and skills (Scheel, Davis and Henderson, 2013).

Although VR interventions are viewed as having the potential to enhance social inclusivity and access to treatment in hard-to-reach groups, there is still a possibility that some participants would be unable to take part due to digital exclusion. Subsequently, a digital exclusion strategy within healthcare services must be implemented (Robotham et al., 2016).

Clinicians expressed concerns regarding maintaining a therapeutic alliance and concerns about the quality assurance of monitoring patient's wellbeing. Although some clinicians understood that some service users might prefer virtual communication than face-to-face, there was still a consensus that VR treatments lacked the empathy and nuances that face-to-face therapy can offer (Cliffe et al., 2020; Jacob, Sanchez-Vazquez and Ivory, 2020).

Research into the therapeutic alliance in digital interventions is limited and mixed, with some studies finding that the therapeutic alliance did not make a difference to the therapeutic outcomes (Andersson et al., 2012). According to a recent narrative review, the agreement of goals between therapists and patients is more important than the therapeutic bond due to the low correlations between bonds and therapeutic outcomes. Reasons for this may be due to the lack of range (Berger, 2017). Nevertheless, a review conducted by Henson et al. (2019) found that there are limited number of DHI studies, that collect data on the therapeutic alliance. Thus, further research is required.

It has been suggested that therapist behaviours, which can be detrimental to the alliance, could be restricted or even eliminated in digital interventions (Caspar and Berger, 2011). Despite this, relational issues such as alliance difficulties may be more likely to occur in digital interventions, as there is less opportunity to immediately respond to patients' needs (Svartvatten et al., 2015). Therefore, more research is needed to assess whether complex therapeutic alliances are present in digital interventions and whether they influence therapeutic outcomes or not (Berger, 2017).

Trust is a vital part of the therapeutic relationship, and digital treatments may exacerbate challenges in communicating with service users (Tompkins, 2003). Typically, evidence to support communication in psychological therapies is based on proximity, time, performance, and perceived consequences (Scharff, 2013; Tompkins, 2003). These factors may make it more challenging for patients to commit to therapy and subsequently discontinue treatment (Amichai-Hamburger et al., 2014). However, the unique form of communication in digital health treatments provides individuals with a sense of control over interpreting messages from each other (Bok, 1989).

Previous research has indicated that therapists and patients adjust their behaviour when taking part in digital therapies. Bischoff et al. (2004) found that digital therapists exaggerated non-verbal behaviour in video-based therapy. Furthermore, Suler (2004) found that under the 'online distribution effect,' patients self-disclosed and expressed themselves more openly in digital therapies. Disinhibition allows patients to feel less stigmatised and vulnerable about revealing information. This promotes further rapport and intimacy. Therefore, one can conclude that whilst specific behaviour and therapeutic alliance fostering is appropriate in face-to-face treatment settings; it may differ in digital environments (Suler, 2004).

Therefore, to overcome this, a clear, detailed process may improve concerns that both clinicians and service users have. Thus, preparing a patient education manual or video may help service users understand VR intervention's boundaries and expectations. As a result, service users may become more autonomous and feel comfortable informing clinicians about any concerns they may have. Other issues that may be highlighted is the importance of shared decision making in VR treatments (Hilty et al., 2019).

Thus, implementing the VEEP intervention into EIP services should occur using the following recommendations. These have been adapted and refined from Lobban et al.'s (2020) implementation study:

1. Understand how the VEEP intervention fits into the clinical service, including auditing targets and care pathways.
2. Acknowledge whether there are (if any) contextual barriers to the use and updates of the VEEP intervention.
3. Consider whether implementing the VEEP intervention requires national integration or local adaptation.
4. Ensure that the VEEP intervention is compatible with the hardware and software available in the service.
5. Reiterate that the VEEP intervention is a healthcare intervention and not a research initiative.
6. All health and social care professionals in services should be involved in the development and adoption of the intervention.
7. All queries and concerns about the VEEP intervention should be identified and addressed. This can be achieved via training and mentorship.
8. Ongoing VEEP intervention training should be provided to all health and social care professionals.
9. Short and long term targets should be developed to monitor the process and update of the VEEP intervention. Furthermore, it can be used to manage professionals' expectations and evaluate progress.

9.4.1 Strengths and limitations

This study has addressed a significant gap in the literature. It is hoped these findings provide information on clinicians' perspectives of VR treatment for those diagnosed with FEP. The focus group was conducted in a flexible manner, which allowed the exploration of thoughts and opinions.

There are potential economic benefits to implementing VR treatments into healthcare. Although VR treatments require a certain amount of time, cost and initial investment, they may nevertheless be considered cost effective if implemented widely. Such treatments can be used to provide treatments to those who cannot easily access services. Furthermore, VR treatments can assist healthcare professionals in role playing for training purposes (Lucas et al., 2014).

The participants in this study consisted of a small sample of care coordinators who worked together in one EIP service. Therefore, participation may be biased. They may have volunteered to participate because they could have had immediate strong opinions concerning the VEEP treatment, a desire to develop an understanding of the VEEP treatment or a chance to verbalise their patients' experiences of taking part in the treatment. This bias could influence the responses received, as they could be more positive or negative than expected.

Additionally, recruiting other clinicians alongside care coordinators may have provided the researchers with varied data, thereby increasing the validity. Thus future qualitative studies with broader samples of clinicians representing more diverse age ranges and various locations can build upon the findings from this study (Yardley, 2015; Vasileiou et al., 2018).

Furthermore, the study was conducted in the UK and therefore, the findings represented the challenges and problems of the UK healthcare system. In other countries, clinicians may experience different challenges in their healthcare system to target groups of patients. Subsequently, further research on the methodology of focus groups in VR treatments in healthcare in other countries is needed (Aebersold et al., 2015; Ke et al., 2015).

Strength of a focus group design is that opinions can be generated through valuable discussions. Nevertheless, a limitation of the focus group is that individual perspectives may influence the variation of the views within the group. There was also a risk of researcher bias; the group facilitator was also the treatment therapist in the VEEP trial. Therefore, the group facilitator would have an expectation of how the care coordinators would respond to VEEP. Furthermore, the care coordinators were aware that the group facilitator was also the candidate working on the VEEP treatment and therefore may have filtered their opinions. The candidate managed this by encouraging all participants to express their views as accurately as possible (Bloor, 2001; Carey and Asbury, 2012).

Credibility was maintained in this study by inviting all care coordinators to participate in the focus group, thereby recruiting a varied sample from the service. To ensure participants provided in-depth responses, the facilitator maintained a neutral stance and asked follow-up questions to gain further clarity. Dependability was maintained because the focus group was transcribed verbatim (Carey and Asbury, 2012; Wallace, Goodyear-Grant and Bittner, 2021).

9.4.2 Implications

This study aimed to explore clinicians' perceptions and experiences of VR treatment to improve the social cognition deficits in FEP. Therefore, these results have vital implications for these services in developing VR and implementing VR treatments.

Understanding and addressing what clinicians' and patients identify as barriers to treatment, increases the opportunities to implement and adopt VR treatments and technologies in services and adhere to this treatment. Methods for promoting clinicians' adoption of VR treatments into their routine clinical practice involve enhancing desirable features and reducing barriers to use in the design phase, continuing professional development once the VR interventions have been implemented, and receiving guidance throughout these processes.

Therefore, integrating the VEEP intervention into an EIP service requires consistent training to ensure clinicians are aware and confident in using the technologies. Clinicians in this study expressed concerns regarding receiving opportunities to develop their knowledge and skills of using the VEEP treatment. Therefore, service managers must financially support the training and provide the resources necessary to implement these treatments. The barriers can be attributed to a broader economic context, where mental health services in the UK have experienced a consistent period of underinvestment. The lack of adequately trained staff and other factors can be attributed to this (Switzer and Harper, 2019).

Furthermore, future studies should focus on conducting focus groups with a variety of health and social care professionals. This is because they provide more routine direct hands-on care with patients. Thus, they could offer a different perspective regarding how patients are progressing through the VEEP treatment. It could also be helpful to undertake multiple focus groups within one specific location and with clinicians from various backgrounds, to collect a comparison of perspectives.

9.4.3 Conclusions

To the best of the candidate's belief, this is thought to be the first qualitative study to explore clinicians' views of VR therapy for those with FEP. Findings from this study showed that clinicians experienced both positive and negative opinions about this form of novel treatment to support those with social cognitive deficits in FEP. Whilst clinicians expressed positive opinions about providing a form of therapy that is appealing and necessary for some; there were concerns about accessibility and implementation. Therefore, continued and improved information around these factors is required. Furthermore, for successful integration in the future, it is suggested that clinicians be involved in the development of these treatments and offered appropriate training, so that they can be delivered successfully in healthcare settings. Overall, VR therapy should be viewed as an alternative tool to extend choice and enhance care. Furthermore, this intervention can be utilised by decision and policymakers to reduce the burden on mental health services. Healthcare organisations, including the NHS should help to support the development and implementation of digital health technologies.

10. Study 6 - an autoethnography of a therapist's experience of delivering the SCIT via a virtual world for those diagnosed with FEP - the VEEP trial

10.1 Introduction to the chapter and rationale

This study is an autoethnography of the VEEP primary therapist's experience of delivering social cognition therapy via a virtual world, to those with FEP. The results are provided, following by a discussion.

There is a lack of research and literature, which describes therapists' subjective experiences of facilitating therapy. There may be various reasons for this, such as the lack of awareness and confidence in what is commonly perceived as opinion-based research (MacCormack, 2001). Autoethnography allows researchers to write in a highly personalised style and reflect on their experiences, which assists others in developing an understanding of a phenomenon (Wall, 2006). This autoethnography arose from the candidate's experience as a primary therapist, in providing therapy in a virtual world, to those with FEP to improve social cognition. Whilst providing therapy to participants on this intervention, the candidate spent time reflecting on how they engaged with participants.

10.2 Autoethnographic narrative - results

A narrative emerged from the themes identified through the written reflections. As the narrative is an autoethnography, the pronoun 'I' has been used.

Theme 1: Participant Progress

Sub theme 1: Understanding and interpreting emotions

I enjoyed providing therapy to each group and felt that the various activities and psychoeducation was stimulating, enjoyable and educational. I always thought that most participants were engaged with the content of each session. An example of such an activity, which occurred during session two, was asking participants to define the seven basic emotions (happiness, sadness, anger, surprise, fear, shame, and disgust) and paranoia. Although this seems simplistic on the surface, it provided me with an insight into people's thinking processes. Participants were asked to define these emotions together, which was the first group task they took part in.

Whilst happiness, sadness and surprise were easy for most participants to define, there were struggles with defining other emotions such as fear, disgust, anger, and shame. It was difficult for some participants to avoid using the word to describe the emotion. An example is that all groups defined fear as "being scared of something." However, the word scared is a synonym for fear. While I and the secondary therapist always reiterated that there was no right or wrong answer, it was clear to me that the groups wanted to develop the most accurate definition leading to stimulating dialogues. One participant in group two used this as an opportunity to expand on the differences between rational and irrational fears.

Although paranoia is not one of the seven basic emotions, the VEEP research team decided to add this as another fundamental emotion to define and understand during the intervention. This is because those with psychosis commonly struggle with paranoia, which can subsequently lead to delusions. Below are the definitions each group provided for paranoia:

> "When you're over-aware, hyper-conscious of everything around you. You think something bad is going to happen, but in reality, that's not the case. Feeling of mistrust" [group one].
>
> "Scared when seeing something that isn't there, believing things that are not true, don't trust people – suspicious, irrational, sometimes extreme" [group three].
>
> "Suspicious/depends on context" [group three].
> "Irrational perception of threat/over-analysing situations in a negative way" [group four].
>
> "Being worried about something that is unlikely to happen (could have happened before)/irrational beliefs/very intense at time – feel you can't counteract it so it influences actions" [group five].

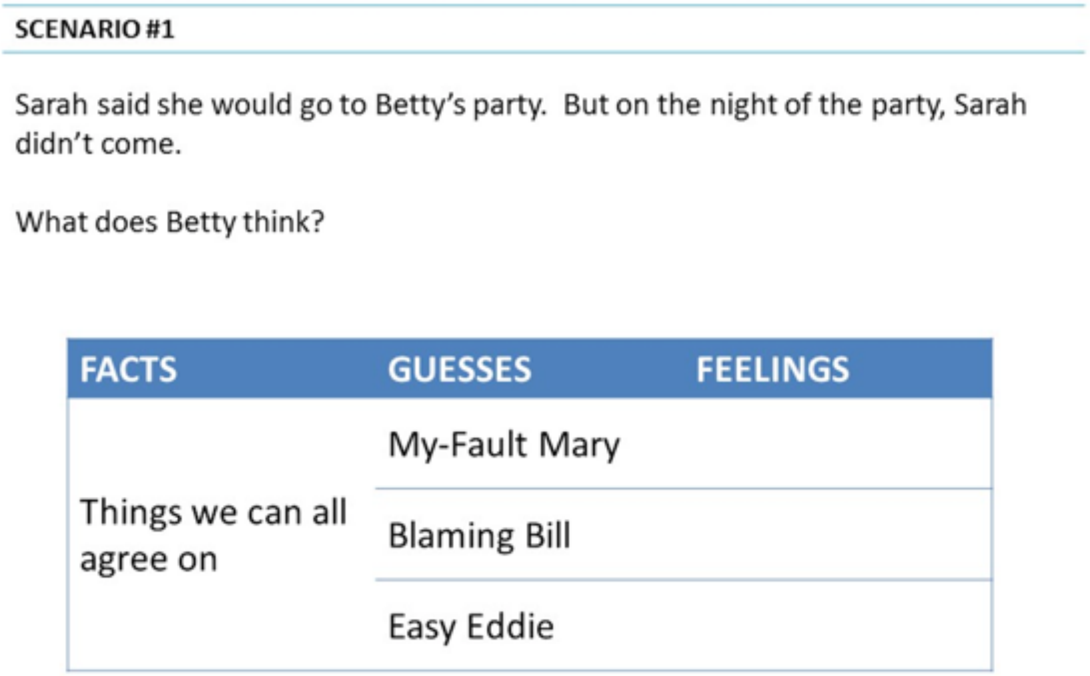
I found that the groups were very confident in defining paranoia due to their experiences of it.

Sub theme 2: Jumping to conclusions

Another aspect of the VEEP intervention was teaching participants about jumping to conclusions. The therapists informed participants that this was a form of thinking that can lead to difficulties in social situations. The aim was to teach participants about this so they could identify this type of behaviour in their daily lives. When this was mentioned in sessions, most participants recognised that they do jump to conclusions in various social situations.

One way participants were taught to avoid jumping to conclusions is via an approach called “generating alternatives,” a CBT technique. This is primarily used to decrease an individuals’ conviction in a maladaptive conclusion or belief. Therefore, during the VEEP intervention, participants were asked to provide three guesses to particular scenarios they were faced with. These three guesses took the perspective of three stereotypical characters: Blaming Bill, My fault Mary, and Easy Eddie). These characters presented themselves to the participants as avatars to make it more realistic (please see appendix 34 for images of Blaming Bill, My fault Mary and Easy Eddie).

Figure 37 is an example of a scenario that participants were presented with is below.



SCENARIO #1

Sarah said she would go to Betty’s party. But on the night of the party, Sarah didn’t come.

What does Betty think?

FACTS	GUESSES	FEELINGS
Things we can all agree on	My-Fault Mary	
	Blaming Bill	
	Easy Eddie	

Figure 37: VEEP intervention jumping to conclusions scenario

Overall, the groups understood what the characters represented and were able to provide answers to the jumping to conclusion scenarios. I felt they enjoyed observing these characters.

Theme 2: Treatment Attendance

Attendance was sporadic between sessions, and there was a lack of consistency. All participants were provided with a timetable of the dates and times of all sessions. Nevertheless, some participants were unable to attend certain sessions. This proved to be difficult for the remaining attendees, as there was an expectation that there would be a group of five participants in each group. Some attendees questioned why there were inconsistencies in attendance and whether those participants were not taking the treatment seriously. As a facilitator I did not discuss this with the attendees in each session. However, I did assure them that we were in touch with all participants and were aware of their circumstances. When we only had one participant in a session, it changed the teaching and treatment structure considerably as the focus was on one participant to complete all the activities and answer all the questions. In these circumstances I tried to take part and form discussions when required, so the participant felt like they were in group therapy. Therefore, futures studies will be useful to over recruit and assume no more than 50% attendance rate in each session.

Theme 3: Treatment Communication

Providing therapy in a virtual world environment relied exclusively on voice and textual communication. Therefore, it is vital that therapists provided a comfortable and supportive environment for their participants.

I tried to ensure participants felt supported throughout the treatment. Before starting the session, participants were given a reminder text to inform them of the time and date for the upcoming session. When participants joined the session, they were given a chance to ‘check in’ with the facilitators and other participants. This meant they were given the opportunity to talk about how they were feeling. They were also given a chance to debrief at the end of each session as well. Therefore, this hopefully allowed them to become autonomous in their treatment process and be honest with others around them.

However, I felt it was preferable when we had two-three participants in each session compared to five. This is because it was more difficult to manage conversations and discussions with a larger group of participants. As facilitators, it is important for all participants to have the opportunity to contribute to discussions when they want. However, the disadvantage of this is that quite frequently, the sessions would overrun past an hour. Participants had scheduled in an hour for the sessions, so they were surprised when we frequently ran over. Therefore, smaller groups allow participants to take part in useful discussions and complete activities in an appropriate time.

Although there are fast paced discussions in the virtual world, equally, there are periods of silences where no participant contributes. This may be because participants are thinking or declining to answer. As a facilitator, I found it challenging to facilitate the session in the absence of visual cues. Therefore, I routinely asked participants if it was ok to move on.

Theme 4: Patient-Therapist Alliance

It may sound surprising that I felt that a group of five was unmanageable when there are face-to-face therapy groups with many more patients. However, facilitating a virtual group is very different from facilitating a face-to-face group. This is because the absence of visual cues and lack of verbal cues meant that it was automatically harder for facilitators to recognise distress in participants.

Therefore, I developed strategies in dealing with distress and disclosure throughout the treatment. This was approved by the research team and implemented into the protocol. During the treatment, I consistently encouraged participants to be honest and reassured them that their contributions were valuable. When I thought a participant was struggling during the session, I offered them the opportunity to discuss the concerns later. If participants wanted to disclose something confidential to the facilitators, they could use text chat to send a message directly to the facilitators without other participants seeing the message. Although none of the participants used the text chat to disclose confidential information, it was helpful for them to know they had this outlet to do so.

Personally, I did not observe any challenges in participants building a rapport with each other. I believe the virtual world environment assisted individuals in building a rapport with one another and developing the confidence to contribute. Prior to beginning my PhD, I worked as an assistant psychologist where I facilitated group therapy for those diagnosed with borderline personality disorder. According to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5), Borderline personality disorder falls into the cluster b of personality disorders (dramatic, emotional or erratic types) (American Psychological Association, 2013).

Whilst working as an assistant psychologist, the group therapy face-to-face setting was where individuals were asked to sit in a circle facing one another. Most patients who were asked to take part in group therapy struggled with their social anxiety significantly and struggled with developing relationships with one another. I observed how difficult it was for patients to take part in face-to-face treatment, and it was not uncommon for patients to attend and walk away after a few minutes. This may have been because there was an absence of support for those with social anxiety to attend treatment to begin with. This did lead to disruption in group therapy sessions, where some patients were not as focused on the psychoeducation.

When comparing my experiences as a face-to-face group facilitator and virtual world group facilitator, I observed that most participants in the virtual world did participate in group discussions and were focused as well as comfortable in taking part. The disconnect between each other due to the virtual element of therapy may have been one of the reasons why. Therefore, I always felt positive and relaxed when delivering sessions. I felt that I could do my job as a facilitator just as effectively in a virtual world, compared to a face-to-face environment.

Previous research has led to mixed findings in this area. Whilst some previous research has suggested that building rapport online can be challenging due to the lack of visual cues (Chen and Hinton, 1999; Hay-Gibson, 2009), other studies have indicated that the absence of visual cues can assist people in forming closer relationships between one another online compared to offline situations (Bargh, McKenna and Fitzsimmons, 2002; McKenna, 2007; Whitty and Carr, 2006). One of the reasons for this is that online scenarios can create a comfortable environment for sharing experiences. Therefore, further research is required to understand the connection between visual cues and relationship building in online environments.

As seen in figure 27, I chose to deliver therapy using an avatar that most closely resembled my ethnicity. Therefore, I wanted to feel a connection with my avatar and hoped that it represented my visual appearance as much as possible. In terms of clothing, I wanted to ensure that my avatar looked smart casual and so therefore chose the outfit as seen in figure 27. I felt that this was important because I wanted participants to feel relaxed and comfortable in my presence.

Theme 5: Technological Difficulties

One of the issues I frequently observed in the sessions were the technical difficulties. Although we completed a thorough PPI co-design process and a beta testing process, we were aware that there were going to be technical issues. The technical difficulties ranged from the virtual world programme not starting to the ‘voice chat’ function, not opening. Therefore, in order to resolve these issues as quickly as possible and to minimise the disturbance, the primary facilitator would continue the session whilst the second facilitator worked on dealing with these issues. If the second facilitator could not resolve these issues the RA would be contacted to provide further support.

Overall, I did consider that we resolved the majority of the technical difficulties immediately, without compromising the intervention delivery. I thought that participants in this study appreciated the effort we put into resolving the issues we encountered. However, these technical issues did have an impact on the participants’ experience of the treatment, and some did inevitably miss out on some parts of the session as a result.

10.3 Discussion

The aims of this study were to assess the feasibility and acceptability of delivering the VEEP intervention, from the primary therapist’s perspective. In this present study, undertaking multiple roles in the VEEP trial and participating in the autoethnographic process was viewed as providing opportunities for self-awareness and contribution to the field. Thus, autoethnography methodology contains relevance to various research questions in this doctoral thesis (Peterson, 2014; Savage, 2000).

The therapist highlighted the inconsistencies in treatment attendance between groups and between participants. Although this was anticipated due to prior studies into treatment attendance and adherence in a psychosis population (Fanning et al., 2012; Lal and Malla, 2015), it still impacted the therapists' ability to provide therapy efficiently and complete the tasks at hand. Therefore, future research would need to focus on developing an understanding of perspectives of those with FEP in engaging with VR treatments. This knowledge will allow services to create a patient-orientated and operational definition of VR service engagement that can be used in future studies. Furthermore, support should be provided to therapists to ensure that they can engage and provide outreach work to those at risk of disengaging.

Findings from this study indicated that both the patients and the therapist had different views about the therapeutic alliance. Overall, patients reported a robust therapeutic alliance (Hubley et al., 2016). This may be because the VEEP intervention was used as an adjunct to the face-to-face treatment patients were receiving in the EIP services. Previous studies that have used digital mental health including VR, alongside face-to-face treatment, have found that this dual exposure led to improved therapeutic alliance (Richards et al., 2018; Thase et al., 2018). Thus virtual treatment allows therapy to be viewed as a continuous process and may provide an opportunity to enhance routine treatment (Yellowlees, Chan and Parish, 2015). Previous research suggests that the increase in communication modalities can increase the strength of the therapeutic alliance (Bengtsson, Nordin and Carlbring, 2015; Sucala et al., 2012).

However, most participants in this study were not receiving consistent face-to-face psychological treatment in the EIP team. Instead, they were receiving pharmacological interventions under the supervision of their care coordinator. Therefore, one of the possible reasons why participants recorded a strong therapeutic alliance is that they received much needed consistent psychological treatment.

The therapist found some disadvantages to VR therapy (Richards et al., 2018; Simpson and Reid, 2014). One reason may be because therapists have training and supervision to build therapeutic relationships. The therapist stated they were not aware of how to alter their behaviours most appropriately in a VR to provide the same support, compassion and understanding as a face-to-face session. Another concern discussed by the therapist was the lack of social cues in virtual therapy. Therapists are trained to undertake a physical assessment of patients' facial expressions and body language. During virtual therapy, the therapist could not make such observations, which impacted their perspective of the therapeutic alliance (D'Alfonso et al., 2020; Tremain et al., 2020).

However, according to the therapist, the sense of anonymity and lack of visual cues were considered to help to reduce the power imbalance and thought to subsequently enhance the therapeutic alliance. This is because both the therapists and the patients used a non-clinical VR environment to attend the treatment using avatars. During a face-to-face treatment, patients may feel that they are entering the therapist's environment, leading to a power imbalance (Nagel, 2008).

During this intervention, some patients experienced consistent technological difficulties. This impacted their experience of the intervention and may have affected the therapeutic alliance (Lopez, 2015; Parish et al., 2017). Technological failures are challenging to resolve and may take up time, leading to the frustration experienced by both the therapist and the patient.

Findings showed that this frustration was minimised by the structures in place. Firstly, the thorough beta testing and co-design process indicated what technological issues were most likely to occur. Therefore, the therapists and research team were aware of how to resolve these issues. Having two therapists to facilitate the intervention was useful because if a patient was experiencing technological difficulties, the secondary therapist was able to contact the patient and work towards a resolution. Furthermore, one of the benefits of a virtual library was that patients had access to past and future session material. Therefore, if a patient could not attend the session due to technological difficulties (i.e. voice chat not working), they could review the material they had missed in their own time.

This plan indicated that the therapists were available and willing to work with the patient. This demonstrated that the patient, as opposed to the communication method is essential. The openness and commitment to talk through and resolve the technological frustrations were essential to maintain and even strengthen the therapeutic alliance (Lopez et al., 2019).

10.3.1 Strengths and limitations

To the candidate's knowledge, this is the first autoethnographic study in the field of VR therapy and psychosis. Ethnographic research helps to provide a detailed understanding of the society around us. However, there are limitations to this methodology. Ethnographies may not capture the breadth of data when compared to other methods. Furthermore, only one autoethnography had been completed in this study. Nevertheless, autoethnography encourages readers to compare their own opinions, with the researcher's own experiences (Ellis and Bocher, 2000).

10.3.2 Conclusions and future implications

This research highlights that it is feasible and acceptable to deliver VR therapy to those diagnosed with FEP. An autoethnography can be used to help clinicians and therapists reflect on their practice. Future research should develop a more thorough understanding of the specific characteristics of online therapeutic relationships, including distinguishing between online and face-to-face therapy. This will assist therapists in getting closer to the goal of understanding how to facilitate a therapeutic alliance in digital therapy (Berger, 2017).

Another consideration is that particular ‘therapeutic alliance’ measures should be developed to analyse the specific characteristics of the digital therapeutic relationship. Therefore, whilst contact with a therapist appears to contribute to the success of a VR intervention, other specific characteristics facilitating positive outcomes do not seem to be illustrated in the therapeutic alliance measures (Berger, 2017). To enhance the rigour in digital therapeutic alliance research, future research should implement repeated therapeutic alliance outcome measures to further understand the temporal relation between alliance and symptom changes.

11. Study 7 - conducting patient and public involvement (PPI) for a VR-360° intervention to improve social cognition in those diagnosed with FEP

11.1 Introduction to the chapter

This chapter first provides further information on 360° videos. The second part of the chapter is a PPI study to assess the feasibility and usability of the 360° videos as part of a wider VR-360° therapy, to target social cognition deficits in FEP. PPI input was only related to viewing the complete 360° videos. The advancement in these newer 360° technologies has developed an 'immersive virtual experience,' which can enhance and strengthen the therapeutic experience (O'Sullivan, Alam and Matava, 2018). The VR-360° themes are illustrated in figure 38.

11.2 Background information

11.2.1 Patient and public involvement

Currently, PPI is an established part of the healthcare research process and can result in successful outcomes. There is growing research on participatory design methodologies and PPI involving patients, carers and the public in developing of digital interventions (Barry and Edgman-Levitan, 2012; Riper et al., 2010; Sin et al., 2019; Vaughan et al., 2018).

Two systematic reviews have concluded that participatory research methods in digital health intervention development are a key factor in determining the usability and acceptability of most interventions (Orlowski et al., 2015; Simblett et al., 2018). Furthermore, participatory research is positively linked to the success of the study when reviewing the recruitment and retention rates (Ennis and Wykes, 2013; Staley, 2013).

Currently, there is limited evidence in utilising PPI specifically for VR interventions. Furthermore, there is limited evidence in conducting PPI successfully in online formats. Therefore, this PPI research into gathering feedback on the VR-360° videos is unique due to these two aspects. Furthermore, despite there being an increase in interest in 360° videos (Corbillon et al., 2017), there are limited studies on its effectiveness in targeting mental health conditions. Therefore, it is vital that PPI is conducted during the development and implementation process of the VR-360° intervention.

11.2.2 Engaging young people in PPI

It is vital to empower service users in the decision-making process. Thus, engaging service users in an empowering manner should involve collaboration using creative methods rather than viewing service user involvement as an afterthought (Nakarada-Kordic et al., 2017). A young person can undertake multiple roles, including being involved as user, tester, and design partner (Druin, 2002).

However, engaging with young service users in practical ways can sometimes be difficult. According to Bassett et al. (2008), some young people may struggle with interacting with ‘traditional research methodologies,’ which can subsequently lead to the risk of disengagement. Thus, traditional research methods often fail to understand the challenges young service users experience, mainly when those service users are mentally unwell. Methods that focus on youth engagement are vital to the contribution of research (Pedersen and Buur, 2000). The participatory design allows service users to participate in the design and research process. This allows young service users to become equal partners in the decision-making research process (Visser et al., 2005).

Thus, during PPI, service users contribute to the design and intervention process through their insight and feedback on prototypes and existing technologies. Once it is developed, they can provide feedback and input (Thabrew et al., 2018). This iterative framework can be considered to increase ownership and engagement with participants (Grant et al., 2020).

11.3 Results

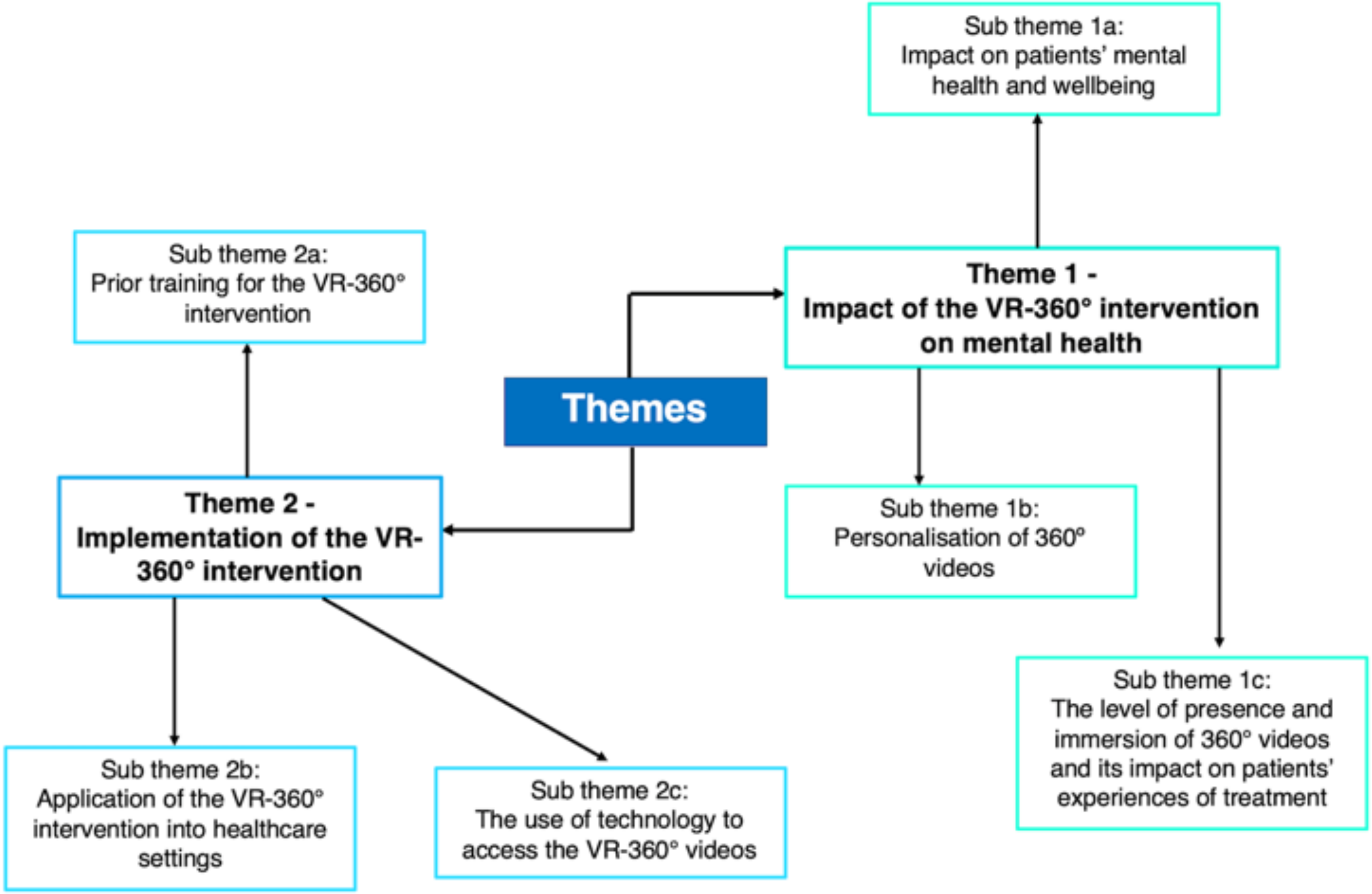


Figure 38: VR-360° intervention workshop themes

11.3.1 Participant vignettes

Below are the three participants who were recruited and consented to take part in this study.

Vignette 1: Ellie Ellie is a 26-year-old female, who has prior experience accessing child and adolescent mental health services in the UK. Therefore, as she is an expert by experience, she has contributed to the design and development of many mental health research studies that target children and young people. Ellie has previously used digital health technologies.

Vignette 2: Aisha Aisha is a 23-year-old British female, who has generalised anxiety disorder and experiences sporadic panic attacks. She is currently a medical student. Aisha's experiences with digital health are that she has attended Zoom appointments with GPs.

Vignette 3: Lila Lila is a 23-year-old British female. She has a diagnosis of depression and is a mental health advocate. Lila's experiences with digital health are that she has attended online counselling to help with her depression.

11.3.2 Themes

Theme 1: Impact of the VR-360° intervention on mental health

This theme illustrates the impact the VR-360° intervention could have on patients' mental health.

Sub theme 1a: Impact on patients' mental health and wellbeing

This sub theme focuses on the impact the 360° videos would have on participants' social cognition and social functioning. According to participants, the videos were immersive and realistic due to their 360° format, which could positively contribute to the therapeutic experience.

However, it may not be sufficient as a stand-alone intervention, particularly for those with severe social cognition and social functioning deficits. This is because the 360° videos lack certain cues that exist in social scenarios, such as various sounds and even smells. Therefore, whilst it may be appropriate for a short-term intervention, this approach should be utilised as a part of a stepped care approach where participants eventually go into the real world and practice their social skills:

> "Well it could be a good starting point but erm as part of therapy alone, I don't it would be like sufficient because I (inaudible), it does kind of mimic er an environment, but there are a lot of other stimulants you see when you go out in public so er, it would be good like erm to work from home, but I don't think it, it's adequate like help for all the problems someone might have with social anxiety." [Aisha, Workshop 2: Line 209 – 213]

Additionally, Aisha suggested that this approach might not be appropriate for all individuals with social cognition and social functioning deficits. Therefore, considerations such as these are essential to consider when designing innovative treatments to reach those most likely to benefit from such programmes when considering designing new treatment approaches (then cite some refs to support your view). Thus it is essential to identify what specific challenges individuals have and how the 360° videos can be used to improve this:

> "Sorry I definitely think it-it may not be perfect, but for things like phobias, like if you're say claustrophic, having like a virtu-virtual reality in like a tiny room sort of thing, it can be like those bab-it can be one of

> the baby steps to building up the actual going in public or going into a small space whatever it is.” [Lila, Workshop 2: Line 221 – 224]

Lila above, used the example of using 360° videos to help an individual deal with and overcome claustrophobia. This comment represents the wider view of utilising the VR-360° intervention as a stepped care approach to improving patients’ social cognition and social functioning.

> “Yeah no I was just thinking like same for me, it was straightforward to use, but I was just thinking that some people with learning disabilities or comorbidities or something might struggle, so it could be an idea to erm to design it first of all with the therapist and like like you said, get reacquainted with it before the therapy starts erm yeah I didn’t think about the claustrophobia, but the actual graphics were quite good, I thought it was like simulated a real life like coffee shop or a room, so I felt like it was a good medium to use.” [Aisha, Workshop 1: Line 506 – 512]

Aisha echoed what Lila had stated: some individuals may find it challenging to utilise 360° videos. This can be mitigated by allowing those individuals with lived experience to be part of the co-design process. As a result, they are more likely to respond to the scenes that they are immersed in.

Sub theme 1b: Personalisation of 360° videos

This sub theme focuses on the importance of personalising the 360° videos for participants, so they respond to them efficiently. Personalisation involves the content of the videos as well as the instructions provided to participants.

The design of VR and digital interventions can have a vital effect on the engagement of participants in taking part in such interventions. Individuals’ cognitive style and approach significantly effect their understanding and information seeking (Chen, Magoulas and Dimakopoulos, 2005). Therefore, by altering the specific features and mechanisms to suit individual cognitive styles, personalisation can increase engagement for specific users.

One editorial device that works well in 2D videos but not always with 360° videos, is dialogue. When watching a 2D video, the camera is positioned to film what they want the viewer to focus on. The viewer is unable to alter the focus. However, this is not the case with 360° videos because the viewer is not always focused on one scene. Therefore, when a conversation takes place, the viewer needs to look around to see who is talking and what is happening:

> “As opposed to it being like one person talking and another person talking, but it’s um bearing in mind the voice level so that it could, you could make sure you hear what the actual conversation should be listening to is, if that makes sense.’ [Lila, Workshop 2: Line 79 – 81]

Thus, Lila stated that it was important for them to be told where to focus during the video. This would improve their experience and allow them to be more prepared. This is particularly important to do with 360° videos because when the FoV becomes bigger, viewers are more likely to view the centre than the peripheral views (Boonsuk, 2011).

Aisha’s feedback points to a broader challenge with attracting and directing attention in 360° videos. This is because compared to 2D videos (where close ups can be edited in), users viewing a 360° video have a wider FoV to explore. Previous 360° video directors have attempted to draw users’ attention to specific scenes using visual or audio cues. In these 360° videos, there were ‘gaps’ between the ending of one scene and the beginning of another.

However, whilst this may be appropriate in the script, this was not enough in practice.

Ellie highlighted how some scenes did not seem realistic and may not achieve what they were meant to. For example, the facial emotion recognition scenes at the beginning of the VR-360° prototype 2, involved the actors changing facial expressions too quickly:

> “Well I think if you’re if you’re trying to understand and learrrn erm what the expressions…are (inaudible) then you will need the maybe at a slower pace but then but in real life obviously expressions can change a lot more quicker erm so would that…” [Ellie, Workshop 2: Line 311 – 314]

However, Ellie acknowledged that people change their facial emotions very quickly in real life and so it is important that participants get used to this. They also highlighted that the fact that being an observer in the 360° videos, as opposed to an active participant in real life, may have hindered participants’ ability to recognise emotions:

> “Oh I guess maybe if someone really found this difficult maybe yeah having more time and it being slower would be beneficial errm…..yeah and I guess ordinarily…errrm it would be within an interaction, the expressions will be happening, rather than sitting and looking at someone but…yeah.” [Ellie, Workshop 2: Line 321 – 324]

This is known as the ‘Swayze Effect’ (named after Patrick Swayze’s character in the 1990 film Ghost), whereby an individual cannot have a relationship and interact with the environment they are present in (Burdette, 2015).

Therefore, as a result, it is vital that the therapist talks to and assesses patients before therapy to ensure that they will view the appropriate amount of 360° video scenes:

> “you can always do more videos like another one afterwards I dunno, maybe different stages with different lengths errm that you’re experiencing this orr hmm.” [Ellie, Workshop 2: Line 253 – 254]

Here a stepped care approach can be used so that participants are viewing videos in corresponding order. Furthermore, participants should view videos that they will benefit from with the support of their therapist. The duration of each scene should be taken into consideration, and participants should be provided with time in between scenes. Not only will this give them time to discuss what they saw, but it will also give them time to recover from the potential cybersickness symptoms.

Sub theme 1c: The level of presence and immersion of 360° videos and its impact on patients’ experiences of treatment

This sub theme focuses on the level of presence and immersion participants experienced when viewing the 360° videos. They were not directly asked about presence and immersion to reduce bias in participants’ responses. However, these topics were mentioned when the interviewees discussed their experiences and feelings. Participants discussed the concept of the presence and feeling embedded into the scenes.

Participants discussed how realistic the 360° videos are. Aisha stated that although they knew they were in a VR setting, they still believed they were participating in real life scenarios:

> "Yeah is just that erm same as (Ellie), I thought it was a lot more realistic 3D and errm I think you guys did a pretty good job managing to capture like, when you looked around, you could still tell you were in a virtual world so I thought it was pretty accurate and it felt you were like you were in a real like interview situation, even if in the the café one as well, it did feel like you were in a café so erm yeah so yeah I thought it was pretty good." [Aisha, Workshop 2: Line 525 – 530]

As Aisha mentioned, one of the reasons why the 360° videos were so realistic was that real life scenarios were filmed instead of relying on computer graphics and virtual avatars. Modality interactivity can be defined as the interactive features, which allow viewers to access information (Oh et al., 2020). Modality interactivity can lead to positive responses of the 360° interface, leading to an adjustment of behaviours and opinions (Chu and Yuan 2013; Oh and Sundar, 2015).

Aisha's experience can be supported by the curvilinear model of interactivity (Bucy, 2004). This model suggests that a moderate level of intensity is most appropriate. This is because whilst low levels could lead to conflict and social discord, high levels can lead to information overload, withdrawal and irritation. Thus, a balance can result in the most appropriate user experience, leading to information recall (Holmes, 2018).

Participants reported that the immersion of the headset and the 360° videos meant that they were not distracted by the external stimuli around them. This led to heightened levels of focus and attention, thereby enhancing presence and realism:

> "You don't obviously when you've got the headset on, you don't have anything outside the zone, distractions around you 'cause that literally does not (inaudible) but yeah I think it really…it like I said it's just getting

> used to it errm and it becoming less novel.” [Ellie, Workshop 2: Line 505 – 508]

Another factor of immersive technology is that viewers must understand their role in the scene and story; therefore, they need to decide whether they are a passive observer or an active participant. Thus, the content and the environment need to have a believability and appeal to the viewer, which goes beyond the physical technological aspects of immersion.

According to prior research, presence is constructed through a two-step process: 1. The viewer must utilise spatial cues to recognise the virtual space as plausible 2. The viewer must recognise themselves as being located within the VR world (Cummings and Bailenson, 2016; Wirth et al., 2007). Due to the high-fidelity nature of these 360° videos, there may be high expectations of behavioural realism. Therefore, users require an understanding of whom they are in the 360° video, as opposed to just where they are:

> “Yeah oo-well if that all slightly expected, it’s almost like you want the interviewer to say ‘okay you’ve got a bit (inaudible) to answer the question,’ ask the question and then so do you actually know of how much time you’ve got or like you would you would need the question be asked in a way you know the response you’re expected like ‘can you give me three words that er summarise your experience’ and then you know you’re not, you don’t have to think that you’re not ‘aah this is a long answer,’ errm.” (Ellie, Workshop 2: Line 576 – 580)

As seen here, Ellie felt they were an interviewee in the scene and wanted to engage and respond to the interviewers, when being asked questions. Therefore, they felt engaged with the content due to the immersive narratives, which led Ellie to connect with the characters. As Ellie felt that the scene related to them, they analysed the social cues from the interviewers and wanted to participate.

The sense of presence is also enhanced by wearing a headset. Narrative engagement is a combination of emotional engagement, narrative comprehension, attentional focus, and narrative presence (Busselle and Bilandzic, 2008). Therefore, the headset enhanced spatial perspective, which allowed them to understand better their position within the scenario (MacQuarrie and Steed, 2017):

> “Yeah so apart from the sound, the clarity of it like was pretty good erm and it felt like I was, like I was walking into a setting or something, so I didn’t I kind of forgot I had the headset on or something a few times so generally I felt, good feedback for that.” [Aisha, Workshop 1: Line 520 – 523]

Therefore, the comfort of wearing the Google Cardboard combined with the videos quality allowed Aisha to feel immersed in the scene, thus offering proof of the balance between usability and immersion.

Theme 2: Implementation of the VR-360° intervention

This theme focuses on the importance of implementing the VR-360° intervention to be utilised efficiently. Implementation can be defined as a series of processes and techniques to improve the adoption and sustainability of an intervention or practice (Eccles and Mittman, 2006; Powell et al., 2015).

Sub theme 2a: Prior training for the VR-360° intervention

This sub theme states that providing training for the VR-360° intervention can improve successful implementation.

Participants discussed the interactive nature of the 360° videos and how they distinguished from the standard 2D or unidirectional experience. One of the reasons for this is due to the FoV. FoV can be defined as the extent to which individuals can observe their environment around them (Chang, Kim and Yoo, 2020). 2D cameras restrict the FoV to even narrower than human perception, whilst a 360° camera films the entire environment from the optical centre (Su and Grauman, 2017). Viewing a 360° video via a Google headset provides you with a FoV of 100° (Shafi, Shuai and Younus, 2020).

Due to the novel nature of 360° videos, they felt an instinct to look around and observe their surroundings. Therefore, according to participants, the FoV of 360° videos provides greater immersion than 2D videos. However, they felt they might miss crucial details in the scenes and therefore did not know where to focus. Thus, the viewer may not focus on specific visual items and parts of the scene that are required.

Therefore, this shows that when viewers experience 360° videos and/or an immersive headset for the first time, they may act differently than those with prior experience. Thus, this is an essential factor to take into consideration in future studies:

> “I think it is important like to spend some time wh—getting like just having a play around, getting used to it, before you go straight to like the intervention or something.” [Ellie, Workshop 1: Line 445 – 447]

According to participants, it is important that viewers are given as much time as needed to get used to the 360° videos and the headset. This may need to be personalised depending on their needs, and therefore will prepare them for the intervention:

> “That’s because, that’s because it’s new and (inaudible) things yeah so I think that should be maybe factored in like if you’re starting an intervention or something with someone, maybe just like I don’t know, the first hour (laughs) you can just play around it with and see what it looks and learn how erm….yeah.” [Ellie, Workshop 1: Line 428 – 431]

Ellie above highlights that there are skills required to navigate through the 360° videos. Therefore, it is important that people are allocated time to learn and become comfortable with the technology.

Sub theme 2b: Application of the VR-360° intervention into healthcare settings

This sub theme focuses on the issues surrounding implementing a novel VR-360° intervention into healthcare settings.

During the workshops, participants discussed whether the VR-360° intervention could be implemented successfully into the NHS. Although the participants engaged with the novel intervention, there were queries about whether it would be efficient in practice.

One of the reasons are the challenges with digital implementation; digital implementation concerns amongst healthcare professionals need to be addressed (Buis, 2019). This could be due to their lack of familiarity on how to utilise the intervention combined with how it could support routine care. Ellie, who currently works in the NHS pointed out that there is a resistance to changes in workload and novel forms of therapy:

> “I anticipate that….that I find this stuff really interesting and I think this really good work (laughs)..but then like err..th-cause I actually also work in the NHS and there is a lot of resistance to new technology and technology is err I think maybe the problem will come, with the services

> and erm (inaudible) with people accessing the services, erm the clinicians (laugh) I suppose are used to people accessing the service, I don't know, this is speculation…" [Ellie, Workshop 1: Line 187 – 192]

Clinicians may not just experience the resistance, but by patients and services more broadly. Therefore, a broad approach needs to be undertaken to first understand what the concerns may be (if any) and how these can be resolved. This is an integral part of the implementation, where a collaborative approach is adopted.

The intervention must be updated if required, depending on people's needs:

> "Advancements and like..so yeah, by the time you get round to publishing and everything, do you think it will still be relevant, or do you think you will have to redesign again (laughs)." [Aisha, Workshop 1: Line 245 – 247]

Ellie highlighted a disadvantage of 360° videos. Creating a 360° video is a long process; the video needs to be scripted, filmed, edited and uploaded. If videos and clips are outdated or need to be changed, it will involve videos being re-created again.

Sub theme 2c: The use of technology to access the VR-360° videos

This sub theme illustrates the participants' responses to the technical aspects of using the 360° videos. One of the common issues arising was cybersickness, which is a prevalent side effect of VR technology (Dennison, Wisti and D'Zmura, 2016). This is particularly the case with HMD displays; according to studies conducted by Sharples et al. (2008) and Kim et al. (2014), participants experienced higher levels of cybersickness with HMDs, when compared to other forms of VR.

As a result of this, some participants believed that there should be a time limit as to how long one should view the 360° videos:

> “(Laughs) I think it depends on how long you’re gonna use it for, ‘cause if you’re using it for like ten fifteen minutes it’s ok (laughs), but it’s uncomfortable, if you’re gonna wear it for a longer time, then erm I dunno, it might distract on what you’re doing.” [Ellie, Workshop 2: Line 197 – 200]

Therefore, Ellie believed that the uncomfortable feeling of wearing a Google Cardboard headset may have the opposite effect and may distract participants from focusing on the intervention. Therefore, having the option of viewing the videos in a 2D format should be retained.

Whilst viewing 360° videos may be uncomfortable for some, other participants believed that it simply might not be an option for everyone:

> So I think it would work well with (inaudible) for many people, but I think there would be a select few who can’t use it, so it would be having the option about for both.” [Lila, Workshop 1: Line 495 – 496]

Here Lila highlighted the importance of finding participants to participate, who can do so to begin with. Therefore, due to the potential consequences of cybersickness, it is not an intervention that is suitable for everyone.

This is particularly the case for Lila, who is visually impaired. As a result, they had a different experience in viewing the 360° videos when compared to the other participants:

> “I feel another thing err also in terms of getting used to I’m blind, that in terms of things like claustrophobia, there may be some people that

> don’t like sensory issues, don’t like things like right on their face that they accept, so it be the fact that even may not, like I didn’t hear the full intro, I don’t know who will be using it, ‘cause there may be some people who point blank like can’t use it ‘cause of the feeling it has on their face, but other might just (inaudible) get used of it, because of the fact that obviously you’re not aware of your surroundings because you’ve got earphones on, which is noise cancelling and then you can’t see anything around you ‘cause of the eye set thing, so it may take either some people time to getting used to it, or there may be some that just point blank struggle to use it.” [Lila, Workshop 1: Line 468 – 477]

Lila highlighted that some individuals, particularly those with disabilities. might have different experiences when viewing the 360° videos.

Lila also felt restricted with the headset and could not utilise the 360° videos. This is because they felt unsure of how to navigate the scene, and subsequently, they lost focus on what was going on. This is known as head-based rendering, which refers to how the environment responds to changes in orientation and head position via adapting the 360° videos in the Google Cardboard (Bowman and McMahan, 2007). This allows viewers to look around the scene.

This led to feelings of discomfort and being unsettled. This connects back to the prior sub theme discussed, which focuses on prior training for participants:

> “I literally had to do like this the whole time for both videos or like this, depending on which way it was to see it. I realised afterwards that I could turn by chair, like turn my physical body around, I thought that was quite like it took me a while to realise that I could physically move, so I started to end up getting neck pain basically…” [Lila, Workshop 2: Line 143 – 146]

Here Lila felt overwhelmed by the different views and perspectives within the 360° videos. However, this led to confusion about where to look and what to observe. Therefore, this led to the participant feeling physically uncomfortable and getting neck pain. Therefore, this had a detrimental impact on their experience and became a distraction.

There are reasons as to why this may be the case. Using the Google Cardboard headset, participants can change their perspective in the 360° videos by moving their head left and right, up and down, leading to a potential sensory mismatch (Yildirim, 2020). Therefore, during a VR experience, the VR environment provides visual cues to create an illusion of movement and motion called a ‘vection.’ However, the lack of corresponding vestibular cues in the physical reality leads to a visuo-vestibular conflict. Here there is a sensory mismatch between the two systems responsible for balance, leading to cybersickness (Yildirim, 2020). The reasons for this may be due to the movement velocity and head movements.

11.4 Discussion

A PPI study was undertaken with young people with lived experience of mental health conditions, to gather their opinions on the feasibility and acceptability of 360° video prototypes.

This study demonstrated that young service users can effectively engage in a thorough PPI process using simple creative participatory methods. Providing a solution-focused, flexible methodology allowed the candidate to interact with PPI participants creatively, thereby enhancing engagement. The findings are supported by previous research, where young people with lived experience are effective partners in research (Bowen et al., 2013; Hetrick et al., 2018).

11.4.1 Outcomes from workshops

This PPI study used an innovative approach to develop a VR-360° intervention to improve social cognition deficits in FEP. The participatory research design method focused on ensuring that those with lived experience were fully involved in all phases of the design and development process (Hickey, Richards and Sheehy, 2018). This PPI study provided a distinct participatory research coproduction methodology – workshops to design and formulate a novel VR intervention, which involved rapid feedback and prototype cycles. This cycle utilised an agile method, and therefore improved the continuous generation of new feedback. This allowed PPI participants to have hands-on involvement in producing and revising the intervention drafts and the 360° videos.

Participants were allowed to view the 360° videos before the workshops, thereby giving them a chance to collate their thoughts and opinions. Participants focused on the storyline of each scene the technical aspects of the 360° videos and the processes involved in producing them. Therefore, this shows that the VR therapy itself cannot be considered in isolation; the writing, acting, and post-production all influenced how the participants perceived and experienced them.

Overall, participants engaged with the storyline and backdrop of each video and believed that it would be helpful to in targeting those social cognition deficits in people with FEP. Filming the scenes using actors in real settings (as opposed to using virtual avatars) combined with the panoramic view enhanced participants' sense of realism. Despite some scenes' video resolution being unsatisfactory, participants felt that the perceived sense of realism and presence was good.

Whilst participants were able to understand and follow the storyline in most of the scenes; there were some difficulties with some. Difficulties included the lack of cues to guide participants on where to look in the videos, which meant missing out on detail (Zulkiewicz et al., 2020). Therefore, these findings provide practical considerations for the development of future 360° videos. Utilising narrative techniques could play a vital role in allowing users to feel part of the story, thereby enhancing immersion. Here users will use contextual cues, such as character interaction, to better understand their role (Vasser and Aru, 2020; Vettehen et al., 2019). Thus, future researchers and developers should consider oral and visual cues, where the user's role could be emphasised scenes.

The introduction of these workshops highlighted the importance of personalising and tailoring VR health interventions for supporting young people (Lindner, 2020; Smits, Staal and van Goor, 2020). Participants in the study enjoyed and felt engaged with the final scenes of VR-360° video 2, where the camera was positioned in the first-person perspective. Therefore, participants felt part of a scene, as opposed to being simply an observer. Thus, it is essential that participants taking part in the future VR-360° therapy are allowed to tailor the videos. One of the challenges is that filming 360° videos takes an extensive amount of time; however, personalisation may involve allowing participants to watch scenes that are more suitable to their needs (Herault et al., 2018; Balzaretti et al., 2019).

Due to the novel immersive nature of the 360° videos, it is understandable that some viewers might have become distracted. Furthermore, it could reduce anxiety and increase confidence. Therefore, the findings from this study suggest that it is helpful for users to be offered a session pre-intervention to enable them to learn and practice using / viewing 360° videos. This allows users to test out the technology and ask the therapist any questions they may have. This is supported by the findings from the VEEP trial, where participants benefited greatly from a pre-intervention session. Future research suggests that focusing on identifying strategies for directing attention to optimise the therapeutic experience would be helpful.

Several technical issues were revealed, particularly with regards to functionality. Safety is an important issue to consider when providing VR treatment to minoritised groups. In this study, one participant began to suffer from neck pain. This subsequently had a detrimental impact on their experience and distracted them from focusing on the videos. Prior evidence on safety is still relatively limited due to the inconsistent reporting and small sample sizes (Gershon et al., 2004; Li, Chung and Ho, 2011; Sander Wint et al., 2002; Tennant et al., 2020; Wolitzky et al., 2005). Therefore, further research is needed to understand what triggers such adverse effects when using VR and what can be done to minimise them.

11.4.2 Facilitating PPI online

Due to the COVID-19 pandemic in the UK, all PPI was conducted online using the online platform, Zoom. Reasons for using Zoom was the following:

1. Free to use for participants.
2. Meetings can be password protected.
3. Those participants who do not have access to the computer or laptop, could phone call in.

The majority of participants benefitted from using conference technologies to participate in PPI consultations, which is consistent with previous research (Deakin and Wakefield, 2014; Hanna, 2012; Sullivan, 2012). General satisfaction with video conferencing methods to conduct PPI workshops highlights its suitability as a methodological tool. Due to the COVID-19 pandemic, many individuals needed to adapt to online methods of communication, education, and work. The findings from this PPI study can contribute to future applications of using videoconferencing in terms of user satisfaction, quality, and contextual appropriateness (Archibald et al., 2019).

There are some differences of opinion in the literature regarding establishing an alliance and rapport using videoconferencing technology. Whilst Cater (2011) stated that it was more challenging to develop a rapport when compared to face-to-face interviews, other studies found that participants on Skype developed a rapport more quickly online (Deakin and Wakefield, 2014; Tuttas, 2015). Participants' satisfaction with Zoom may have been due to its user-friendly and intuitive platform, and thus is appropriate to use for a wide range of participants (Archibald et al., 2019).

11.4.3 Barriers and facilitators to PPI

Although it did not emerge in the results, one potential barrier to VR adoption involves access to VR technology. Patients taking part in the intervention were allowed to view the 360° videos between sessions; nevertheless, their lack of access to HMDs may prohibit them from doing so in an immersive way. However, as was seen with the Google Cardboard, some VR equipment is affordable and accessible. Furthermore, the price of other VR technologies may reduce, leading to an increase in accessibility (Coburn, Freeman and Salmon, 2017). Furthermore, most smartphones contain the necessary technology to view 360° videos (Frisby et al., 2020).

A low-cost Google Cardboard was provided to participants to use, as it is affordable, and therefore, every participant was able to have one mailed to them. This was particularly important during the COVID-19 pandemic when face-to-face meetings were prohibited. Furthermore, low-cost disposable HMDs reduce logistical concerns and infection risk. However, previous research has suggested that low-cost HMDs lack a sense of immersion when compared to high-cost HMDs (Schlögl et al., 2017). This is particularly evident when those individuals with significant prior experience of VR, choose not to access and utilise Google Cardboards. Therefore, future studies should ensure that individuals can access appropriate HMDs, depending on their prior VR experience and expertise.

This PPI study indicates that service users with lived experience can sufficiently contribute to research, where the outputs are considered shared responsibilities between the research and the PPI participant. Future researchers can implement this description of this process. A particular benefit was recruiting a PPI participant who had assisted with the co-design of the VEEP trial (Realpe et al., 2020).

Here are several limitations to this PPI project. Recruiting participants to take part in the PPI process was challenging and was exacerbated by the COVID-19 pandemic. The candidate experienced situations where suitable organisations she approached, did not respond to invitations. Possible reasons may include staff working from home and research projects being suspended. Therefore, a smaller number of participants were recruited than had initially been anticipated pre-COVID-19. A smaller sample of participants may fail to capture disadvantaged communities, thereby reducing diversity (Vasileiou et al., 2018).

Whilst the age range for this PPI was based on the intended target audience for this intervention; it could be suggested that this might limit the applicability to younger patients, although those who did volunteer to take part in this study were in the appropriate age range (ages 23 – 26 years). Therefore, as with any such small and focused study, future research should recruit a larger sample size.

Conducting a PPI study during a PhD involves very few resources. Thus, PPI participants did not get paid for their time. However, they were provided with a Google Cardboard to keep. Furthermore, they were provided with a £10 Amazon voucher as well. Therefore, the motivation to take part was most likely intrinsic, discussing their experiences, sharing their thoughts and taking part in a research process.

Despite the positive perceptions of 360° videos, the impact of the VR-360° intervention on social cognition remains to be seen. Previous research remains mixed on the impact of 360° videos on the efficiency of learning and education. Whilst Stupar-Rutenfrans, Ketelaars and van Gisbergen (2017) and Walshe and Driver (2019) found positive results; other studies found non-significant results (Panchuk et al., 2018; Pulijala et al., 2018).

11.4.4 Future directions

Going forward, based on these findings, a feasibility and acceptability trial which combines exposure to virtual environments with psychoeducation, is recommended. Here, patients will be taking part in virtual cue exposure, whilst therapists will support patients in developing coping strategies to enhance social cognition. Furthermore, suggestions for future research could include using a person-centred approach to delivering interventions and using physiological measures to measure anxiety (i.e., heart rate variability). This will allow researchers and clinicians to provide greater analyses and give specific recommendations.

11.4.5 The candidate's reflections on taking part in this PPI study

Overall, it was a positive experience to involve a PPI process in developing the VR-360° intervention. Forming trust and relationships was vital to ensuring a positive working relationship. One of the ways in which this was achieved, was to understand participants' motivations for taking part and their expectations. The candidate gathered this information during the recruitment process. Furthermore, when developing PPI for this research, discussions with supervisors concluded that PPI involvement should be more flexible and less categorical, thereby making the process more 'authentic.' Therefore, the workshops were designed to foster discussion between a small group of participants.

However, there may have been some limitations. The PPI participants were aware that the candidate who was facilitating the PPI workshops, also developed the 360° videos. Thus, it is possible that this may have prevented participants from providing some critical feedback. Nevertheless, the candidate did continuously encourage participants to be as honest as possible.

11.4.5.1 The candidate's reflections on the usability of the VR-360° video prototype 1

According to the candidate, the VR-360° videos were feasible and acceptable to use. This is because users only required a smartphone with an internet connection to access YouTube. The video was uploaded onto YouTube in a 360° format and so users could view the videos without a headset. Users could navigate the scenes by either moving their head (whilst wearing a headset) or using the arrows on the video to view different aspects of the scene (without wearing the headset).

Ease of use could have been improved by enabling participants to zoom in and move closer to a particular part of the scene; participants were in a fixed position and could not narrow down their focus. For example, in scene 1, participants taking part in the intervention would be asked to observe the emotions on the actors' faces. However, the camera appeared to be too far away for participants to see the actors' faces.

It can be challenging to develop immersive experiences via VR-360° videos. When users watch the videos, they are not simply watching something but are becoming part of the environment (Bucher, 2017). Nevertheless, the key issue is developing a truly immersive experience that mimics the real world's engagement and sensations. The aim with 360° videos is to design an 'experience' for the user that may help reduce 'real life' distractions and thus participants can focus on the task in front of them.

One of the challenges of filming the 360° videos is ensuring that the depth perception is as accurate and realistic as possible. This VR-360° prototype 1 was filmed with a static camera. Although there is a benefit to reducing the risk of cybersickness, some objects and people appeared further away than they were. For the viewer, this could lead to a 'collapse in perspective,' where it is challenging to distinguish actors from the background. In contrast, when actors were too close to the camera, this led to a 'curved effect.' Thus, compromised depth perception is a challenge and needs to be considered in future 360° filming events.

One of the challenges of filming VR-360° videos is that although the camera is used as a 'head' of the body, there is no experience or sensation of the viewer's body when the user looks down. Therefore, this may affect the feeling of being immersed in the experience and sense of realism.

There were some technical difficulties whilst filming the scenes and during post-production. The lighting from outside affected the quality of some scenes, thereby preventing the participant from viewing what was in front of them. In one scene, one of the actors interacts directly with the camera (and therefore the participant viewing the video) by asking the camera if he can take the chair in front of them. This is an integral part of the video, because participants taking part in the intervention would be asked to interpret the actor's emotion and body language. However, due to the lighting, the participant is unable to view the actor clearly.

During the post-production process, some of the stitching between scenes led to some 'blurring' between cameras. One of the reasons this may have occurred is that the actor in the scene crossed the 'stitch line.' This glitch is difficult to correct during post-production and can have a detrimental impact on participants' immersion and sense of realism.

11.4.5.2 The candidate's reflections on the usability of the VR-360° video prototype 2

Based on the candidate's prior experience with VR-360° prototype 1, some changes were made in preparation for filming VR-360° prototype 2. Whilst a professional technological company filmed and edited the first prototype, the 2nd prototype was filmed by the candidate and her colleagues at Orygen. Therefore, this allowed the candidate to develop her skills in filming and editing.

One of the lessons learned from the candidate's previous experience was the position of the camera and the impact it had on video quality and resolution. Thus, in preparation for filming VR-360° prototype 2, the candidate and her colleagues went through a 'practice run' of filming some scenes. This allowed them to review where the camera should be positioned, how high/low it should be and where the natural lighting was least likely to affect the quality of the footage. Furthermore, they could book an office room in advance and plan where the scenes would be filmed. The attention to detail was significant, and it was vital that the user would be able to view the actors' facial expressions; For example there are scenes where the actors are positioned at a diagonal angle in front of the 360° camera, and so, therefore, can clearly see the actors' facial expressions and hear the dialogue.

Although there was extensive planning in where to position the 360° camera, there were some errors. In some scenes, the camera was positioned too close to the actors, and so therefore, one of the actor's hands looked 'curved' and disproportionately larger than their body. Not only does this reduce the sense of realism, but it can also impact on 'social mimicry.' This is a phenomenon by which humans subconsciously mirror other people's behaviour during interactions (Chartrand and Bargh, 1999). If someone is sitting very close to you, you will instinctively move away. However, as 360° videos are pre-recorded, there is no opportunity to respond to real life events. Nevertheless, these behaviours are nuanced, and more research is needed to understand its impact in VR on users' experiences.

Despite this, there were still some technical issues observed during postproduction. Overall, the video quality was lower than anticipated, which is believed to be a common issue and current challenge to developing the 360° videos. While the Insta360 Pro 2 can record at 3840 x 3840, this resolution is spread across the entire 360° image. Therefore, the final video quality is lower than anticipated at 1080p. Thus, this does impact on the quality, thereby reducing the sense of realism and presence the user experiences. Some scenes show that although the user can see the actors and the background clearly, there is still some 'fuzziness' in certain areas.

Like VR-360° prototype 1, there was some 'blurriness' observed in some scenes. As discussed previously, this is most likely because since the actors overlapped between two cameras, and therefore this impacted the stitching post-production.

11.5 Summary and conclusions

This study described the development of 360° videos, which would form part of the VR-360° intervention targeting social cognition deficits in those with FEP. Furthermore, a PPI study was conducted to collate feedback on the usability, feasibility, and acceptability of the 360° videos. Therefore, to conclude, involving young service users in the PPI process offered a unique insight into their views and experiences, thereby ensuring the successful usage of new interventions. This current PPI provides two key themes to consider when developing VR technologies for service users. Whilst participants found the videos to be enjoyable, engaging, and immersive, further training is required. This is so participants feel comfortable when viewing the videos in a therapeutic environment. Further support is also required to ensure that the intervention is accessible for healthcare services and implemented. These findings apply to the future development of VR and e-health interventions.

12. Discussions and reflections

12.1 Introduction

The chapter aims is to provide a summary of the key findings from the seven studies described in this doctoral thesis, along with implications for future research. Firstly, the primary study aims, and corresponding findings will be presented. Secondly, the strengths and limitations of the overall thesis will be discussed. Thirdly, the broader implications for the use of VR treatment in those diagnosed with FEP will be discussed, focusing on the implementation into clinical practice.

12.2 Overview of thesis aims and main findings

This doctoral thesis examined whether VR is a feasible and acceptable method to deliver therapy to improve social cognition impairments in those diagnosed with psychosis.

Study 1. The aim of the systematic review was to evaluate the feasibility, acceptability, and efficacy of VR interventions, for those diagnosed with psychosis. This review suggested that it is feasible and acceptable to deliver VR therapy to target various symptoms (hallucinations and delusions) and mechanisms (cognition, social functioning) in those diagnosed with psychosis. The opportunity to provide therapy in a controlled environment can be beneficial for those with psychosis.

Study 2. The purpose of this beta test study was to determine the feasibility and usability of the VEEP intervention and identify any technical issues before undertaking the proof-of-concept trial. The findings show that the virtual world intervention was well received and rated highly in terms of feasibility, acceptability and usability. The testing identified those modifications to enhance the successful implementation of the virtual world intervention. For example, this involved ensuring that audio communication was primarily used. Furthermore, accessing session material via the internet browser as opposed to via the virtual world, would enhance usability.

Study 3. The aims of this study were the following:

a) Assess the feasibility and acceptability of the VEEP intervention on those diagnosed with FEP.

b) Assess whether there were significant differences between VEEP intervention completers and non-completers at post-intervention. Participants were asked to complete outcome measures on social cognition, social functioning, behaviour change, QoL, neurocognition and psychopathology variables.

c) Assess whether there were significant differences between VEEP intervention completers between pre and post intervention.

d) Assess whether there were any differences between VEEP intervention non-completers between pre and post intervention.

e) To measure participants' sense of presence whilst attending therapy in a virtual world.

Completion and attrition rates indicated that it is feasible for service users with FEP to attend virtual world social cognition therapy. Furthermore, the end of session feedback forms completed by participants showed a high level of favourability based on all aspects of the intervention that was consistent throughout all sessions.

A comparison of post-intervention outcomes for completers vs non-completers indicated no significant differences at T2. Similarly, a comparison of pre and post-intervention outcomes for completers indicated that there was no significant differences between T1 and T2. The descriptive statistics for pre and post-intervention outcomes for non-completers indicated that there were improvements for the following outcome measures at T2; BPRS (total score as well as the depression subscale), SCSQ (total score as well as the schematic inference and verbal memory subscales) BLERT, CSQ-SF (total score as well as the stability, negative consequences and self-worth implications subscale), EuroQual-VAS, TDF-4, TDF-8 and the TDF-9 (total score as well as the group subscale).

Study 4a. The aim of this study was to obtain feedback on the acceptability of the VEEP service user interview schedules and to shape the interview questions based on the feedback before commencing the VEEP intervention. The findings collected from workshops provided valuable insights and were highly beneficial in improving the interview schedules for the VEEP intervention, thereby ensuring they were user-centred.

Study 4b. The aim of this study was to assess the acceptability of the VEEP trial from the participants' perspective. This involved a deep exploration of participants' perceptions and opinions. This study highlighted that VR interventions are acceptable to those with FEP due to their novel approach, ease of use, and treatment structure.

Study 5. This focus group study aimed to investigate care coordinators' perceptions of VR treatment in healthcare, their evaluation of patients' opinions on VR treatment use in healthcare and whether VR treatment is related to patient engagement. Findings from this study showed that clinicians experienced both positive and negative opinions about this form of novel treatment to support those with social cognitive deficits in FEP. Whilst clinicians expressed positive opinions about providing a form of therapy that is appealing and necessary for some individuals who find it challenging to interact with others, there were concerns about accessibility and implementation. Therefore, continued and improved information around these factors is required in order to lead to successful implementation of VR therapies into routine mental health services.

Study 6. This study aimed to collect information on the VEEP primary candidate's experiences of delivering VR social cognition therapy to those with FEP, during the VEEP trial. The therapist stated that it was feasible and acceptable to deliver the SCIT via Second Life® to those with FEP. The primary therapist felt that there was a therapeutic alliance between herself and the service users. Attendance was high throughout the intervention and the therapist felt that participants were comfortable and able to interact with others during the sessions. This autoethnography is part of the limited number of studies that gather the opinions of a VR therapist; these findings can be used to develop future VR therapies.

Study 7. The aim firstly was to develop an immersive VR intervention to target social cognition deficits in those with FEP. Therefore two 360° video prototypes were scripted and filmed of social scenarios. Secondly, a PPI study was undertaken with young people with lived experience of mental health conditions to gather their opinions on 360° video prototypes that had already been edited and filmed. Therefore, to conclude, involving young service users in the PPI process offered a unique insight into their views and experiences, thereby ensuring the successful usage of new interventions. Whilst participants found the videos to be enjoyable, engaging, and immersive, further training is required.

12.3 Discussion and recommendations

Although the seven studies were implemented to address a series of aims in this thesis, the overall thesis has sought to assess whether VR can be used as a vehicle to provide social cognition therapy to those diagnosed with early psychosis. Therefore after reviewing the aims and findings of each study, a series of themes have been developed to address the overall objective of the thesis: 1) It is feasible and acceptable to deliver VR social cognition therapy to those diagnosed with FEP : 2) In order to enhance the usability, efficacy and implementation of VR therapy, a codesign process should take place with service users and healthcare professionals: 3) Accessing VR therapy can exacerbate digital inequalities and poverty that already exist in society: 4) A blended approach between VR therapy and face-to-face therapy appears to be vital.

12.3.1 It is feasible and acceptable to deliver VR social cognition therapy to those diagnosed with FEP

The findings from VEEP trial and the VR-360° PPI study indicate that it is feasible and acceptable to deliver VR therapy to improve social cognition in those with FEP. Thus, a relatively simple and potentially low cost VR setup has the potential to be implemented into healthcare settings, as an adjunct therapy. This can be supported by the findings from the systematic review in this thesis.

Whilst feasibility was measured using consent rates, attendance and feedback from participants in the VEEP trial and in the VR-360° PPI study, it is possible that VR therapy may not be feasible and acceptable for all individuals. During study 4b, participants who took part in the VEEP trial provided a mixture of responses as to whether the presence and immersive side of the virtual world provided a benefit to the therapeutic experience. Similarly, in phase 3, the PPI participants stated that it is possible that the immersion of the VR therapy may have a detrimental impact on some service users. These opinions were repeated by the clinicians in study 5: some clinicians expressed concerns that VR therapy may not be appropriate for those service users who have severe symptoms and are most unwell. Thus, it may be important to tailor VR therapy interventions, so that the immersion and presence can be enhanced or reduced, depending on what the participant needs and wants.

It is possible that feasibility may be impacted by the lack of knowledge and access to the relevant VR technologies. There were service users who refused to take part in the VEEP trial, as they did not have access to either a computer/laptop or WiFi. Therefore, this needs to be taken into consideration and mitigated. Similarly, the 360° videos may have an impact on some individuals' sensory experiences. Future studies should provide special consideration to those individuals who may be susceptible to adverse experiences.

Nevertheless, service user participants who took part in the VEEP trial and VR-360° PPI study stated that they enjoyed taking part and could see the benefits of the therapy for those with FEP. This demonstrates the acceptability of such therapies. This was bolstered by the personalised and flexible nature of attending and undergoing such therapies. For example, in the VEEP trial, all participants agreed that the Second Life® environment was interactive, fun, engaging and allowed them to feel comfortable.

Acceptability of the VEEP trial was also maintained by the way in which the therapists interacted and facilitated the SCIT therapy in Second Life®. As seen in study 4b, participants felt supported by the therapists and the RA. This is because there were detailed explanations throughout the intervention and opportunities to ask questions whenever required. This was echoed in the autoethnography in study 6. The candidate who was the primary therapist, enjoyed the role, and felt that the participants were participating well throughout. Therefore, this highlights the importance of developing and maintaining a therapeutic alliance in order to enhance the acceptability.

12.3.2 A coproduction process for VR therapy should take place with service users and healthcare professionals

In order to enhance the usability, efficacy and implementation of VR therapy, a codesign process should take place between healthcare professionals and service users. Coproduction is based on the idea of moving from a passive service user approach to creating the expectation of active roles between service users and healthcare professionals, in the delivery of a particular service (Cepiku and Giordano, 2014; Osborne, Radnor and Strokosch, 2016). Coproduction is a collaborative development between two or more individuals that focuses on knowledge development.

Despite there being an interest in coproduction to develop healthcare services (Amery, 2014; Butler and Greenhalgh, 2011), there is still limited reported user involvement in health research. According to a rapid review of reviews into codesign and health, codesign is seldom described or evaluated in published articles. Thus, consistent concise reporting is required, leading to the possibility of better evaluation of the impact coproduction has on healthcare service development (Slattery, Saeri and Bragge, 2020).

Over the last few years, there have been minimal number of VR therapy coproduction articles that have been published. Along with the VEEP coproduction article (Realpe et al., 2020), Knight et al. (2021) published a participatory design article, which explained how a VR therapy was developed for those with psychosis. This has formed part of the gameChange project, (gameChange, 2021) which looks at the impact of VR treatment on people with psychosis. Eisapour, Cao and Boger (2020) conducted a participatory design and evaluation of VR games to promote physical activity in those with dementia. They concluded that collaborating with both experts and those with dementia resulted in an engaging and intuitive design. These articles stated that the coproduction methods allowed research teams to rapidly develop VR therapy for those individuals with complex mental health needs. Codesign in DHIs is becoming more incorporated. However, user involvement and user interface research in methodologies is required. This can lead to an increase in usability (Klein, Kulp asnd Sarcevic, 2018).

12.3.3 Accessing VR therapy can exacerbate digital inequalities and poverty that already exist in society

The number of adults that are ‘internet non-users’ or ‘digitally excluded’ is declining in the UK. Despite this, 5.3 million adults are digitally excluded in the UK (Office for National Statistics, 2019). Digital exclusion can be defined as when someone does not have access to the internet or digital technologies (Robotham et al., 2016). This exclusion does not simply exist in a vacuum; digital exclusions have been shown to be closely associated with socioeconomic deprivations (Helsper, 2012). Factors such as living in rural areas and old age increases the chances of digital exclusion (Williams et al., 2016; Philip et al., 2017).

This doctoral thesis identified significant issues with digital access amongst those diagnosed with psychosis. These could be exacerbated by individuals’ personal circumstances, knowledge and mental health. Similar concerns have been raised in previous surveys and studies (Borzekowski et al., 2009; Greer et al., 2019; Robotham et al., 2016).

Some participants stated that the severity of their mental health and access to technologies, were barriers to engagement with accessing the VEEP treatment. Thus, efforts to close the digital divide should address the complexities based on socioeconomic, geographic and health factors, and how these issues intersect with one another. For example, individuals who suffer from cognitive impairments and hallucinations may find it challenging to retain skills in the future. Therefore, understanding specific needs will help alleviate digital inequalities in the future.

A single approach to overcoming digital exclusion may not be practical due to the range of reported knowledge gaps. While some of the participants may have benefited from assistance tailored to the VEEP intervention (such as receiving a laptop to take part and receiving phone calls from the RA when there were technical difficulties), other participants may have required support in using digital technologies. Thus, future digital mental health studies should focus on assessing individuals' perceived competence and confidence, informing methods to overcome digital exclusion.

The motivation was a critical factor in overcoming digital exclusion in the VEEP intervention. Without motivation, engagement with interventions will not be successful. For example, participants were offered the opportunity to take part in the VEEP treatment at WMS. A room with a computer and WiFi access would have been booked for them, where they would have taken part in the session. They would have also been reimbursed for their expenses. However, no participant took up this opportunity.

Consequently, techniques such as motivational interviewing (Rubak et al., 2005) could be implemented to enhance intrinsic motivation. Additionally, there are instances where digital exclusion does not impact negatively on individuals' life and so, therefore they may simply not be interested in a novel VR intervention. Reasons as to why should be investigated further in future studies.

Personal support could also be seen as a factor in reducing the digital divide. For example, a participant who took part in the VEEP trial would travel to their mother's house to access the internet and computer and therefore attend sessions. Her mother's support was encouraging for her. Thus, developing an individualistic approach for all participants is essential for future studies.

Financial barriers in owning and using digital technologies can result in digital exclusion. The VEEP trial did not explore this in enough detail. Therefore, tailored support should be given to help participants overcome these difficulties. For example, individuals should be provided with affordable internet data plans (Elahi, 2020). Furthermore, researchers should signpost individuals to free services to develop their digital technology skills and usage, such as the library.

Therefore, future research and interventions should focus on targeting the multiple deprivations that are experienced in the offline world and how these are associated with their mental health needs. Thus a 'one size fits all' approach to overcoming digital exclusion is essential, with a greater understanding of an individuals' confidence and competence in digital technologies (Greer et al., 2019).

12.3.4 A blended approach between VR therapy and face-to-face therapy requires more research

As this PhD thesis investigates the feasibility and acceptability of VR therapy, the candidate is unable to definitively state whether VR therapy has the same efficacy and effectiveness as face-to-face therapy. As discussed throughout the thesis, participants expressed that whilst VR therapy had its benefits, it may not be appropriate for all individuals diagnosed with various mental health conditions. This may be due to variable levels of presence and immersion, the experience of virtual embodiment, followed by inequitable access to digital technologies.

Therefore, further research is required to assess whether blended therapy effectively improves targeted aspects of mental health and well-being in particular populations, compared to face-to-face therapy only (Wentzel et al., 2016). Blended therapy is an integration of online and offline components, and so therefore, they are not standalone treatment pathways (van der Vaart et al., 2014). For example, an individual with FEP could partake in short, structured group psychoeducation (as seen in the VEEP trial) programme virtually, followed by tailored, personalised face-to-face sessions with a therapist.

Erbe et al.'s (2017) conducted a systematic review into blended therapies for the treatment of mental health disorders. They found that for common mental health disorders, it is feasible and can be more effective to deliver blended therapy, compared to treatment controls. However more RCTs need to be conducted into the efficacy and cost-effectiveness of blended therapies.

Schuster et al. (2020) conducted an online survey to gather therapists' views towards both internet based treatments and blended treatments in Sweden and Germany. The findings showed that relevancy of personal experience with DHIs influenced therapists' attitudes towards DHIs and blended therapies. Therefore, it is important to take this into consideration.

Nevertheless, the most important factor is ensuring that there is an increase in engagement and adherence to therapies in those with FEP and associated mental health conditions.

12.4 The strengths of this PhD thesis

12.4.1 Development of VR interventions

Elements of good practice in this PhD thesis, was the application of an incremental and iterative developmental model for the development of both the VEEP and the VR-360° interventions. The software development method chosen for both interventions was the agile method (Nerur and Balijepally, 2007). Agile methods focus on the importance of communication, people and flexibility with incremental and iterative changes; thus, the evolving scope of the VR interventions was defined through integrating the expertise of academics, professionals, developers and service users.

The concept of flexibility was also applied to the structure of the VEEP intervention. The SCIT structure and modules were designed and refined to suit being delivered in a virtual world. The intervention covered a comprehensive agenda that taught all aspects of social cognition. This modular nature created a resource that was relevant to those with FEP.

12.4.2 Mixed methods approach

The first element of good practice in this PhD thesis was the use of mixed methods. This was achieved through the systematic review of the current literature, analysis of outcome measures using t-tests, descriptive statistics, interviews, focus groups, and workshops. The combination of these methods provides a robust and thorough approach to answering the thesis aims and objectives. Thus, the integration of these methods allowed for the advantages of each particular method to contribute to the thesis's strengths.

12.4.3 Incorporating those individuals with lived experience into the research

Throughout this PhD thesis, those with lived experiences of psychosis and other mental health conditions were involved in developing and delivering the VEEP and VR-360° interventions. According to previous research, those individuals with lived experience should be involved and included in all aspects of research. This is because it is viewed as good practice for researchers, as it can enhance the quality and appropriateness of the research being undertaken (Staniszewska et al., 2007). Those individuals with lived experience were involved in the refining of the VEEP service user interview schedules. Furthermore, the VR-360° PPI workshops involved recruiting those young individuals with a lived experience of mental health difficulties. According to a recent systematic review of reviews into the theory, barriers and enablers for PPI across healthcare, PPI should occur at all aspects of the research process. This is because it is viewed as an opportunity to improve research relevance, impact and quality. Furthermore, it can benefit those PPI advisors who have taken part (Johnson et al., 2021). Additionally, PPI participants should be reimbursed for their contribution and time. This was achieved in the research conducted in this PhD thesis (Ocloo et al., 2021).

12.5 Critical evaluation of the doctoral thesis

An evaluation of the methods and methodologies provided throughout this PhD thesis is provided below.

12.5.1 Sampling and recruitment

Studies 3, 4a and 4b, which focused on the VEEP trial, recruited people diagnosed with FEP from the West Midlands, UK. The small sample size combined with the limitations in recruiting from multiple locations, meant that it may not be possible to generalise the findings to a broader population. Study 5 involved recruiting and interviewing EIP clinicians. To the candidate's knowledge, this is the first qualitative study that seeks to obtain professionals' views of VR interventions for psychosis. Currently, there are still a limited number of studies that seek to collect professionals' views on the feasibility and acceptability of DHIs for those with mental health difficulties. Another strength of this thesis was the aspects of PPI and coproduction of both the VEEP trial and the VR-360° trial development. Whilst sample sizes for studies 2, 4a and 7 were small (n= two to four), there were variations in the experiences and diagnoses of those participants recruited.

However, there are limitations with regards to the recruitment of the VEEP trial. Participants were recruited from a limited number of geographical locations in the UK. Furthermore, most of the recruits came from one particular EIP service in the West Midlands. Additionally, participants were all self-selecting. This could mean that there was a sampling bias in those individuals with an interest in and capability of using virtual worlds and digital technologies more broadly. The qualitative interviews with the care coordinators who had referred service users to the VEEP trial stated that they were more likely to refer service users, who they deemed to be well enough to take part. Indeed, service users were either unable to or declined to take part in the VEEP trial. Thus, those referred were most likely ‘well enough’ and ‘enthusiastic enough’ to participate. Despite promising results, further research with a more significant number of those with social cognition deficits is required before definitive generalisations can be made towards the FEP population.

Similarly, those participants who took part in the PPI studies 4a and 7 were also self-selecting. Most PPI participants had taken part in prior advisory groups on various mental health research studies. Therefore, it is possible that whilst they had an experience and understanding of what their PPI role and duties were, they may have volunteered to take part because they already had positive opinions about VR interventions. Furthermore, due to the COVID-19 pandemic, there were more challenges in recruiting participants online. As a result, only three participants were recruited and consented to participate in the PPI workshop for study 7.

Additionally, most of the service users who took part in the VEEP trial were White British in ethnicity. Thus, this sample is not reflective of the broader population of those people diagnosed with psychosis (Burkhard et al., 2021). Therefore, future studies should focus on recruiting a diverse range of service users, health and social care professionals and PPI participants (Burkhard et al., 2021; Rugkása and Canvin, 2010). Future trials should ensure they collect data on participants’ demographic and clinical background to ensure a more diverse sample is being recruited.

12.5.2 Self-report methods

Throughout this PhD thesis, participants were required to self-report whether it is feasible and acceptable to deliver VR treatment for those diagnosed with FEP. The benefits of using questionnaire-based outcome measures are that it is a quick and efficient method of data collection that captures individuals’ various states at that current time. However, self-reports could be influenced by social desirability factors, where participants may provide more socially acceptable answers than their real opinions. This could particularly be the case during the VEEP qualitative interviews because the participants knew they were being interviewed face-to-face by the lead facilitator (the candidate). This was a clear weakness in the methodology, but this was a pragmatic choice due to financial constraints on the trial.

However, efforts were made to reduce this social desirability in all primary data collection studies. The candidate encouraged participants to be as honest as possible and that their views were valid. Additionally, as discussed in study 1, future trials should seek to adopt physiological measures to measure the relationship between task completion and arousal and anxiety (Weibel et al., 2018).

12.5.3 Potential sources of bias

The external validity of the results in the studies may not be applicable to other settings. This is because individuals who are willing to participate in research may not represent the target population (Mohr et al., 2017). Thus, those service users who took part in the VEEP trial may represent a subgroup of those with FEP, who are interested in participating in research and interested in VR therapies.

Additionally, there may be some unintended influences for those who took part in the research. For example, those participants who took part in the VEEP trial were reimbursed for completing the outcome measures at both pre and post-intervention. Therefore, the high completer rate may be because participants were being reimbursed for their time. Participants may have felt that they were obliged to take part (Gerhards et al., 2011).

12.5.3.1 The role of the candidate as the primary VEEP therapist and VEEP interviewer

As was discussed in the autoethnography, the candidate was both the VEEP primary therapist and the VEEP qualitative interviewer. Thus, this may have precipitated more positive results from the VEEP participants, all of whom were aware of the trial's purpose and the multiple roles of the candidate. Nevertheless, participants were reminded at the start of the interview of the importance of providing accurate and honest responses to mitigate against this.

The candidate's role in coding qualitative data and developing the qualitative themes could be considered a qualitative limitation. This is because it may be considered an inadvertent bias. These possible biases were addressed by completing reflective field notes (that has formed part of the autoethnography) and engaging with the supervisory team to review codes and themes. This allowed multiple individuals to engage with the information and challenge any assumptions critically.

12.5.4 Ongoing developments of the VR-360° videos

A limitation of the PPI study into the development of the VR-360° prototype videos is that participants were asked to provide feedback on the finalised versions. This meant that the videos had been scripted, reviewed, filmed, edited, and uploaded to YouTube without any PPI involvement. Furthermore, participants were only provided with the video prototypes to review; they were not provided with the VR-360° intervention psychoeducation content.

There were three reasons for this. First, there were limitations on time. Designing, filming, and editing the 360° videos took a substantial amount of time. Thus, PPI involvement may have delayed the process. Second, there were limitations on resources; the candidate was solely responsible for undertaking the PPI for the 360° videos. However as seen in figure 4, the candidate spent a substantial amount of time during her doctoral thesis working on the VEEP trial. Third, due to limitations on research funds, the candidate could only recruit a limited number of PPI participants to take part in a small number of workshops.

Therefore, whilst the participants provided thorough feedback on the prototypes themselves, the candidate felt that some participants might have found it challenging to conceptualise the idea of receiving VR-360° therapy in a healthcare setting. Therefore, future trials should focus on implementing PPI within every stage of the developmental and implementation process.

12.5.5 Fast-paced nature of VR development

Second Life® and 360° videos were chosen to explore the concept of providing social cognition therapy for those with FEP because they are widely available types of technology (Keelan et al., 2015; Zulkiewicz et al., 2020). However, a limitation inherent in most VR studies is that technology is at risk of being outdated. Thus, it is critical that platforms and devices are easily adapted for continued use and affordable. These platforms should be discreet, user-friendly and immersive (Pimentel et al., 2021). Furthermore, the exploration of the safety of more immersive technologies is required due to the risk of side effects such as falls and motion sickness. There needs to be further research to understand the complex relationship between VR and motion sickness (Jerdan et al., 2018). For example, Pot-Kolder et al. (2018) found that anxiety partially mediates the relationship between VR exposure and cybersickness in healthy patients, but not necessarily in mental health patients.

The fast-paced development of VR interventions can be seen in the industry. For example, a company in the USA called ‘Embodied Labs’ have created VR simulations using 360° videos, to allow users to understand what it is like to experience life from another person’s perspective. The VR technology is specifically adjusted to what users can or cannot hear or see (Embodied Labs, 2021). Another company called XRHealth have created a series of VR and augmented reality apps that can be prescribed and are approved to be delivered as a therapy or medication to those who require it (XRHealth, 2021).

The development and testing of VR interventions via traditional evaluation methods may require more rapid development, testing cycles and flexibility (Mishkind et al., 2017; Thomas et al., 2019). Specifically, approaches that adopt multiple rounds of development and feedback from users before the intervention is delivered, may successfully develop successful VR interventions. This can lead to increased adherence, engagement and usability (Mummah et al., 2016). Furthermore, designing adaptive trials that allow researchers to change elements during standard trials may be an approach to overcome these barriers with academic research and industry technological development (Thompson, Gleeson and Alvarez-Jimenez, 2018).

While the VEEP trial involved a flexible thorough co-design process (which has not been reported in this thesis), the beta testing process could have adopted a more iterative process with multiple rounds of usability testing. Furthermore, the VR-360° intervention would have benefitted from more prototypes being developed of the same scenes and adopting a more iterative stage in PPI feedback. This would potentially keep VR interventions up-to-date with their software and hardware, as well as on par with commercially developed programmes. These processes would also highlight any issues and challenges regarding safety, privacy and usability (Kim and Kim, 2020).

Table 34: Main findings, strengths and limitations of the doctoral thesis

Key findings	**Evidence obtained from the following studies:**	**Main strengths**	**Main limitations**
It is feasible to deliver VR social cognition therapy to those with FEP.	1,2,3,6,7	The doctoral thesis conducted an up-to-date thorough systematic review. The candidate identified and addressed gaps in the literature.	The constant developments of VR technologies mean that it is possible that some VR evidence based interventions may become 'out of date' to what is available.
It is acceptable to deliver VR social cognition therapy to those with FEP.	1,2,4a,4b,6,7	The doctoral thesis assessed the feasibility and acceptability of two novel VR social cognition therapies to those with FEP.	The candidate's multiple roles during the VEEP trial may mean that participants provided favourable feedback.

Further research is required to understand the relationship between presence, immersion and realism and the impact it can have on the feasibility and acceptability of VR social cognition therapy.	1,3,4b,7		
Further research is required to further understand who will benefit the most from VR social cognition therapy.	1,4b,5,7		
VR social cognition therapy may exacerbate the digital divide that exists in society. Therefore, this needs to be mitigated.	4b,5,7		

12.6 Contribution to the knowledge

This PhD thesis has contributed to a body of knowledge in several areas. To the candidate's knowledge, this is the first systematic review to assess the feasibility, acceptability and efficacy of VR interventions for those with psychosis. The literature review added to the findings of previous literature reviews (Bisso et al., 2020; Cieślik et al., 2020; Dellazizzo et al., 2019; Freeman et al., 2017; Kim and Kim, 2020; Macedo, Marques and Queirós, 2015; Rus-Calafell et al., 2018; Välimäki et al., 2014; Valmaggia et al., 2016).

However, most reviews have reviewed VR assessments as well as treatments for those with psychosis and focused on trials. The clinical utility of the findings from the systematic review in this PhD thesis was enhanced including all study designs and all types of VR interventions.

The findings from phase two added to the limited body of evidence regarding the feasibility and acceptability of using VR treatments to improve social cognition in those with FEP. To the candidate's knowledge, this is the first trial to deliver social cognition therapy via a virtual world to those with FEP (Thompson et al., 2020). Furthermore, this is one of the limited VR trial studies to integrate both qualitative and quantitative findings. However, since the time of Thompson et al.'s (2020) publication, there has been further research that has used VR social cognition therapy for those with psychosis.

As discussed in the systematic review (study 1) the DiSCoVR study concluded that it was feasible and acceptable to deliver VR social cognition therapy for those with psychosis (Nijman et al., 2020). The gameChange trial is an automated VR cognitive therapy for those with psychosis. The single-blind randomised controlled trial has currently finished recruiting in the UK (Freeman et al., 2019). The CHALLENGE clinical trial is currently underway in

The Netherlands; here approximately 133 patients who suffer from auditory hallucinations, will undergo VR therapy to help with their malevolent voices (Viera, Fisher, Lajboschitz, Serafin and Nordentoft, 2021). Therefore it is anticipated that within the next couple of years, there will be more robust larger scale trials into VR therapy and psychosis.

The findings from phase 3 have added to the limited body of evidence on the use of 360° videos for health interventions. To the candidate's knowledge, this is the first PPI study on the use of 360° videos to improve social cognition in those with FEP. The findings indicate that it may be feasible to deliver social cognition therapy to those with FEP, using 360° videos, as part of a personalised individual face-to-face social cognition structured therapy format.

12.7 Future research and recommendations

The implications for future research have been discussed in each study chapter. However, several overarching themes have derived from the overall PhD thesis.

12.7.1 The importance of delivering VR interventions in a COVID-19 world

The majority of the delivery, data collection and analysis in this PhD thesis were conducted before the COVID-19 pandemic. However, this pandemic has highlighted how digital health access and interventions are vital to future healthcare (Robotham et al., 2016). This is the first time in which a large percentage of clinicians and patients have had to utilise the full potential of these technologies, at a time when routine face-to-face treatment has been significantly reduced on an international scale (Torous et al., 2020). Furthermore, it is expected that the demand for mental health care is expected to rise significantly (Wind et al., 2020).

According to an audit conducted by the Royal College of Psychiatrists (2021), most EIP services in England, have adapted treatments and services to online. This included therapies, consultations and physical health screenings. Whilst this relates to telehealth, it is possible to suggest that more advanced and engaging technological interventions could be implemented into clinical services. Whilst it has not been possible to evaluate the impact of these adaptions formally to date, some teams could provide feedback on the benefits. 50% of EIP teams (14/28) believed that virtual support was more accessible to service users, carers, friends and family. However, 68% of EIP teams (19/28) also claimed that those with FEP and their carers had a preference for face-to-face contact and/or did not want to engage virtually.

Therefore, this indicates that further research is required to investigate what types of individuals are more likely to engage with virtual reality therapy and why. Nevertheless, these audit findings support the notion of continuing to provide support and treatment digitally.

12.7.2 Implementation of VR interventions for those diagnosed with FEP to improve social cognition

Despite significant evidence to support the use of VR treatments in mental health services, this has not always resulted in the implementation of VR and, more broadly DHI, into routine care (Tuerk et al., 2019; Vis et al., 2018). There are many reasons why this is the case; there are major gaps regarding the lack of data into how VR treatments and technology can be implemented into existing services and therapies. Thus, there needs to be further research into this area (Best et al., 2020).

One reason could be the lack of acceptance from clinicians and services (Wind et al., 2020). This was reiterated by care coordinators' feedback on the VEEP intervention in study 5. Thus, to enhance health and social care professionals' confidence and comfort, accessible guidelines and policies relating to the use and provision of VR treatments must be created and disseminated. During the COVID-19 pandemic, there have been attempts to create national guidelines and guidance; for example, the British Psychological Society (2020) created guidelines on delivering therapy online to children and young people. However, organisations and registered bodies should go further and create guidelines that acknowledge the complexity of VR. Furthermore, digital health champions or representatives in services, may help to guide and support clinicians in adopting these interventions.

An online survey completed by 335 psychotherapists showed that remote working led to reduced interpersonal cues, feelings of fatigue, isolation, and technical issues. However, they felt that remote working should be part of therapy training (McBeath, du Plock and Bager-Charleson. 2020). This was supported by further research conducted in The Netherlands; an online survey found that mental health practitioners had positive experiences of delivering therapy online and required better organisational, technological, and logistical support (Bierbooms et al., 2020; Feijt et al., 2020). A survey conducted in Australia aimed to gather service users' (aged between 12 – 25 years) and healthcare professionals' feedback on telehealth. The majority of service users stated that telehealth was more likely to have a positive impact on service quality, compared to clinicians. It was concluded that future research should work to explore how telehealth can be implemented long term into services (Nicholas et al., 2021).

Barriers to implementation include the costs of the VR systems. However, the costs of some VR equipment have reduced significantly, making it an accessible option. Furthermore, an increasing number of VR environments are available at limited costs; Second Life® is an example of this. Assessing usability in interventions is essential, as it may provide an insight as to whether the technology is feasible or not (Glegg and Levac, 2017). Therefore, it can be argued that VR is best utilised when both presence and immersion is vital to the intervention (Trahan, Smith and Tablot, 2019). Maintaining existing services and promoting new forms of practice that increases accessibility and provides cost-effective therapy, should be a priority (Di Carlo et al., 2020; Moreno et al., 2020).

12.7.3 Importance of undertaking high-quality rigorous studies

Unfortunately, VR research suffers from issues surrounding non-rigorous study designs. This may be compounded by small sample sizes, the absence of RCTs, and issues with evaluating the feasibility and acceptability of the intervention. These challenges reduce the potential for meta-analyses (Trahan, Scott and Talbot, 2019).

Future research should focus on developing more methodologically rigorous studies. Therefore, implementing control conditions and large sample sizes when developing the intervention is essential. Studies should have enough power to detect significant improvements whilst considering drop-out rates during the intervention and attrition post-intervention. Therefore, it would be useful for future studies to assess patients' psychophysiological responses to VR stimuli at baseline to consider individual differences, which could influence their experience of presence and immersion in the VR stimuli (Maples-Keller et al., 2017). Furthermore as discussed above, flexible VR trial designs that can be adapted quickly, in order to accommodate changes in VR technology, should be considered.

Clinicians facilitating the VR intervention should record the following: patients' potential feelings of distress particularly during VR exposure therapy, therapeutic alliance, any technological difficulties patients experienced and patients' experiences of presence, immersion, and engagement. Furthermore, post-intervention and follow up assessments should be collected from participants to investigate the effects of the VR treatment over an extended period (Maples-Keller et al., 2017). According to a review conducted by Gregg and Tarrier (2007), only one VR study had a long term follow up of more significant than a year (Wiederhold and Wiederhold, 2003).

12.7.4 Collaboration between researchers, health and social care professionals, services, key stakeholders, service users and industry

Furthermore, VR treatment remains essentially exposure-based and techniques to improve complex mental health problems have yet to be achieved. Therefore, it is vital to focus on strengthening the relationship between technological companies and mental health services to develop novel interventions (Macedo et al., 2015). Therapists and clinical researchers need to be trained and made aware that VR treatments has the potential to reduce their workload, reduce the barriers to seeking professional help (thereby improving accessibility) and allow them to move away from traditional therapies to more remote, flexible treatments that provide added value (Skeva et al., 2021).

12.7.5 Utilising physiological measures in VR intervention trials

Additionally, implementing physiological measures to assess patients' responses to VR will contribute to the validity of such interventions (Veiling et al., 2014). Examples of this include measuring cortisol and autonomic measures such as diastolic blood pressure, systolic blood pressure, heart rate and heart rate variability (Pascoe, Thompson and Ski, 2017).

Martens et al. (2019) studied the stress response of 28 healthy men exposed to either a stressor VR elevator or a control elevator. The findings showed that those in the VR condition experienced increases in skin conductance, pulse, altered HRV and a delayed rise in cortisol. Previous studies have found a positive correlation between skin conductance and presence levels (Meehan, 2002; Wiederhold and Weiderhold, 1998).

Cella et al. (2019) conducted a proof-of-concept study to assess the feasibility, acceptability and usefulness of using a digital method to assess the association between psychotic symptom distress and physiological signals. Results showed that those with FEP completed on average 76% of mobile phone symptom assessments. A study conducted by Cella et al. (2017), found that autonomic abnormalities could be detected in those with schizophrenia. Furthermore, those with severity of positive symptoms was associated with parasympathetic deregulation. Therefore, this could be used as a monitoring symptom.

12.8 Conclusion

In summary, the findings from the systematic review (phase 1) indicated that it is feasible and acceptable to deliver therapeutic interventions in VR settings for those diagnosed with psychosis. Phase 2 indicated that it was feasible and acceptable to deliver many aspects of the SCIT intervention via a virtual world called Second Life® to those with FEP. The data collected via outcome measures and semi-structured interviews from those with FEP were supported by the focus group conducted with clinicians from an EIP service and the autoethnography completed by the lead therapist, the candidate.

The findings from these studies highlighted the need for more immersive tailored VR therapies to improve social cognition in those with FEP. Therefore, this informed the development of the VR-360° intervention; the candidate designed and created two 360° videos of two social scenarios (sitting in a café and taking part in job interviews). These social scenarios were based on the 2D videos delivered by the SCIT. Phase 3 was a PPI study, which involved collecting feedback on these videos from those young people with mental health difficulties. Findings showed that it might be feasible and acceptable to deliver therapy to improve social cognition in those with FEP using these videos.

Future studies should focus on conducting large scale RCTs to assess the efficacy and effectiveness of VR therapy to improve social cognition in those with FEP. There should be a particular focus on the design, delivery and implementation of such therapies into mental health services. Thus, this will involve developing a further understanding of developing a blended approach to therapy: integrating face-to-face therapies with VR therapies and delivering it to those who would benefit from it the most. Involving service users, health and social care professionals, industry developers and key stakeholders in all aspects of the development of novel VR treatments is vital.

References

Activeworlds Inc. (2021) Activeworlds: Home of the 3D Internet. Available at: https://www.activeworlds.com [Accessed 7 May 2021].

Adams, T.E., Ellis, C., & Jones, S.H. (2017) Autoethnography. In: Matthes, J., Davis, C.S., & Potter, R.F. (eds). *The International Encyclopedia of Communication Research Methods.* USA: John Wiley & Sons, Inc: 1-11.

Addington, J., Penn, D., Woods, S. W., Addington, D. & Perkins, D. O. (2008) Social functioning in individuals at clinical high risk for psychosis. *Schizophrenia Research*, 99 (1-3): 119-124.

Addington, J., Saeedi, H. & Addington, D. (2006) Influence of social perception and social knowledge on cognitive and social functioning in early psychosis. *British Journal of Psychiatry*, 189 373-378.

Adery, L.H., Ichinose, M., Torregrossa, L.J., Wade, J., Nichols, H., Bekele, E., Bian, D., Gizdic, A., Granholm, E., Sarkar, N., & Park, S. (2018) The acceptability and feasibility of a novel virtual reality based social skills training game for schizophrenia: preliminary findings. *Psychiatry Research,* 496-502.

Aebersold, M., Villarruel, A., Tschannen, D., Valladares, A., Yaksich, J., Yeagley, E., & Hawes, A. (2015) Using a virtual environment to deliver evidence-based interventions: the facilitator's experience. *JMIR Serious Games,* 3(2): e5.

Ahmadpour, N., Keep, M., Janssen, A., Rouf, A.S., & Marthick, M. (2020) Design strategies for virtual reality interventions for managing pain and anxiety in children and adolescents: scoping review. *JMIR Serious Games*, 8(1): e14565.

Ahmed F.S., & Miller, S. (2011) Executive function mechanisms of theory of mind. *Journal of Autism and Developmental Disorders*, 41: 667-678

Allan, S., Mcleod, H., Bradstreet, S., Bell, I., Whitehill, H., Wilson-Kay, A., Clark, A., Matrunola, C., Morton, E., Farhall, J., Gleeson, J., & Gumley A. (2021) Perspectives of Trial Staff on the Barriers to Recruitment in a Digital Intervention for Psychosis and How to Work Around Them: Qualitative Study Within a Trial. *JMIR Hum Factors*, 8(1):e24055.

Amado, I., Brenugat-Herne, L., Orriols, E., Desombre, C., Dos Santos, M., Prost, Z., Krebs, M. O. & Piolino, P. (2016) A Serious Game to Improve Cognitive Functions in Schizophrenia: A Pilot Study. *Frontiers in Psychiatry*, 7(64).

American Psychological Association (2013) *Diagnostic and statistical manual of mental disorders, 5th edition: DSM-5*. Washington, DC: American Psychiatric Publishing.

Amery, J (2014) *Co-creating in health practice*. London, UK: Radcliffe.

Amichai-Hamburger, Y., Klomek, A.B., Friedman, D., Zuckerman, O., & Shani-Sherman, T. (2014) The future of online therapy. *Computers in Human Behavior,* 41: 288-294.

Amminger, G.P., Harris, M.G., Conus, P., Lambert, M., Elkins, K.S., Yuen, H.P., & McGorry, P.D. (2006) Treated incidence of first-episode psychosis in the catchment area of EPPIC between 1997 and 2000. Acta Psychiatrica Scandinavica, 114(5):337-45.

Anderson, L. (2006) Analytic autoethnography. *Journal of Contemporary Ethnography,* 35: 373-395.

Andersson, G. (2018) Internet interventions: past, present and future. *Internet Interventions*, 12: 181-188.

Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., & Hedman, E. (2014) Guided internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: A systematic review and meta-analysis. *World Psychiatry*, 13(3): 288-95.

Andersson, G., Paxling, B., Roch-Norland, P., Ostman, G., Norgren, A., Almlov, J., Georen, L., Breitholtz, E., Dahlin, M., Cuijpers, P., Carlbring, P., & Silverberg, F. (2012) Internet-based psychodynamic versus cognitive behavioral guided self-help for generalized anxiety disorder: a randomized controlled trial. *Psychotherapy and Psychosomatics,* 81(6): 344-355.

Andreasen, N.C., Carpenter, W.T., Kane, J.M., Lasser, R.A., Marder, S.R., Weinberger, D.R. (2005) Remission in schizophrenia: propsed criteria and rationale in consensus. *American Journal of Psychiatry,* 162: 441-449.

Andresen, R., Oades, L., & Caputi, P. (2003) The experience of recovery from schizophrenia: towards an empirically validated stage model. *Australian and New Zealand Journal of Psychiatry,* 37: 586-594.

Andrews, L.M., Allen, H., Sheppard, Z.A., Baylis, G., & Wainwright, T.W. (2015) More than just ticking a box…how patient and public involvement improved the research design and funding application for a project to evaluate a cycling intervention for hip osteoarthritis. *Research Involvement and Engagement,* 1:13.

Anstadt, S. P., Bradley, S. & Burnette, A. (2013) Virtual Worlds: Relationship Between Real Life and Experience in Second Life. *International Review of Research in Open and Distance Learning*, 14 (4): 160-190.

Anthony, K., & Nagel, D.M. (2009) Ethical framework for the use of technology in mental health. *Online Therapy Institute.* [online] Available from: https://www.mrc.ac.uk/documents/pdf/complex-interventions-guidance/ (Accessed 11 January 2018).

Archibald, M.M., Ambagtsheer, R.C., Casey, M.G., & Lawless, M. (2019) Using zoom videoconferencing for qualitative data collection: perception and experiences of researchers and participants. *International Journal of Qualitative Methods,* 18: 1-8.

Aref-Adib, G., McCloud, T., Ross, J., O'Hanlon, P., Appleton, V., & Rowe, S. (2019) Factors affecting implementation of digital health interventions for people with psychosis or bipolar disorder, and their family and friends: a systematic review. *The Lancet Psychiatry,* 6(3): 257-266.

Aref-Adib, G., O'Hanlon, P., Fullarton, K., Morant, N., Sommerlad, A., Johnson, S., & Osborn, D. (2016) A qualitative study of online mental health information seeking behaviour of those with psychosis. *BMC Psychiatry,* 16(232): 1-10.

Arnett, J., & Labovitz, J. (1995) Effect of physical layout in performance of the trail making test. *Psychological Assessment,* 7(2): 220-221.

Arnold, C., Williams, A., & Thomas, N. (2020) Engaging with a web-based psychosocial intervention for psychosis: qualitative study of user experiences. *JMIR Mental Health,* 7(6): e16730.

Assländer, L., & Streuber, S. (2020) Virtual reality as a tool for balanced research: eyes open body sway is reproduced in photo-realistic, but not in abstract virtual scenes. *PLoS ONE,* 15(10): e0241479.

Ata, R. (2016) An exploration of higher education teaching in Second Life in the context of blended learning. *The Turkish Online Journal of Educational Technology,* 15(3): 9-26.

Atkins, L., Francis, J., Islam, R., O'Connor, D., Patey, A., Ivers, N., Foy, R., Duncan, E.M., Colquhoun, H., Grimshaw, J.M., Lawton, R., & Michie, S. (2017) A guide to using the theoretical domains framework of behaviour change to investigate implementation problems. *Implementation Science,* 12: 77.

Ayesa-Arriola, R., Alcaraz, E.G., Hernandez, B.V., Perez-Iglesias, R., Morinigo, J.D.L., Duta, R., David, A.S., Taberes-Seisdedos, R., & Crespo-Facorro, B. (2015) Suicidal behaviour in first-episode non-affective psychosis: specific risk periods and stage-related factors. *European Neuropsychopharmacology,* 25(12): 2278-2288.

Aymerich-Franch, L., Kizilcec, R.F., & Bailenson, J.N. (2014) The relationship between virtual self similarity and social anxiety. *World Psychiatry*, 8(944): 1-10.

Baker, K.D., & Ray, M. (2011) Online counseling: the good, the bad, and the possibilities. *Counselling Psychology Quarterly,* 4: 341-346.

Balzaretti, N., Ciani, A., Cutting, C., O'Keeffe, L., & White, B. (2019) Unpacking the potential of 360degree video to support pre-service teacher development. *REM- Research on Education and Media,* 11(1).

Baniasadi, T., Ayyoubzadeh, S.M., & Mohammadzadeh, N. (2020) Challenges and practical considerations in applying virtual reality in medical education and treatment. *Oman Medical Journal,* 35(3): e125.

Banos, R.M., Botella, C., Guerrero, B., Liano, V., Alcaniz, M. & Rey, B. (2005) The third pole of the sense of presence: comparing virtual and imagery spaces. *PsychNology Journal,* 3(1): 90-100.

Bargh, J. A., McKenna, K. Y. A., & Fitzsimmons, G. M. (2002) Can you see the real me? Activation and expression of the "true self" on the Internet. *Journal of Social Issues*, 58(1): 33-48.

Barnum, C. (2011) *Usability testing essentials: read, set…test!.* London: Elsevier.

Baron-Cohen, S. & Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001) The "Reading the Mind in the Eyes" Test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry*, 42: 241-251.

Barrett, M. S., Chua, W-J., Crits-Christoph, P., Gibbons, M.B., & Thompson, D. (2008) Early withdrawal from mental health treatment: implications for psychotherapy practice. *Psychotherapy: Theory, Research, Practice, Training*, 45(2): 247-267.

Barry, M.J. & Edgman-Levitan, S. (2012) Shared decision making – the pinaccle of patient-centered care. *The New England Journal of Medicine*, 366(9): 780-781.

Bartholomeusz, C. F., Allott, K., Killackey, E., Liu, P., Wood, S. J. & Thompson, A. (2013) Social cognition training as an intervention for improving functional outcome in first-episode psychosis: a feasibility study. *Early Intervention in Psychiatry*, 7(4): 421-426.

Bartholomeusz, C.F., & Allott, K. (2012) Neurocognitive and social cognitive approaches for improving functional outcome in early psychosis: theoretical considerations and current state of evidence. *Schizophrenia research and treatment*, 815315: 1-15.

Barton, K. & Maharg, P. (2007) E-simulations in the wild: Interdisciplinary research, design and implementation. In: Aldrich, C., Gibson, D., & Prensky, M. eds. *Games and simulations in online learning: Research and development frameworks*. London: Information Science Publishing: 115-48.

Bassett, R., Beagan, B.L., Ristovski-Slijepcevic, S., & Chapman, G.E. (2008) The methodological challenges of interviewing teenagers as research participants. *Journal of Adolescent Research,* 23(2): 119-131.

Batra, S., Baker, R.A., Wang, T., Forma, F., DiBiasi, F., & Peters-Strickland, T. (2017) Digital health technology for use in patients with serious mental illness: a systematic review of the literature. *Medical Devices: Evidence and Research,* 10: 237-251.

Baumeister, H., Seifferth, H., Lin, J., Nowoczin, M., Luking, M., & Ebert, D. (2015) Impact of an acceptance facilitating intervention on patients' acceptance of internet-based pain interventions: a randomized controlled trial. *The Clinical Journal of Pain,* 31(6): 528-535.

Bayne, S. (2008) Uncanny spaces for higher education: teaching and learning in virtual worlds. *Association for Learning Technology Journal,* 16(3): 197-205.

Beard, L., Wilson, K., Morra, D., & Keelan, J. (2009) A survey of health-related activities of Second Life. *Journal of Medical Internet Research,* 11(2): e17.

Beauchamp, T.L., & Childress, J.F. (2001) *Principles of biomedical ethics.* Oxford: Oxford University Press.

Beaudoin, C. & Beauchamp, M.H. (2020) Social cognition. In: Gallagher, A., Bulteau, C., Cohen, D., & Michaud, J.L. eds. *Handbook of clinical psychology*. London: Elsevier: 255-264.

Bechi, M., Spangaro, M., Bosia, M., Zanoletti, A., Fresi, F., Buonocore, M., Cocchi, F., Guglielmino, C., Smeraldi, E., & Cavallaro, R. (2013) Theory of Mind intervention for outpatients with schizophrenia. *Neuropsychological Rehabilitation*, 23(3): 383-400.

Behm, D. J. (1972) Self-perception theory. In: Berkowitz, L. ed. *Advances in experimental social psychology*. New York: Academic Press: 1-62.

Bell, M.W. (2008) Towards a definition of “virtual worlds”. *Journal of Virtual Worlds Research,* 1: 1.

Bell, I.H., & Alvarez-Jimenez, A. (2019) Digital technology to enhance clinical care of early psychosis. *Current Treatment Options in Psychiatry,* 6: 256-270.

Bell, I.H., Lim, M.H, & Thomas, T. (2020) The therapeutic use of digital technologies in psychosis. In: Badcock, J., & Paulik, G. (eds). *A clinical introduction to psychosis.* London: Elsevier: 637-662.

Bell, M.D., & Weinstein, A. (2011) Simulated job interview skill training for people with psychiatric disability: feasibility and tolerability of virtual reality training. *Schizophrenia Bulletin,* 37(2): S91-S97.

Bengtsson, J., Nordin, S., & Carlbring, P. (2015) Therapists' experiences of conducting cognitive behavioural therapy online vis-à-vis face-to-face. *Cognitive Behaviour Therapy,* 44(6): 470-479.

Bennett, D., & Rosenheck, R. (2021) Socioeconomic status and the effectiveness of treatment for first episode psychosis. *Health Research and Educational Trust,* 56: 409-417.

Ben-Zeev, D., Buck, B., Kopelovich, S., & Meller, S. (2019) A technology-assisted life of recovery from psychosis. *Nature Portfolio Journal Schizophrenia,* 5: 15.

Berger, R. (2015) Now I see it, now I don't: researcher's position and reflexivity in qualitative research. *Qualitative Research*, 15(2): 219-234.

Berger, T. (2017) The therapeutic alliance in internet interventions: a narrative review and suggestions for future research. *Psychotherapy Research,* 27(5): 511-524.

Berger, M., Jucker, A.H., & Locher, M.A. (2016) Interaction and space in the virtual world of Second Life. *Journal of Pragmatics,* 101: 83-100.

Bergin, M., Wells, J.S.G., & Owens, S. (2008) Critical realism: a philosophical framework for the study of gender and mental health. *Nursing Philosophy,* 9 (3): 169-179.

Berman, I., Sapers, B.L., Chang, H.H.J., Losonczy, M.F., Schmidler, J., & Green, A.I. (1995) Treatment of obsessive-compulsive symptoms in schizophrenic patients with clomipramine. *Journal of Clinical Psychopharmacology,* 15: 206-210.

Berry, N., Bucci, S., & Lobban, F. (2017) Use of the internet and mobile phones for self-management of severe mental health problems: qualitative study of staff views. *JMIR Mental Health,* 4: e52.

Best, M.W., Grossman, M., Milanovic, M. Renaud, S., & Bowie, C.R. (2018) Be outspoken and overcome stigmatizing thoughts (BOOST): a group treatment for internalized stigma in first episode psychosis. *Psychosis,* 10: 187-197.

Best, P., McKenna, A., Quinn, P. Duffy, M., & Daele, T.V. (2020) Routine clinical settings? A systematic narrative review of clinical procedures contained within case reports for the treatment of PTSD. *Frontiers in Virtual Reality,* 1: 563739.

Bertrand, P., Guegen, J., Robieux, L., McCall, C.A., & Zenasni, F. (2018) Learning empathy through virtual reality: multiple strategies for training empathy-related abilities using body ownership illusions in embodied virtual reality. *Frontiers in Robotics and AI,* 26(5): 1-18.

Bierbooms, J.J.P.A., van Haaren, M., IJsselsteijn, W.A., de Kort, Y.A.W., Feijt, M., & Bongers, I.M.B. (2020) Integration of online treatment into the “new normal” in mental health care in post-COVID-19 times: exploratory qualitative study. *JMIR Formative Research,* 4(10): e21344.

Bigger, S. (2009). Learn, Live, Thrive: Victor Turner, social process and performance. Available at: http://learnlivethrive.blogspot.co.uk/ [Accessed May 5, 2018].

Birchwood, M., Smith, J., Cochrane, R., Wetton, S., & Copestake, S. (1990) The social functioning scale: the development and validation of a new scale of social adjustment for use in family intervention programmes with schizophenic patients. *British Journal of Psychiatry*, 157: 853-859.

Bird, V., Premkumar, P., Kendall, T., Whittington, C., Mitchell, J. & Kuipers, E. (2010) Early intervention services, cognitive-behavioural therapy and family intervention in early psychosis: systematic review. *British Journal of Psychiatry*, 197(5): 350-356.

Birnbaum, M.L., Rizvi, A.F., Faber, K., Addington, J., Correll, C.U., Gerber, C., Lahti, A.C., Loewy, R.L., Mathalon, D.H., Nelson, L.A., Voineskos, A.N., Walker, E.F., Ward, E., & Kane, J.M. (2021) Digital trajectories to care in first-episode psychosis. *Psychiatric Services,* 69(12): 1259-1263.

Birnie, K.A., Kulandaivelu, Y., Jibb, L., Hroch, P., Positano, K., Robertson, S., Campbell, F., Abla, O., & Stinson, J. (2018) Usability testing of an interactive virtual reality distraction intervention to reduce procedural pain in children and adolescents with cancer. *Journal of Pediatric Oncology Nursing,* 35(6): 406-416.

Bischoff, R.J., Hollist, C.S., Smith, C.W., & Flack, P. (2004) Addressing the mental health needs of the rural underserved: findings from a multiple case study of a behavioral telehealth project. *Contemporary Family Therapy,* 26(2): 179-198.

Bisso, E., Signorelli, M.S., Milazzo, M., Maglia, M., Polosa, R., Aguglia, E., & Caponnetto, P. (2020) Immersive virtual reality applications in schizophrenia spectrum therapy: a systematic review. *International Journal of Environmental Research and Public Health,* 17: 6111.

Black, D. (2017) Why can I see my avatar? Embodied visual engagement in the third-person video game. *Games and Culture*, 12(2): 179-199.

Blanca Ibanez, M., Jesus Garcia, J., Galan, S., Maroto, D., Morillo, D. & Delgado Kloos, C. (2011) Design and Implementation of a 3D Multi-User Virtual World for Language Learning. *Educational Technology & Society*, 14(4): 2-10.

Blascovich, J., Loomis, J., Beall, A. C., Swinth, K. R., Hoyt, C. L. & Bailenson, J. N. (2002) Immersive virtual environment technology as a methodological tool for social psychology. *Psychological Inquiry*, 13(2): 103-124.

Bloor, M. (2001) *Focus groups in social research*. London: SAGE Publications Ltd.

Bodden, M.E., Mollenhauer, B., Trenkwalder, C., Cabanel, N., Eggert, K.M., Unger, M.M., Oertel, W.H., Kessler, J., Dodel, R., & Kalbe, E. (2010) Affective and cognitive theory of mind in patients with parkinson’s disease. *Parkinsonism & Related Disorders*, 16(7): 466-470.

Boeldt, D., McMahon, E., McFaul, M., & Greenleaf, W. (2019) Using virtual reality exposure therapy to enhance treatment of anxiety disorders: identifying areas of clinical adoption and potential obstacles. *Frontiers in Psychiatry*, 10: 773.

Boellstorff, T. (2008) *Coming of age in Second Life – an anthropologist explores the virtually human.* Oxford: Princeton University Press.

Bohil, C. J., Alicea, B. & Biocca, F. A. (2011) Virtual reality in neuroscience research and therapy. *Nature Reviews Neuroscience*, 12(12): 752-762.

Bok, S. (1989) *Lying: Moral Choice in Public and Private Life*. New York, USA: Vintage.

Bombari, D., Mast, M. S., Canadas, E. & Bachmann, M. (2015) Studying social interactions through immersive virtual environment technology: virtues, pitfalls, and future challenges. *Frontiers in Psychology*, 6(869): 1-11.

Bonet, L., Torous, J., Arce, D., Blanquer, I., & Sanjuan, J. (2020) ReMindCare App for early psychosis: pragmatic real world intervention and usability study. *JMIR mhealth and uhealth,* 8(11): e22997.

Boonsuk, W. (2011) Evaluation of desktop interface displays for 360-degree video. *Iowa State University Capstones, Theses and Dissertations.* 10249.

Boote, J., Telford, R., & Cooper, C. (2002) Consumer involvement in health research: a review and research agenda. *Health Policy*, 6(2): 213-236.

Borzekowski, D.L.G., Leith, J., Medoff, D.R., Potts, W., Dixon, L.B., Balis, T., Hackman, A.L., & Himelhoch, S. (2009) Use of the internet and the other media for health information among clinic outpatients with serious mental illness. *Psychiatric Services,* 60(9): 1265-1268.

Botella, C., Fernandez-Alvarez, J., Guillen, V., Garcia-Palacios, A., & Banos, R. (2017) Recent progress in virtual reality exposure therapy for phobias: a systematic review. *Current Psychiatry Reports,* 19(7): 42.

Boulos, M.N.K, Hetherington, L., & Wheeler, S. (2007) Second Life: an overview of the potential of 3-D virtual worlds in medical education and health education. *Health Information and Libraries Journal,* 24(4): 233-245.

Bowen, D.J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., Bakken, D., Kaplan, C.P., Squiers, L., Fabrizo, C., & Fernandez, M. (2010) How we design feasibility studies. *American Journal of Preventative Medicine,* 36(5): 452-457.

Bowen, S., Sustar, H., Wolstenholme, D., & Dearden, A. (2013) Engaging teenagers productively in service design. *International Journal of Child-Computer Interaction,* 1(3-4): 71-81.

Bowman, D.A., & McMahan, R.P. (2007) Virtual reality: how much immersion is enough? *IEEE Computer,* 40(7): 36-43.

Bradford, E., Jentzsch, I., & Gomez, J. (2015) From self to social cognition: theory of mind mechanisms and their relation to executive functioning. *Cognition*, 138: 21-34.

Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. Qualitative Research in Psychology. *Qualitative Research in Psychology*, 3(2): 77-101.

Bressler, S. E., & Grantham, C. E. Sr., (2000) *Communities of commerce. Building internet business communities*. New York: McGraw-Hill.

Breton-Lopez, J., Quero, S., Botella, C., Garcia-Palacios, A., Banos, R.M., & Alcaniz, M. (2010) An augmented reality system validation for the treatment of cockroach phobia. *Cyberpsychology, Behavior, and Social Networking,* 13: 705-710.

Brett, J., Staniszewska, S., Mockford, C., Herron-Marx, S., Hughes, J., Tysall, C. & Suleman, R. (2014) Mapping the impact of patient and public involvement on health and social care research: a systematic review. *Health Expectations*, 17(5): 637-650.

Brickenkamp, R., & Zillmer, E. (1998) The *D2 Test of Attention*. 1st ed. Seattle, WA: Hogreffe and Huber Publishers.

Bright, F.A.S., Boland, P., Rutherford, S.J., Kayes, N.M., & McPherson, K.M. (2012) Implementing a client-centred approach in rehabilitation: an autoethnography. *Disability and Rehabilitation,* 34(12): 997-1004.

British Psychological Society (2020) Considerations for psychologists working with children and young people using online video platforms. *British Psychological Society – Resource Paper*, 1-4.

British Psychological Society (2021) *"We've got vacancies, and we're missing out on the right people."* [online] Available from: https://thepsychologist.bps.org.uk/volume-34/march-2021/weve-got-vacancies-and-were-missing-out-right-people (Accessed 19th June 2021).

Brown, E. C., Tas, C. & Brune, M. (2012) Potential therapeutic avenues to tackle social cognition problems in schizophrenia. *Expert Review of Neurotherapeutics*, 12(1): 71-81.

Brown, W., Yen, P.Y., Rojas, M., & Schnall, R. (2013) Assessment of the health IT usability evaluation model (health-item) for evaluating mobile health (mhealth) technology. *Journal of Biomedical Informatics,* 46: 1080-1087.

Brunner, E. (1997) Socioeconomic determinants of health: stress and the biology of inequality. *British Medical Journal,* 314 (7092).

Bucci, S., Barrowclough, C., Ainsworth, J., Machin, M., Morris, R., Berry, K., et al. (2018). Actissist: Proof-of-Concept Trial of a Theory-Driven Digital Intervention for Psychosis. *Schizophrenia Bulletin,* 44(5): 1070-1080.

Bucci, S., Morris, R., Berry, K., Berry, N., Haddock, G., Barrowclough, C., Lewis, S., & Edge, D. (2018) Early psychosis service user views on digital technology: qualitative analysis. *JMIR Mental Health,* 5(4): e10091.

Bucci, S., Berry, N., Morris, R., Berry, K., Haddock, G., Lewis, S., & Edge, D. (2019). “They are not hard-to-reach clients. We have just got hard-to-reach services.” Staff views of digital health tools in specialist mental health services. *Frontiers in Psychiatry,* 10: 344.

Bucher, J. (2017) *Storytelling in virtual reality: methods and principles for crafting immersive narratives.* London: Routledge, Taylor and Francis Group.

Bucy, E. (2004) Interactivity in society: locating an elusive concept. *The Information Society,* 376-379.

Buis, L. (2019) Implementation: the next giant hurdle to clinical transformation with digital health. *Journal of Medical Internet Research,* 21(11): e16259.

Bulu, S.T. (2012) Place presence, social presence, co-presence, and satisfaction in virtual worlds. *Computer & Education,* 58: 154-161.

Buntrock, C., Ebert, D.D., Lehr, D., Cuijpers, P., Riper, H., Smit, F., & Berking, M. (2014) Evaluating the efficacy and cost-effectiveness of web-based indicated prevention of major depression: design of a randomised controlled trial. *BMC Psychiatry BioMed Central,* 14: 25.

Burches, E., & Burches, M. (2020) Efficacy, effectivenss and efficiency in the health care: the need for an agreement to clarify its meaning. *International archives of public health and community medicine,* 4(1): 1-3.

Burdette, M. (2015) *The Swayze Effect*. [online] Available from: https://www.oculus.com/story-studio/blog/the-swayze-effect/ (Accessed 30 October 2020).

Burkhard, C., Cicek, S., Barzilay, R., Radhakrishnan, R., & Guloksuz, S. (2021) Need for ethnic and population diversiy in psychosis research. *Schizophrenia Bulletin:* sbab048.

Burns, J.K., & Esterhuizen, T. (2008) Poverty, inequality and the treated incidence of first-episode psychosis. *Social Psychiatry and Psychiatric Epidemiology*, 43(4): 331–335.

Busetto, L., Wick, W., & Gumbinger, C. (2020) How to use and assess qualitative research methods. *Neurological Research and Practice,* 2(14): 1-10.

Busselle, R., & Bilandzic, H. (2008) Measuring narrative engagement. *Media Psychology,* 12(4): 321-347.

Butler, C., & Greenhalgh, T. (2018) What is already known about involving users in service transformation. In: Greenhalgh, T., Humphrey, C., & Woodard, F. (eds). *User involvement in health care*. Chichester, UK: Wiley-Blackwell.

Callan, J., Maheu, M., & Bucky, S. (2017) Crisis in the Behavioral Health Classroom: Enhancing Knowledge, Skills, and Attitudes in Telehealth Training. In: Maheu, M., Drude, K., & Wright, S. eds. *Field Guide to Evidence-based, Technology Careers in Behavioral Health: Professional Opportunities for the 21st century.* New York, USA: Springer: 63-80.

Cambridge Cognition (2018) CANTAB® [Cognitive assessment software]. Cambridge, UK.

Cancela, J., Charlafti, I., Colloud, S., & Wu, C. (2021) Chapter 2 - Digital health in the era of personalized healthcare: opportunities and challenges for bringing research and patient care to a new level. In: Syed-Abdul, S., Zhu, X., & Fernandez-Luque, L. (eds). *Digital Health.* London: Elsevier: 7-31.

Carey, M. A., & Asbury, J-E. (2016) *Focus Group Research.* London: Routledge.

Carr, A. J., Gibson, B. & Robinson, P. G. (2001) Measuring quality of life - Is quality of life determined by expectations or experience? *British Medical Journal*, 322(7296): 1240-1243.

Carroll, J., Hopper, L., Farrelly, A.M., Lombard-Vance, R., Bamidis, P.D., & Konstantinidis, E.I. (2021) A scoping review of augmented/virtual reality health and wellbeing interventions for older adults: redefining immersive virtual reality. *Frontiers in Virtual Reality,* 2: 655338.

Carter, L., Read, J., Pyle, M., Law, H., Emsley, R., & Morrison, A. (2018) Casual beliefs in people experiencing psychosis: the relationship to treatment accessed and the perceived helpfulness of treatment. *Psychology and Psychotherapy: Theory, Research and Practice,* 91(3): 332-344.

Caserman, P., Garcia-Agundez, A., Zerban, A.G., & Göbel, S. (2021) Cybersickness in current-generation virtual reality head-mounted displays: systematic review and outlook. *Virtual Reality.*

Caspar, F., & Berger, T. (2011) Internet-delivered psychological treatments and psychotherapy integration. *Psychotherapy Bulletin,* 46(4): 6-11.

Cater, J. (2011) SKYPE – a cost-effective method for qualitative research. *Rehabilitation Counselors & Educators Journal,* 4: 10-17.

Cella, M., He, Z., Killikelly, C., Okruszek, Ł., Lewis, S., & Wykes, T. (2019) Blending active and passive digital technology methods to improve symptom monitoring in early psychosis. *Early Intervention in Psychosis,* 13: 1271-1275.

Cella, M., Okruszek, Ł., Lawrence, M., Zarlenga, V., He, Z., & Wykes, T. (2018) usng wearable technology to detect the autonomic signature of illness severity in schizophrenia. *Schizophrenia Research,* 195: 537-542.

Cepiku, D., & Giordano, F. (2014) Co-production in developing countries. Insights from the Community Health Workers experiences. *Public Management Review*, 16(3): 317–340.

Cieślik, B., Mazurek, J., Rutkowski, S., Kiper, P., Turolla, A., & Szczepańska-Gieracha, J. (2020) Virtual reality in psychiatric disorders: a systematic review of reviews. *Complementary Therapies in Medicine,* 52: 102480.

Chadwick, P., Lees, S., & Birchwood, M. (2018) The revised beliefs about voices questionnaire (BAVQ-R). *The British Journal of Psychiatry,* 177 (3): 229-232.

Chan, C. L. F., Ngai, E. K. Y., Leung, P. K. H. & Wong, S. (2010) Effect of the adapted virtual reality cognitive training program among Chinese older adulcraits with chronic schizophrenia: a pilot study. *International Journal of Geriatric Psychiatry*, 25(6): 643-649.

Chang, E., Kim, H.T., & Yoo, B. (2020) Virtual reality sickness: a review of causes and measurements. *International Journal of Human-Computer Interaction,* 36(17): 1658-1682.

Chang, H. (2016) Autoethnography in health research: growing pains?. *Qualitative Health Research*, 26(4): 443-451.

Chartrand, T.L., & Bargh, J.A. (1999) The chameleon effect: the perception-behavior link and social interaction. *Journal of Personality and Social Psychology,* 76: 893.

Chavez, L.J., Kelleher, K., Slesnick, N., Holowacz, E., Luthy, E., Moore, L., & Ford, J. (2020) Virtual reality meditation among youth experiencing homelessness: pilot randomized controlled trial of feasibility. *JMIR Mental Health,* 7(9): e18244.

Chen, P., & Hinton, S.M. (1999) Real time interviewing using the World Wide Web. *Sociological Research Online,* 4(3): 1-19.

Chen, S.Y., Magoulas, G.D., & Dimakopoulos, D. (2005) A flexible interface design for web directories to accommodate different cognitive styles.

Journal of the American Society for Information Science and Technology, 56(1): 70-83.

Cheng, F., Kirkbride, J.B., Lennox, B.R., Perez, J., Masson, K., Lawrence, K., Hill, K., Feeley, L., Painter, M., Murray, G.K., Gallagher, O., Bullmore, E.T., & Jones, P.B. (2011) Administrative incidence of psychosis assessed in an early intervention service in England: First epidemiological evidence from a diverse, rural and urban setting. *Psychological Medicine,* 41: 949–958.

Cheung, K.L., ten Klooster, P.M., Smit, C., de Vries, H., & Pieterse, M.E. (2017) The impact of non-response bias due to sampling in public health studies: a comparison of voluntary versus mandatory recruitment in a Dutch national survey on adolescent health. *BMC Public Health,* 17: 276.

Choi, K.H., & Kwon, J.H. (2006) Social cognition enhancement training for schizophrenia: a preliminary randomized controlled trial. *Community Mental Health Journal,* 42(2): 177-187.

Christensen, H., Griffiths, K.M., & Farrer, L. (2009) Adherence in internet interventions for anxiety and depression. *Journal of Internet Medical Research,* 11(2): e13.

Chu, K.M., & Yuan, J.C. (2013) The effects of perceived interactivity on e-trust and e-consumer behaviors: the application of fuzzy linguistic scale. *Journal of Electronic Commerce Research,* 14(1): 124.

Cieślik, B., Mazurek, J., Rutkowski, S., Kiper, P., Turolla, A., & Szczepańska-Gieracha, J. (2020) Virtual reality in psychiatric disorders: a systematic review of reviews. *Complementary Therapies in Medicine,* 52: 102480.

Claghorn, J.L., Johnstone, E.E., Cook, T.H., & Itschner, L. (1974) Group therapy and maintenance treatment of schizophrenics. *Archives of General Psychiatry,* 31(3): 361-365.

Clark, A.M. (1998) The qualitative-quantitative debate: moving from positivism and confrontation to post-positivism and reconciliation. *Journal of Advanced Nursing,* 27 (6): 1242-1249.

Clarke, S., Hanna, D., Mulholland, C., Shannon, C., & Urquhart, C. (2019) A systematic review and meta-analysis of digital health technologies effects on psychotic symptoms in adults with psychosis. *Psychosis,* 11(4): 362 – 373.

Clement, S., Schauman, O., Graham, T., Maggioni, F., Evans-Lacko, S., Bezborodovs, N., Morgan, C., Rüsch, N., Brown, JSL., & Thornicroft, G. (2015) What is the impact of mental health-related stigma on help-seeking? A systematic review of quantitative and qualitative studies. *Psychological Medicine*, 5(1): 11–27.

Cliffe, B., Croker, A., Denne, M., & Stallard, P. (2020) Clinicians' use of and attitudes towards technology to provide and support interventions in child and adolescent mental health services. *Child and Adolescent Mental Health*, 25(2): 95–101.

Clifton, J., & Palmisano, S. (2020) Effects of steering locomotion and teleporting on cybersickness and presence in HMD-based virtual reality. *Virtual Reality*, 24: 453–468.

Clus, D., Larsen, M.E, Lemey, C., & Berrouiguet, S. (2018) The use of virtual reality in patients with eating disorders: systematic review. *Journal of Medical Internet Research*, 20(4): e157.

Coburn, J.Q., Freeman, I., & Salmon, J.L. (2017) A review of the capabilities of current low-cost virtual reality technology and its potential to enhance the design process. *Journal of Computing and Information Science in Engineering,* 17(3): 031013.

Collin, P.J., Metcalf, A.T., Stephens-Reicher, J.C., Blanchard, M.E., Herrman, H.E., Rahilly, K., & Burns, J.M. (2011) ReachOut.com: The role of an online service for promoting help-seeking in young people. *Advances in Mental Health*, 10(1): 39-51.

Combs, D. R., Adams, S. D., Penn, D. L., Roberts, D., Tiegreen, J. & Stem, P. (2007) Social Cognition and Interaction Training (SLIT) for inpatients with schizophrenia spectrum disorders: Preliminary findings. *Schizophrenia Research*, 91(1-3): 112-116.

Corbillon, X., Simon, G., Devlic, A., & Chakareski, J. (2017) Viewport-adaptive navigable 360-degree video delivery. *2017 IEEE International Conferenve on Communications (ICC)*: 1-7.

Corcoran, R. (2003) Inductive reasoning and the understanding of intention in schizophrenia. *Cognitive Neuropsychiatry,* 8(3): 223-235.

Corcoran, R., Mercer, G., & Frith, C.D. (1995) Schizophrenia, symptomatology and social interference: investigating "theory of mind" in people with Schizophrenia. *Schizophrenia Research,* 17: 5-13.

Côté-Arsenault, D., & Morrison-Beedy, D. (2005) Maintaining your focus in focus groups: avoiding common mistakes. *Research in Nursing and Health,* 28(2): 172-179.

Couture, S. M., Penn, D. L. & Roberts, D. L. (2006) The functional significance of social cognition in schizophrenia: A review. *Schizophrenia Bulletin*, 32: S44-S63.

Cowey, A. E., & Potts, H. W.W. (2018) What can we learn from second generation digital natives? A qualitative study of undergraduates' views of digital health at one London university. *Digital Health*, 4: 1-13.

Craig, T. K., Garety, P., Power, P., Rahaman, N., Colbert, S., Fornells-Ambrojo, M., & Dunn, G. (2004) The Lambeth Early Onset (LEO) Team: randomised controlled trial of the effectiveness of specialised care for early psychosis. *British Medical Journal*, 329(7474): 1067-1070.

Craig, T.K.J., Rus-Calafell, M., Ward, T., Leff, J.P., Huckvale, M., Howarth, E., Emsley, R., & Garety, P.A. (2018) AVATAR therapy for auditory verbal hallucinations in people with psychosis: a single-blind, randomized controlled trial. *Lancet Psychiatry,* 5: 31-40.

Cranen, K., Veld, R.H. in't., Ijzerman, M., & Vollenbroek-Hutten, M. (2011) Change of patients' perceptions of telemedicine after brief use. *Telemedicine and e-Health,* 17(7): 530-535.

Croquet Corporation (2021) Croquet. Available at: https://www.croquet.io [Accessed 7 May 2021].

Cruickshank, J. (2012) Positioning positivism, critical realism and social constructionism in the health sciences: a philosophical orientation. *Nursing Inquiry,* 19 (1): 71-82.

Cruz-Neira, C., Sandin, D.J., DeFanti, T.A. (1993) Surround-screen-projection-based virtual reality: the design and implementation of the CAVE. *SIGGRAPH 93,* 1-8.

Csillag, C., Nordentoft, M., Mizuno, M., Jones, P.B., Killackey, E., Taylor, M., Chen, E., Kane, J., & McDaid, D. (2016) Early intervention services in psychosis: from evidence to wide implementation. *Early Intervention in Psychiatry,* 10(6): 540-546.

Cuijpers, P., Donker, T., van Straten, A., Li, G., & Andersson, G. (2010) Is guided self-help as effective as face-to-face psychotherapy for depression and anxiety disorders? A systematic review and meta-analysis of comparative outcome studies. *Psychological Medicine,* 40: 1943-57.

Cummings, J.J., & Bailenson, J.N. (2016) How immersive is enough? A meta-analysis of the effect of immersive technology on user presence. *Media Psychology,* 19(2): 272-309.

Curran, J.P. (1982) A procedure for the assessment of social skills. The simulated social interaction test. In J.P. Curran & P.M. Monti (eds.) *Social skills training a practical handbook for assessment and treatment.* New York: Guildford Press: 355-400.

D'Alfonso, S., Lederman, R., Bucci, S., & Berry, K. (2020) The digital therapeutic alliance and human-computer interaction. *JMIR Mental Health,* 7(12): e21895.

D'Arcey, J., Collaton, J., Kozloff, N., Voineskos, A.N., Kidd, S.A., & Foussias, G. (2020) The use of text messaging to improve clinical engagement for individuals with psychosis. *JMIR Mental Health,* 7(4): e16993.

Dark, F., Scott, J.G., Baker, A., Parker, S., Gordon, A., Newman, E., Gore-Jones V., Lim, C.C.W., Jones, L., & Penn, D.L. (2020) Randomized controlled trial of social cognition and interaction training compared to befriending group. *British Journal of Clinical Psychology,* 59(3): 384-402.

Dalgarno, B. & Lee, M. J. W. (2010) What are the learning affordances of 3-D virtual environments? *British Journal of Educational Technology*, 41(1): 10-32.

de Borst, A.W., & de Gelder, B. (2015) Is it the real deal? Perception of virtual characters versus humans: an affective cognitive neuroscience perspective. *Frontiers in Psychology,* 6(576): 1-12.

de Carvalho, M.R., Dias, T.R.D.S., Duchesne, M., Nardi, A.E., & Appolinario, J.C. (2017) Virtual reality as a promising strategy in the assessment and treatment of bulimia nervosa and binge eating disorder: a systematic review. *Behavioral Sciences,* 7(3): 43.

Deacon, B.J. (2013) The biomedical model of mental disorder: a critical analysis of its validity, utility, and effects on psychotherapy research. *Clinical Psychology Review,* 33: 846-861.

Deakin, H., & Wakefield, K. (2014) SKYPE interviewing: reflections of two PhD researchers. *Qualitative Research,* 14: 1-14.

DeJonckheere, M., & Vaughn, L.M. (2019) Semistructured interviewing in primary care research: a balance of relationship and rigour. *Family Medicine and Community Health,* 7: e000057.

Dellazizzo, L., Potvin, S., Bahig, S., & Dumais, A. (2019) Comprehensive review on virtual reality for the treatment of violence: implications for youth with schizophrenia. *Nature Partner Journals Schizophrenia,* 5: 11.

Dellazizzo, L., Potvin, S., Phraxayavong, K., Lalonde, P., & Dumais, A. (2018) Avatar therapy for persistent auditory verbal hallucinations in an ultra-resistant schizophrenia patient: a case report. *Frontiers in Psychiatry,* 9(131).

Dellazizzo, L., Potvin, S., Phraxayavong, K., & Dumais, A. (2021) One-year randomized trial comparing virtual reality-assisted therapy to cognitive-behavioral therapy for patients with treatment-resistant schizophrenia. *Nature Partner Journals,* 7(9).

Delwiche, A. (2006) Massively multiplayer online games (MMOs) in the new media classroom. *Educational Technology and Society*, 9(3): 160–72.

Dengel, A., & Mägdefrau, J. (2019) Presence is the key to understanding immersive learning. *5th International Conference Immersive Learning Research Network 2019,* 185-198.

Dennison, M.S., Wisti, A.Z., & D'Zmura, M. (2016) Use of physiological signals to predict cybersickness. *Displays,* 44: 42-52.

Di Carlo, F., Sociali, A., Picutti, E., Pettorruso, M., Vellante, F., Verrastro, V., Martinotti, G., & di Giannantonio, M. (2020) Telepsychiatry and other cutting-edge technologies in COVID-19 pandemic: bridging the distance in mental health assistance. *The International Journal of Clinical Practice,* 1-9.

Dickinson, P., Gerling, K., Wilson, L., and Parke, A. (2020) Virtual reality as a platform for research in gambling behaviour. *Computers in Human Behaviour*, 107: 106293.

Didehbani, N., Allen, T., Kandalaft, M., Krawczyk, D., & Chapman, S. (2016) Virtual reality social cognition training for children with high functioning autism. *Computers in Human Behaviour*, 62: 703-711.

Diemer, J., Alpers, G. W., Peperkorn, H. M., Shiban, Y. & Muehlberger, A. (2015) The impact of perception and presence on emotional reactions: a review of research in virtual reality. *Frontiers in Psychology*, 6(26): 1-9.

Dietrichkeit, M., Flint, K., Krieger, E., Grzella, K., Nagel, M., & Moritz, S. (2018) Two case studies from a virtual reality intervention for delusions: feasibility and preliminary evidence. *The Cognitive Behaviour Therapist,* 11(e10): 1-17.

Dilgul, M., Hickling, L.M., Antonie, D., Priebe, S., & Bird, V.J. (2021) Virtual reality group therapy for treatment of depression: a qualitative study on stakeholder perspectives. *Frontiers in Virtual Reality,* 1: 698545.

Dixson, M.D., Greenwall, M.R,, Roger-Stacey, C., Weister, T., & Lauer, S. (2016) Nonverbal immediacy behaviors and online student engagement: bringing past instructional research into the present virtual classroom. *Communication Education,* 66(1): 37-53.

Donkin, L., Christensen, H., Naismith, S.L., Neal, B., Hickie, I.B. & Glozier, N. (2011) A systematic review of the impact of adherence on the effectiveness of e-therapies. *Journal of Medical Internet Research,* 13(3): e52.

Drake, R.J., Husain, N., Marshall, M., Lewis, S.W., Tomenson, B., Chaudhry, I.B., Everard, L., Singh, S., Freemantle, N., Fowler, D., Jones, P.B., Amos, T., Sharma, V., Green, C.D., Fisher, H., Murray, R.M., Wykes, T., Buchan, I., & Birchwood, M. (2020) Effect of delaying treatment of first-episode psychosis on symptom and social outcomes: a longitudinal analysis and modelling study. *Lancet Psychiatry,* 7: 602-610.

Druin, A. (2002) The role of children in the design of new technology. *Behaviour & Information Technology,* 21(1): 1-25.

Du Sert, O.P., Potvin, S., Lipp, O., Dellazizzo, L., Laurelli, M., Breton, R., Lalonde, P., Phraxayavong, K., O'Connor, K., Pelletier, J-F., Boukhalfi, T., Renaud, P., & Dumais, A. (2018) Virtual reality therapy for refractory auditory verbal hallucinations in schizophrenia: a pilot clinical trial. *Schizophrenia Research,* 197: 176-181.

Ducheneaut, N., Wen, M., Yee, N., & Wadley, G. (2009) Body and mind: a study of avatar personalization in three virtual worlds. *In Proceedings of the 27th International Conference on Human Factors in Computer Systems,* 1151-1160.

Dunn, R.A., & Guadagno, R.E. (2012) My avatar and me – gender and personality predictors of avatar-self discrepancy. *Computers in Human Behavior,* 28(1): 97-106.

Ebert, D.D., Berking, M., Cuijpers, P., Lehr, D., Portner, M., & Baumeister, H. (2015) Increasing the acceptance of internet-based mental health interventions in primary care patients with depressive symptoms. A randomized controlled trial. *Journal of Affective Disorders,* 176: 9-17.

Ebert, D.D., Harrer, M., Apolionario-Hagen, & Baumeister, H. (2019) Digital interventions for mental disorders: key features, efficacy, and potential for artificial intelligence applications. In: Kim, Y-K. eds. *Frontiers in Psychiatry*. Singapore: Springer: 583-628.

Ebert, D.D., Lehr, D., Smit, F., Zarski, A-C., Riper, H., Heber, E., Cuijpers, P., & Berking, M. (2014) Efficacy and cost-effectiveness of minimal guided and unguided internet-based mobile supported stress-management in employees with occupational stress: a three- armed randomised controlled trial. *BMC Public Health*, 14(1): 807.

Ebert, D.D., Nobis, S., Lehr, D., Baumeister, H., Riper, H.M., Auerbach R.P., Snoek, F., Cuijpers, P., & Berking, M. (2016) The 6-month effectiveness of Internet-based guided self-help for depression in adults with Type 1 and 2 diabetes mellitus. *Diabetic Medicine,* 34(1): 99-107.

Eccles, M.P., & Mittman, B.S. (2006) Welcome to implementation science. *Implementation Science,* 1(1).

Eichenberg, C. (2012) *Virtual reality in psychological, medical and pedagogical applications.* New York: InTech.

Eisapour, M., Cao, S., & Boger, J. (2020) Participatory design and evaluation of virtual reality games to promote engagement in physical activity for people with dementia. *Journal of Rehabilitation and Assistive Technologies Engineering,* 7: 1-14.

Eijlers, R., Utens, E.M.W.J., Staals, L.M., de Nijs, P.F.A., Berghmans, J.M., Wijnen, R.M.H., Hillegers, M.H.J., Dierckx, B., & Legerstee, J. (2019) A systematic review of the use of virtual reality and its effects on cognition in individuals with neurocognitive disorders. *Pediatric Anesthesiology,* 129(5): 1344-1353.

Elahi, F. (2020) *Digital Inclusions: Bridging Divides*. London: Cumberland Lodge.

El Alaoui, S., Hedman, E., Ljotsson, B., & Lindefors, N. (2015) Long-term effectiveness and outcome predictors of therapist-guided internet-based cognitive-behavioural therapy for social anxiety disorder in routine psychiatric care. *BMJ Open,* 5(6): e007902.

El Aziz, E.M., El Aziz Rady, H.E., & El Din, M.N. (2017) Effectiveness of social skills training program on social functioning and severity of symptoms among patients with schizophrenia. *American Journal of Nursing Science,* 6(6): 454 – 466.

Ellis, C.S., & Bochner, A. (2000) Autoethnnography, personal narrative, reflexivity: researcher as subject. In: Denzin, N.K., & Lincoln, Y.S. eds. *Handbook of Qualitative Research* (2nd ed). London: Sage: 733-768.

Embodied Labs (2021) Embodied Labs. Available at: https://embodiedlabs.com [Accessed July 4, 2021].

Engel, M., Fritzsche, A., & Lincoln, T.M. (2016) Anticipation and experience of emotions in patients with schizophrenia and negative symptoms. An experimental study in a social context. *Schizophrenia Research,* 170: 191-197.

Ennis, L., & Wykes, T. (2013) Impact of patient involvement in mental health research: longitudinal study. *The British Journal of Psychiatry*, 203(5): 381-386.

eOrygen VR (2020) *Orygen – 360 Video (VR Fixed).* Available at: https://www.youtube.com/watch?v=vuvB4B5lwwU [Accessed April 29 2020].

Equator Network (2020) CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. Available at: https://www.equator-network.org/reporting-guidelines/consort/ [Accessed July 4, 2020].

Erbe, D., Eichert, H-C., Riper, H., & Ebert, D.D. (2017) Blending face-to-face and internet-based interventions for the treatment of mental disorders in adults: systematic review. *Journal of Medical Internet Research,* 19(9): e306.

EuroQol Group (1990) EuroQol – a new facility for the measurement of health-related quality of life. *Health Policy,* 16(3): 199-208.

Eysenbach, G. (2005) The law of attrition. *Journal of Medical Internet Research,* 7(1): e11.

Falconer, C. J., Slater, M., Rovira, A., King, J. A., Gilbert, P., Antley, A. & Brewin, C. R. (2014) Embodying Compassion: A Virtual Reality Paradigm for Overcoming Excessive Self-Criticism. *PLoS ONE*, 9(11): e111933.

Falconer, L., (2011) Metaxis: the transition between worlds and the consequences for education. *Innovative Research in Virtual Worlds Conference*: 1-2.

Fan, H., & Poole, M.S. (2006) What is personalization? Perspectives on the design and implementation of personalisation in information systems. *Journal of organizational computing and electronic commerce,* 16(3-4): 179-202.

Fan, S., Ng, T-T., Koenig, B.L., Herberg, J.S., Jiang, M., Shen, Z., & Zhao, Q. (2018) Image visual realism: from human perception to machine computation. *EEE Transactions on Pattern Analysis and Machine Intelligence,* 40(9): 2180-2193.

Fanning, F., Foley, S., Lawlor, E., McWilliams, S., Jackson, D., Renwick, L., Sutton, M., Turner, N., Kinsella, A., Trimble, T., & O'Callaghan, E. (2012) Group cognitive behavioural therapy for first episode psychosis: who's referred, who attends and who completes it? *Early Intervention in Psychiatry,* 6(4): 432-441.

Feijt, M., de Kort, Y., Bongers, I., Bierbooms, J., Westerink, J., & Ijsselsteijn, W. (2020) Mental health care goes online: practitioners' experiences of providing mental health care during the COVID-19 pandemic. *Cyberpsychology, Behavior and Social Networking,* 23(12): 860-864.

Ferrer-Garcia, M., & Gutierrez-Maldonado, J. (2012) The use of virtual reality in the study, assessment, and treatment of body image in eating disorders and nonclinical samples: a review of the literature. *Body Image,* 9:1-11.

Festinger, L. (1957) *A theory of cognitive dissonance*. Evanston, IL: Row, Peterson.

Fett, A.-K. J., Viechtbauer, W., Dominguez, M.-d.-G., Penn, D. L., van Os, J. & Krabbendam, L. (2011) The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: A meta-analysis. *Neuroscience and Biobehavioral Reviews*, 35(3): 573-588.

Firth, J., Cotter, J., Torous, J., Bucci, S., Firth, J.A., & Yung, A.R. (2016) Mobile phone ownership and endorsement of “mHealth” among people with psychosis: a meta-analysis of cross-sectional studies. *Schizophrenia Bulletin,* 42: 448-455.

Fiszdon, J.M. & Reddy, L. F. (2012) Review of social cognitive treatments for psychosis. *Clinical Psychology Review*, 32(8): 724-740.

Fiszdon, J.M., Roberts, D.L., Penn, D.L., Choi, K., Tek, C., Choi, J., & Bell, M. D. (2017) Understanding social situations (USS): a proof-of-concept social cognitive intervention targeting theory of mind and attributional bias in individuals with psychosis. *Psychiatric Rehabilitation Journal*, 40(1): 12-20.

Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2018) Integrating virtual reality devices into the body: effects of technological embodiment on customer engagement and behavioral intentions toward the destination. *Journal of Travel & Tourism Marketing,* 36(7): 847-863.

Fletcher-Tomenius, L., & Vossler, A. (2009) Trust in online therapeutic relationships: the therapist’s experience. *Psychology Review,* 24(2): 24-34.

Fodor, L.A., Cotet, C.D., Cuijpers, P., Szamoskozi, S., David, D., & Cristea, I.A. (2018) The effectiveness of virtual reality based interventions for symptoms of anxiety and depression: a meta-analysis. *Scientific Reports,* 8: 10323.

Folstein, M.F., Folstein, S.E., & McHugh, P.R. (1975) “Mini-mental state.” A practical method for grading the cognitive state of pateints for the clinician. *Journal of Psychiatric Research,* 12(3): 189-198.

Foster, K., McAllister, M., & O'Brien, L. (2006) Extending the boundaries: autoethnography as an emergent method in mental health nursing research. *International Journal of Mental Health Nursing,* 15: 44-53.

Fowler, D., Hodgekins, J., & French, P. (2019) Social recovery therapy in improving activity and social outcomes in early psychosis: current evidence and longer term outcomes. *Schizophrenia Research,* 203: 99 – 104.

Frampton, G.K., Shepherd, J., Pickett, K., Griffiths, G., & Wyatt, J.C. (2020) Digital tools for the recruitment and retention of participants in randomised controlled trials: a systematic map. *Trials,* 21: 478.

Freeman, D., Bradley, J., Antley, A., Bourke, E., DeWeever, N., Evans, N., Cernis, E., Sheaves, B., Waite, F., Dunn, G., Slater, M. & Clark, D. M. (2016) Virtual reality in the treatment of persecutory delusions: randomised controlled experimental study testing how to reduce delusional conviction. *British Journal of Psychiatry*, 209(1): 62-67.

Freeman, D., Reeve, S., Robinson, A., Ehlers, A., Clark, D., Spanlang, B. & Slater, M. (2017) Virtual reality in the assessment, understanding, and treatment of mental health disorders. *Psychological medicine*, 47: 2393-2400.

Freeman, D., Yu, L-M., Kabir, T., Martin, J., Craven, M., Leal, J., Lambe, S., Brown, S., Morrison, A., Chapman, K., Dudley, R., O'Regan, E., Rovira, A., Goodsell, A., Rosebrock, L., Bergin, A., Cryer, T.L., Robotham, D., Andleeb, H., Geddes, J.R., Hollis, C., Clark, D.M., & Waite, F. (2019) Automated virtual reality (VR) cognitive therapy for patients with psychosis: study protocol for a single-blind parallel group randomised controlled trial (gameChange). *BMJ Open*, 9: e031606.

Frisby, B.N., Kaufmann, R., Vallade, J.I., Frey, T.K., & Martin, J.C. (2020) Using virtual reality for speech rehearsals: an innovative instructor approach to enhance student public speaking efficacy. *Basic Communication Course Annual,* 32: 59-78.

Frith, U. & Blakemore, S-J. (2006) Social cognition. In: Morris, R., Tarassenko, L., & Kenward, M. eds. *Cognitive systems – information processing meets brain science*. London: Academic Press: 138-162.

Frith, H., & Glesson, K. (2004) Clothing and embodiment: men managing body image and appearance. *Psychology of Men and Masculinity,* 5(1): 40-48.

Frommann, N., Streit, M., & Wolwer W. (2003) Remediation of facial affect recognition impairments in patients with schizophrenia: a new training program. *Psychiatry Research*,117: 281–284.

Fuentes, I., Garcia, S., Ruiz, J., Soler, M., & Roder, V. (2007) Social perception training in schizophrenia: a pilot study. *International Journal of Psychology and Psychological Therapy,* 7(1): 1-12.

Fulford, D., Campellone, T., & Gard, D.E. (2018) Social motivation in schizophrenia: how research on basic reward processes informs and limits out understanding. *Clinical Psychology Review,* 63: 12-24.

Furniss, D., Iacovides, I., Lynos, I., Blandford, A., & Franklin, B.D. (2016) Patient and public involvement in patient safety research: a workshop to review patient information, minimise psychological risk and inform research. *Research Involvement and Engagement,* 63: 12-24.

Fusar-Poli, P., McGorry, P.D., & Kane, J.M. (2017) Improving outcomes of first-episode psychosis: an overview. *World Psychiatry,* 16(3): 251–265.

Gaebel, W., Lukies, R., Kerst, A., Stricker, J., Zielasek, J., Diekmann, S., Trost, N., Gouzoulis-Mayfrank, E., Bonroy, B., Cullen, K., Desie, K., Ewalds Mulliez, A.P., Gerlinger, G., Günther, K., Hiemstra, H.J., McDaid, S., Murphy, C., Sander, J., Sebbane, D., Roelandt, J.L., Thorpe, L., Topolska, D., Van Assche, E., Van Daele, T., Van den Broeck, L., Versluis, C., & Vlijter, O. (2020) Upscaling e-mental health in Europe: a six-country qualitative analysis and policy recommendations from the eMEN project. *European Archives of Psychiatry and Clinical Neuroscience*.

Gagnon, J.C., & Barber, B.R. (2018) Feasibility. In: Frey, B.B. (ed). *The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation.* London: SAGE Publications Inc.: 668.

Gagnon, M.P., Ngangue, P., Payne-Gagnon, J., & Desmartis, M. (2015) m-Health adoption by healthcare professionals: a systematic review. *Journal of the American Medical Informations Association*, 23: 212–20.

Gallego, M.D., Bueno, S., & Noyes, J. (2016) Second Life adoption in education: a motivational model bases on uses and gratifications theory. *Computers & Education*, 100: 81–93.

Gambrill, E.D., & Richey, C. (1975) An assertion inventory for use in assessment and research. *Behavior Therapy*, 6: 550–561.

gameChange (2021) *gameChange - improving lives through VR therapy*. [Online] Available from: https://gamechangevr.com (Accessed 10 July 2021).

Garcia, S., Fuentes, I., Ruiz, J., Gallach, E., & Rocher, V. (2003) Application of the IPT in a Spanish sample: evaluation of the 'social perception subprogramme.' *International Journal of Psychology and Psychological Therapy,* 3: 299-310.

Gardsjord, E.S., Romm, K.L., Friis, S., Barder, H.E., Evensen, J., Haahr, U., Hegelstad, W.t., Joa, I., Johannessen, J.O., Larsen, T.K., Opjordsmoen, S., Rund, B.R., Simonsen, E., Vaglum, P., McGlashan, T., Melle, I., & Røssberg, J.I. (2016) Subjective quality of life in first-episode psychosis. A ten year follow-up study. *Schizophrenia Research,* 172: 23-28.

Garety, P. A., Craig, T. K. J., Dunn, G., Fornells-Ambrojo, M., Colbert, S., Rahaman, N., Reed, J. & Power, P. (2006) Specialised care for early psychosis: symptoms, social functioning and patient satisfaction - Randomised controlled trial. *British Journal of Psychiatry*, 188: 37-45.

Garety, P., Ward, T., Emsley, R., Greenwood, K., Freeman, D., Fowler, D., Kuipers, E., Bebbington, P., Rus-Calafell, M., McGourty, A., Sacadura, C., Collett, N., James, K., & Hardy, A. (2021) Effects of SlowMo, a blended digital therapy targeting reasoning, on paranoia among people with psychosis. *JAMA Psychiatry*: e210326.

Gay, K., Torous, J., Joseph, A., Pandya, A., & Duckworth, K. (2016) Digital technology use among individuals with schizophrenia: results of an online survey. *Journal of Medical Internet Research,* (3): e15.

Gayer-Anderson, C., & Morgan, C. (2013) Social networks, support and early psychosis: a systematic review. *Epidemiology and Psychiatric Sciences,* 22: 131-146.

Gega, L., White, R., Clarke, T., Turner, R., & Fowler, D. (2013) Virtual environments using video capture for social phobia with psychosis. *Cyberpsychology, Behavior and Social Networking,* 16(6): 473-479.

General Data Protection Regulation (2018) Complete guide to GDPR compliance. Available at: https://gdpr.eu [Accessed June 10 2018].

Geraets, C.N.W., Snippe, E., van Beilen, M., Pot-Kolder, R.M.C.A., Wichers, M., van der Gaag., M., & Veiling, W. (2020) Virtual reality based cognitive behavioral therapy for paranoia: effects on mental states and the dynamics among them. *Schizophrenia Research,* 227-234.

Gerhards, S.A., Abma, T.A., Arntz, A., de Graaf, L.E., Evers, S.M., Huibers, M.J., & Widdershoven, G.A. (2011) Improving adherence and effectiveness of computerised cognitive behavioural therapy without support for depression: a qualitative study on patient experiences. *Journal of Affective Disorders*, 129(1-3):117-25.

Gershon, J., Zimand, E., Pickering, M., Rothbaum, B.O., & Hodges, L. (2004) A pilot and feasibility study of virtual reality as a distraction for children with cancer. *Journal of American Academy of Child and Adolescent Psychiatry.* 43(10): 1243-1249.

Gilbody, S., Littlewood, E., Hewitt, C., Brierley, G. Tharmanathan, P., Araya, R., Barkham, M., Bower, P., Cooper, C., Gask, L., Keesler, D., Lester, H., Lovell, K., Parry, G., Richards, D.A., Andersen, P., Brabyn, S., Knowles, S., Shepherd, C., Tallon, D., & White, D. (2015) Computerised cognitive behaviour therapy (cCBT) as treatment for depression in primary care (REEACT trial): large scale pragmatic randomised controlled trial. *British Medical Journal,* 351: h5627.

Gill, P., Stewart, K., Treasure, E. & Chadwick, B. (2008) Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*, 204(6): 291-295.

Girvan, C. (2018) What is a virtual world? Definition and classification. *Educational Technology Research and Development,* 66: 1087-1100.

Glegg, S.M.N., & Levac, D.E., (2017) Enhancing clinical implementation of virtual reality, *2017 International Conference on Virtual Rehabilitation (ICVR)*, Montreal, QC: 1-7.

Gohar, S.M., Hamdi, E., El Ray, L.A., Horan, W.P., & Green, M.F. (2013) Adapting and evaluating a social cognitive remediation program for schizophrenia in Arabic. *Schizophrenia Research,* 148(1-3): 12-17.

Gonçalves, R., Pedrozo, A.L., Coutinho, E.S.F., Figueira, I., & Ventura, P. (2012) Efficacy of virtual reality exposure therapy in the treatment of PTSD. *PLoS ONE,* 7(12): e48469.

Gorini, A., Gaggioli, A., Vigna, C. and Riva, G. (2008). A second life for eHealth: prospects for the use of 3-D virtual worlds in clinical psychology. *J Med Internet Res* 10(3): e21.

Gorisse, G., Christmann, O., Houzangbe, S. and Richir, S. (2019). From robot to virtual doppelganger: impact of visual fidelity of avatars controlled in third-person perspective on embodiment and behavior in immersive virtual environments. *Frontiers in Robotic and AI,* 6(8): e21.

Goss, L., & Anthony, K. (2006) Technology in Counselling and Psychotherapy. A Practitioner's Guide. *Counselling and Psychotherapy Research*, 6: 213-14.

Gottschalk, S. (2010) The presentation of avatars in Second Life: self and interaction of social virtual spaces. *Symbolic Interaction*, 33(4): 501-525.

GOV.UK (2018) Data protection. Available at: https://www.gov.uk/data-protection [Accessed May 2, 2017].

Grant, C., Widnall, E., Cross, L., Simonoff, E., & Downs, J. (2020) Informing the development of an E-platform for monitoring wellbeing in schools: involving young people in a co-design process. *Research Involvement and Engagement,* 6:51.

Grant, D.A., & Berg, E. (1948) A behavioral analysis of degree of reinforcement and ease of shifting to new responses in a Weigl-type card-sorting problem. *Journal of Experimental Psychology,* 38: 404-411.

Grant, N., Lawrence, M., Preti, A., Wykes, T., & Cella, M. (2017) Social cognition interventions for people with schizophrenia: a systematic review focussing on methodological quality and intervention modality. *Clinical Psychology Review,* 56: 55-64.

Green, M. F., Kern, R. S. & Heaton, R. K. (2004) Longitudinal studies of cognition and functional outcome in schizophrenia: implications for MATRICS. *Schizophrenia Research*, 72(1): 41-51.

Green, S.A., Carnegie, W., Barber, S., Matthew, D., & Matthews, R. (2018) Co-designing interventions within quality improvement initiatives: notes from the field. *The Journal of Health Design,* 3(1): 49-56.

Greer, B., Robotham, D., Simblett, S., Curtis, H., Griffiths, H., & Wyles, T. (2019) Digital exclusion among mental health service users: qualitative investigation. *Journal of Medical Internet Research,* 21(1): e11696.

Gregg, L. & Tarrier, N. (2007) Virtual reality in mental health - A review of the literature. *Social Psychiatry and Psychiatric Epidemiology*, 42(5): 343-354.

Greig, T.C., Bryson, G.J., & Bell, M.D. (2004) Theory of mind performance in schizophrenia: diagnositic, symptom, and neuropsychological correlates. *Journal of Nervous and Mental Disease*, 192: 12-18.

Grinberg, A. M., Careaga, J. S., Mehl, M. R. & O'Connor, M. F. (2014) Social engagement and user immersion in a socially based virtual world. *Computers in Human Behavior*, 36: 479-486.

Grossman, M.J., Woolridge, S., Lichtenstein, S., McLaughlin, D., Auther, A.M., Carrion, R.E., Cornblatt, B.A., & Bowie, C.R. (2019) Patterns and perceptions of face-to-face and digital communication in the clinical high risk and early stages of psychosis. *Psychiatry Research*: 122667.

Gustafson, D., & Wyatt, J.C. (2004) Evaluation of ehealth systems and services. *British Medical Journal,* 328: 1150.

Haans, A., Kaiser, F. G., Bouwhuis, D. G., & IJsselsteijn, W. A. (2012) Individual differences in the rubber-hand illusion: Predicting self-reports of people’s personal experiences. *Acta Psychologica*, 141: 169–177.

Haddock, G., Eisner, E., Boone, C., Davies, G., Coogan, C. & Barrowclough, C. (2014) An investigation of the implementation of NICE-recommended CBT interventions for people with schizophrenia. *Journal of Mental Health*, 23(4): 162-165.

Haddock, G., McCarron, J., Tarrier, N., Faragher, E.B. (1999) Scales to measure dimensions of hallucinations and delusions: the psychotic symptom rating scales (PSYRATS). *Psychological Medicine*, 29(4): 879-889.

Hagel, J., & Armstrong, A. G. (1997) *Net gain: Expanding markets through virtual communities*. Boston, MA: Harvard Business School Press.

Hale, J., Payne, M.E.M., Taylor, K.M., Paoletti, D., & Hamilton, A.F.de.C. (2017) The virtual maze: a behavioural took for measuring trust. *The Quarterly Journal of Experimental Psychology,* 71(4): 989-1008.

Halldorsson, B., Hill, C., Waite, P., Partridge, K., Freeman, D., & Creswell, C. (2021) Annual research review: immersive virtual reality and digital applied gaming interventions for the treatment of mental health problems in children and young people: the need for rigorous treatment development and clinical evaluation. *The Journal of Child Psychology and Psychiatry,* 62(5): 584-605.

Hanna, P. (2012) Using internet technologies (such as skype) as a research medium: a research note. *Qualitative Research,* 12: 239-242.

Harari, H., Shamay-Tsoory, S.G., Ravid, M., & Levkovitz, Y. (2010) Double dissociation between cognitive and affective empathy in borderline personality disorder. *Psychiatry Research,* 175(3): 277-279.

Hariman, K., Ventriglio, A., & Bhugra, D. (2019) The future of digital psychiatry. *Current Psychiatry Reports,* 21: 88.

Harrison, G., Hopper, K., Craig, T., Laska, E., Siegel, C., Wanderling, J., Dube, K.C., Ganev, K., Giel, R., An Der Heiden, W., Holmberg, S.K., Janca, A., Lee, P.W.H., Leon, C.A., Malhotra, S., Marsella, A.J., Nakane, Y., Sartorius, N., Shen, Y., Skoda, C., Thara, R., Tsirkin, S.J., Varma, V.K., Walsh, D., & Wiersma, D. (2001) Recovery from psychotic illness: A 15 and 25-year international follow-up study. *The British Journal of Psychiatry,* 178: 506-517.

Harrow, M., Grossman, L.S., Jobe, T.H. & Herbener, E.S. (2005) Do patients with schizophrenia ever show periods of recovery? A 15-year multi-follow-up study. *Schizophrenia Bulletin,* 31: 723-734.

Harvey, P.D., & Bellack, A.S. (2009) Toward a terminology for functional recovery in schizophrenia: is functional remission a viable concept? *Schizophrenia Bulletin,* 35: 300-306.

Hasson-Ohayon, I., Avidan-Msika, M., Mashiach-Eizenberg, M., Kravetz, S., Rozencwaig, S., Shalev, H., Lysaker, P.H. (2015) Metacognitive and social cognition approaches to understanding the impact of schizophrenia on social quality of life. *Schizophrenia Research,* 161(2-3): 386-391.

Hay-Gibson, N.V. (2009) Interviews via VoIP: benefits and disadvantages within a PhD study of SMEs. *Library and Information Research,* 33(105): 39–50.

Haynes, K. (2012) Reflexivity in Qualitative Research. In: Symon, G. & Cassell, C., eds. *Qualitative Organizational Research*. London: SAGE: 72-89.

Hazell, C. M., Hayward, M., Cavanagh, K. & Strauss, C. (2016) A systematic review and meta-analysis of low intensity CBT for psychosis. *Clinical Psychology Review*, 45: 183-192.

Healey, K. M., Bartholomeusz, C. F. & Penn, D. L. (2016) Deficits in social cognition in first episode psychosis: A review of the literature. *Clinical Psychology Review*, 50: 108-137.

Helsper, E.J. (2012) A corresponding fields model for the links between social and digital exclusion. *Communication Theory,* 22(4): 403-426.

Hennemann, S., Beutel, M.E., Zwerenz, R. (2017) Ready for eHealth? Health professionals' acceptance and adoption of ehealth interventions in inpatient routine care. *Journal of Health Communication,* 22(3): 274-284.

Henry, J.D., Cowan, D.G., Lee, T., & Sachdev, P.S. (2015) Recent trends in testing social cognition. *Current Opinion in Psychiatry,* 28(2): 133-140.

Henry, L.P., Amminger, G.P., Harris, M.G., Yuen, H.P., Harrigan, S.M., Prosser, A.L., Schwartz, O.S., Farrelly, S.E., Herrman, H., Jackson, H.J., & McGorry, P.D. (2010) The epic follow-up study of first-episode psychosis: longer-Term clinical and functional outcome 7 years after index admission. *Journal of Clinical Psychiatry,* 71: 716-728.

Henson, P., Wisniewski, H., Hollis, C., Keshavan, M., & Torous, J. (2019) Digital mental health apps and the therapeutic alliance: initial review. *BJPsych Open,* 5(e15): 1-5.

Herault, R.C., Lincke, A., Milrad, M., Forsgärde, E-S., & Elmqvist, C. (2018) Using 360-degrees interactive videos in patient trauma treatment education: design, development and evaluation aspects. *Smart Learning Environments,* 5: 26.

Hershfield, H.E., Goldstein, D.G., Sharpe, W.F., Fox, J., Yeykelis, L., Carstensen, L.L., & Bailenson, J.N. (2011) Increasing saving behavior through age-progressed renderings of the future self. *Journal of Marketing Research,* 48: S23-S37.

Hetrick, S.E., Robinson, J., Burge, E., Blandon, R., Mobilio, B., Rice, S.M., Simmons, M.B., Alvarez-Jimenez, M., Goodrich, S., & Davey, C.G. (2018) Youth codesign of a mobile phone app to facilitate self-monitoring and management of mood symptoms in young people with major depression, suicidal ideation, and self harm. *JMIR Mental Health,* 5(1): e9.

Hew, K. H., & Cheung, W.S. (2010) Use of three-dimensional (3-D) immersive virtual worlds in K-12 and higher education settings: a review of the research. *British Journal of Educational Technology*, 41(1): 33–55.

Hickey, G., Richards, T., & Sheehy, J. (2018) Co-production from proposal to paper. *Nature,* 562(7725): 29-31.

Highton-Williamson, E., Priebe, S., & Giacco, D. (2014) Online social networking in people with psychosis: a systematic review. *International Journal of Social Psychiatry,* 61: 92-101.

Hilty, D.M., Randhawa, K., Maheu, M.M., McKean, A.J.S, & Pandera, R. (2019) Therapeutic Relationship of Telepsychiatry and Telebehavioral Health: Ideas from Research on Telepresence, Virtual Reality and Augmented Reality. *Psychology and Cognitive Sciences*, 5(1): 14– 29.

Hinkley, J. (2005) The piano lesson: an autoethnography about changing clinical paradigms in aphasia practice. 19: 765-779.

Hodel, B., Brenner, H.D., Merlo, M.C.G., & Teuber, J.F. (1998) Emotional management therapy in early psychosis. *British Journal of Psychiatry,* 172(33): 128-133.

Hodel, B., Kern, R.S., & Brenner, H.D. (2004) Emotion Management Training (EMT) in persons with treatment-resistant schizophrenia: first results. *Schizophrenia Research,* 68(1): 107-108.

Hollis, C., Falconer, C. J., Martin, J. L., Whittington, C., Stockton, S., Glazebrook, C. & Davies, E. B. (2017) Annual Research Review: Digital health interventions for children and young people with mental health problems - a systematic and meta-review. *Journal of Child Psychology and Psychiatry*, 58 (4): 474-503.

Holmes, C.M. (2018) Exploration of information processing outcomes in 360-degree video. *Scripps College of Communication of Ohio University and the Institute of Communication and Media Studies of Leipzig University,* 1-52.

Hong, Q.N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M-P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M-C., & Vedel, I. (2018) Mixed Methods Appraisal Tool

(MMAT), version 2018. Registration of Copyright (#1148552). Canadian Intellectual Property Office, Industry Canada.

Hooker, C., & Park, S. (2002) Emotion processing and its relationship to social functioning in schizophrenia patients. *Psychiatry Research,* 112(1): 41-50.

Hopper, S. (2014) Auto-ethnography: inquiry into identity. *New Directions for Higher Education,* 166: 63-71.

Horan, W.P., Dolinsky, M., Lee, J., Kern, R.S., Hellemann, G., Sugar, C.A, Glynn, S.M., & Green, M.F. (2018) Social cognitive skills training for psychosis with community-based training exercises: a randomized controlled trial. *Schizophrenia Bulletin,* 44(6): 1254-1266.

Horan, W.P., Kern, R.S., Tripp, C., Hellemann, G., Wynn, J.K., Bell, M., Marder, S.R., & Green, M.F. (2011) Efficacy and specificity of social cognitive skills training for outpatients with psychotic disorders. *Journal of Psychiatric Research,* 45(8): 1113-1122.

Horan, W.P., Kern, R.S., Shokat-Fadai, K., Sergi, M.J., Wynn, J.K., & Green, M.F. (2009) Social cognitive skills training in schizophrenia; an initial efficacy study of stabilized outpatients. *Schizophrenia Research,* 107(1): 47-54.

Huber, M., Knottnerus, J.A., Green, L., Horst, H.V.D., Jadad, A.R., Kromhout, D., et al. (2011) How should we define health? *British Medical Journal*, 343: d4163.

Hubley S, Schneck C, Thomas M, & Shore J. (2016) Review of key Telepsychiatry outcomes. *World J Psychiatry,* 6(2): 269–82.

Humm, L.B., Olsen, D., Bell, M., Fleming, M., & Smith, M. (2014) Simulated job interview improves skills for adults with serious mental illnesses. *Studies in Health Technology and Informatics,* 199: 50-54.

ImpleMentAll (2019) ImpleMentAll – Getting eHealth implementation right. [Online] Available at: https://www.implementall.eu [Accessed 10 September 2019].

Infinite Pixel Ltd (2017) *Warwick Uni All Scenes V1*. Available at: https://www.youtube.com/watch?v=yFfoRLuXkZM [Accessed January 20 2017].

INVOLVE (2011) Patient and public involvement in research and research ethics committee review. Available at: https://www.invo.org.uk/wp-content/uploads/2011/12/INVOLVENRESfinalStatement310309.pdf [Accessed 15 May 2018].

Ioannou, A., Papastavrou, E., Avraamides, M.N., & Charalambous, A. (2020) Virtual reality and symptoms management of anxiety, depression, fatigue, and pain: a systematic review. *SAGE Open Nursing,* 6: 1-13.

Jacob. C., Sanchez-Vazquez, A., & Ivory, C. (2020) Social, organizational, and technological factors impacting clinicians' adoption of mobile health tools: systematic literature review. *JMIR mhealth and uhealth,* 8(2): e15935.

Jackson, R.L., Drummond, D.K., & Camara, S. (2007) What is qualitative research? *Qualitative Research Reports in Communication,* 8(1): 21-28.

Javed, A., & Charles, A. (2018) The importance of social cognition in improving functional outcomes in schizophrenia. *Frontiers in Psychiatry,* 9: 157.

Jennings, H., Slade, M., Bates, P., Munday, E., & Toney, R. (2018) Best practice framework for patient and public involvement (PPI) in collaborative data analysis of qualitative mental health research: methodology development and refinement. *BMC Psychiatry,* 18(1): 1-11.

Jerdan, S.W., Grindle, M., van Woerden, H.C., & Kamel Boulos, M.N. (2018) Head-mounted virtual reality and mental health: critical review of current research. *JMIR Serious Games,* 6: e14-12.

Jo, G., Rossow-Kimball, B., Park, G., & Lee, Y. (2018) Effects of virtual reality exercise for Korean adults with schizophrenia in a closed ward. *Journal of Exercise Rehabilitation,* 41(1): 39-48.

Johnson, H., Ogden, M., Brighton, L.J., Etkind, S.N., Oluyase, A.O., Chukwusa, E., Yu, P., de Wolf-Linder, S., Smith, P., Bailey, S., Koffman, J., & Evans, C.J. (2019) Patient and public involvement in palliative care research: what works, and why? A qualitative evaluation. *Palliative Medicine,* 35(1): 151-160.

Jonathan, G., Carpenter-Song, E.A., Brian, R.M., & Ben-Zeev, D. (2019) Life with FOCUS: a qualitative evaluation of the impact of a smartphone intervention on people with serious mental illness. *Psychiatric Rehabilitation Journal,* 42(2): 182-189.

Jongsma, H.E., Turner, C., Kirkbride, J.B., & Jones, P.B. (2019) International incidence of psychotic disorders, 2002-17: a systematic review and meta-analysis. *Lancet Public Health,* 4: e229-e244.

Juan, M.C., Alcaniz, M., Monserrat, C., Botella, C., Banos, R.M., & Guerrero, B. (2005) Using augmented reality to treat phobias. *IEEE Computer Graphics and Applications,* 25(6): 31-37.

Jung, Y. & Kang, H. (2010) User goals in social virtual worlds: A means-end approach. *Computers in Human Behavior*, 26(2): 218–25.

Kandalaft, M. R., Didehbani, N., Krawczyk, D. C., Allen, T. T. and Chapman, S. B. (2013). Virtual Reality Social Cognition Training for Young Adults with High-Functioning Autism. *Journal of Autism and Developmental Disorders,* 43(1): 34-44.

Kanie, A., Kikuchi, A., Haga, D., Tanaka, Y., Ishida, A., Yorozuya, Y., Matsuda, Y., Morimoto, T., Fukuoka, T., Takazawa, S., Hagiya, K., Ozawa, S., Iwata, K., Ikebuchi, E., Nemoto, T., Roberts, D.L., & Nakagome, K. (2019) The feasibility and efficacy of social cognition and interaction training for outpatients with schizophrenia in Japan: a multicenter randomized clinical trial. *Frontiers in Psychiatry*, 10: 589.

Kaptein, M., Markopoulos, P., De Ruyter, B., & Aarts, E. (2015) Personalizing persuasive technologies: explicit and implicit personalization using persuasion profiles. *International Journal of Human-Computer Studies,* 77: 38–51.

Kardong-Edgren, S., Farra, S. L., Alinier, G., & Young, H. M. (2019) A Call to Unify Definitions of Virtual Reality. *Clinical Simulation in Nursing,* 31: 28–34.

Kay, S.R., Fiszbein, A., & Opler, L.A. (1987) The positive and negative syndrome scale (PANSS) for schizophrenia. *Schizophrenia Bulletin,* 13(2): 261–276.

Kayser, N., Sarfati, Y., Besche, C., & Hardy-Baylé, M.C. (2006) Elaboration of a rehabilitation method based on a pathogenetic hypothesis of “theory of mind” impairment in schizophrenia. *Neuropsychological Rehabilitation,* 16: 83–95.

Ke, F., & Im, T. (2013) Virtual-reality-based social interaction training for children with high-functioning autism. *The Journal of Educational Research,* 106(6): 441-461.

Ke, F., Im, T., Xue, X., Xu, X., Kim, N., & Lee, S. (2015) Experience of adult facilitators in a virtual-reality-based social interaction program for children with autism. *The Journal of Special Education,* 48(4): 290-300.

Keelan. J., Ashley, L.B., Morra, D., Busch, V., Atkinson, K., & Wilson, K. (2015) Using virtual worlds to conduct health-related research: lessons from two pilot studies in Second Life. *Health Policy and Technology,* 4: 232-240.

Kendall, T., Hollis, C., Stafford, M., Taylor, C. & Guideline Dev, G. (2013) Recognition and management of psychosis and schizophrenia in children and young people: summary of NICE guidance. *British Medical Journal*, 346: f150.

Kennedy, R. S., Drexler, J., & Berbaum, K. S. (1994). Methodological and measurement issues for identification of engineering features contributing to virtual reality sickness. *IMAGE VII Conference*: 244-254.

Kennedy, R. S., Lane, N. E., Berbaum, K. S., & Lilienthal, M. G. (1993) Simulator Sickness Questionnaire: An enhanced method for quantifying simulator sickness. *The International Journal of Aviation Psychology*, 3: 203–220.

Kern, A. C., & Ellermeier, W. (2020) Audio in VR: effects of a soundscape and movement-triggered step sounds on presence. *Frontiers in Robotics and AI*, 7(20).

Kessler, R.C., Amminger, G.P., Aguilar-Gaxiola, S., Alonso, J., Lee, S., Üstün, T. B. (2007) Age of onset of mental disorders: a review of recent literature. *Current Opinion in Psychiatry*, 20(4): 359-364.

Knight, I., West, J., Matthews, E., Kabir, T., Lambe, S., Waite, F., & Freeman, D. (2021) Participatory design to create a VR therapy for psychosis. *Design for Health*.

Kim, K., Rosenthal, M.Z., Zielinski, D.J., & Brady, R. (2014) Effects of virtual environment platforms on emotional response. *Computer Methods and Programs in Biomedicine,* 113(3): 882-893.

Kim, S., & Kim, E. (2020) The use of virtual reality in psychiatry: a review. *Journal of the Korean Academy of Child and Adolescent Psychiatry,* 31(1): 26-32.

Kirkbride, J.B., Barker, D., Cowden, F., Stamps, R., Yang, M., Jones, P.B., & Cold, J.W. (2008) Psychoses, ethnicity and socio-economic status. *The British Journal of Psychiatry,* 193(1): 18-24.

Kirkbride, J. B., Errazuriz, A., Croudace, T. J., Morgan, C., Jackson, D., Boydell, J., Murray, R. M. & Jones, P. B. (2012) Incidence of Schizophrenia and Other Psychoses in England, 1950-2009: A Systematic Review and Meta-Analyses. *PLoS ONE*, 7(3): e31660.

Klein, A., Kulp, L., & Sarcevic, A. (2018) Designing and optimizing digital applications for medical emergencies. *CHI 2018 Late-Breaking Abstract*.

Kocaballi, A. B., Berkovsky, S., Quiroz, J.C., Laranjo, L., Tong, H.L., Rezazadegan, D., Briatore, A., & Coiera, E. (2019) The personalization of conversational agents in health care: systematic review. *Journal of Medical Internet Research*, 21(11): e15360.

Kolasa, K., & Kozinski, G. (2020) How to value digital health interventions? A systematic literature review. *International Hournal of Environmental Research and Public Health*, 17: 2119.

Kooijman, L., Happee, R., & de Wintter, J. (2019) How do eHMIs affect pedestrians' crossing behavior? A study using a head-mounted display combined with a motion suit. *Information,* 10(12): 386.

Kozumplik, O., Uzun, S., & Jakovljevic, M. (2009) Psychotic disorders and comorbidity: somatic illness vs. side effect. *Psychiatria Danubina,* 21(3): 361-367.

Krueger, R.A., & Casey, M.A. (2014) *Focus groups: a practical guide for applied research*. London: Sage Publications.

Ku, J., Han, K., Lee, H. R., Jang, H. J., Kim, K. U., Park, S. H., Kim, J. J., Kim, C. H., Kim, I. Y. & Kim, S. I. (2007) VR-based conversation training program for patients with schizophrenia: A preliminary clinical trial. *Cyberpsychology & Behavior*, 10(4): 567-574.

Kurtz, M. M. & Richardson, C. L. (2012) Social Cognitive Training for Schizophrenia: A Meta-Analytic Investigation of Controlled Research. *Schizophrenia Bulletin*, 38(5): 1092-1104.

Kwong, V.W.Y., Chang, W.C., Chan, G.H.K., Jim, O.T.T., Lau, E.S.K., Hui, C.L.M., Chan, S.K.W., Lee, E.H.M., & Chen, E.Y.H. (2017) Clinical and treatment-related determinants of subjective quality of life in patients with first-episode psychosis. *Psychiatric Research,* 249: 39-45.

Lambri, M., Chakraborty, A., Leavey, G., & King, M. (2012) Quality of life and unmet need in people with psychosis in the London Borough of Haringey, UK. *Mental Health, Recovery, and the Community:* 836067.

La Paglia, F., La Cascia, C., Rizzo, R., Sanna, M., Cangialosi, F., Sideli, L., Francomano, A., Riva, G. & La Barbera, D. (2016) Virtual reality environments to rehabilitation attention deficits in schizophrenic patients. *Annual Review of Cybertherapy and Telemedicine*, 14: 143-148.

La Paglia, F., La Cascia, C., Rizzo, R., Sideli, L., Francomano, A., & La Barbera, D. (2013) Cognitive rehabilitation of schizophrenia through neurovr training. *Annual Review of Cybertherapy and Telemedicine,* 191: 158-162.

Lahera, G., Herrera, S., Reinares, M., Benito, A., Rullas, M., Gonzalez-Cases, J., & Vieta, E. (2015) Hostile attributions in bipolar disorder and schizophrenia contribute to poor social functioning. *Acta Psychiatrica Scandinavica,* 131(6): 472-482.

Lal, S., & Adair, C.E. (2014) E-mental health: a rapid review of the literature. *Psychiatric Services, American Psychiatric Association,* 65(1): 24-32.

Lal, S., & Malla, A. (2015) Service engagement in first-episode psychosis: current issues and future directions. *Psychiatric Services,* 60(8): 341-345.

Lal, S., Dell'Elce, J., & Malla, A.K. (2015) Technology access and use among young adults with a first episode of psychosis. *Psychiatric Services,* 66: 764-765.

Law, C. W., Chen, E. Y. H., Cheung, E. F. C., Chan, R. C. K., Wong, J., Lam, C. L. K., Leung, K. F. & Lo, M. S. M. (2005) Impact of untreated psychosis on quality of life in patients with first-episode schizophrenia. *Quality of Life Research*, 14(8): 1803-1811.

Leamy, M., Bird, V., Le Boutillier, C., Williams, J., & Slade, M. (2011) Conceptual framework for personal recovery in mental health: a systematic review and narrow synthesis. *The British Journal of Psychiatry,* 199: 445-452.

Leask, C.F., Sandlund, M., Skelton, D.A., Altenburg, T.M., Cardon, G., Chinapaw, M.J.M., Bourdeaudhuij, D.I., Verloigne, M., & Chastin, S.F.M. (2019) Framework, principles and recommendations for utilising participatory methodologies in the co-creation and evaluation of public health interventions. *Research Involvement and Engagement,* 5(2): 1-16.

Lederman, R., D'Alfonso, S., Rice, S., Coghlan, S., & Wadley, G., & Alvarez-Jimenez, M. (2020) Ethical issues in online mental health interventions. *Research Papers,* 66.

Ledoux, T., Nguyen, A.S., Bakos-Block, C., & Bordnick, P. (2013) Using virtual reality to study food cravings. *Appetite,* 71: 396-402.

Lee, P., Li, P.C., & Hsieh, C.L. (2011) Test–retest reliability of two attention tests in schizophrenia. *Archives of Clinical Neuropsychology*, 26(5): 405–411.

Leff, J., Williams, G., Huckvale, M. A., Arbuthnot, M., & Leff, A. P. (2013) Computer-assisted therapy for medication-resistant auditory hallucinations: proof-of-concept study. *British Journal of Psychiatry*, 202(6): 428-433.

Lenior, M. E., Dingemans, P., Linszen, D. H., De Haan, L. & Schene, A. H. (2001) Social functioning and the course of early-onset schizophrenia -

Five-year follow-up of a psychosocial intervention. *British Journal of Psychiatry*, 179: 53-58.

Lentferink, A. J., Oldenhuis, H. K., de Groot, M., Polstra, L., Velthuijsen, H., & Van Gemert-Pijnen, J. E. (2017) Key components in eHealth interventions Combining Self-Tracking and Persuasive eCoaching to Promote a Healthier Lifestyle: A Scoping Review. *Journal of Medical Internet Research,* 19(8): 277.

Lewis, R.F. (1992) *Digit Vigilance Test: Professional User's Guide*. American Psychological Association: Washington.

Lewis, S., Ainsworth, J., Sanders, C., Stockton-Powdrell, C., Machin, M., Whelan, P., Hopkins, R., He, Z., Applegate, E., Drake, R., Bamford, C., Roberts, C., & Wykes, T. (2020) Smartphone-enhanced symptom management in psychosis: open, randomized controlled trial. *Journal of Medical Internet Research,* 22(8): e17019.

Li, S., Sun, B., Wei, N., Shen, Z., Jin, K., Zhao, H., Chen, Y., Huang, M., & Xu, Y. (2020) Effect of virtual reality on cognitive impairment and clinical symptoms among patients with schizophrenia in the remission stage – a randomized controlled trial. *Research Square,* [Pre-print].

Li, W.H., Chung, J.O., & Ho, E.K. (2011) The effectiveness of therapeutic play, using virtual reality computer games, in promoting the psychological well-being of children hospitalised with cancer. 20(15-16): 2135-2143.

Liberati, E., Richards, N., Parker, J., Willars, J., Scott, D., Boydell, N., Pinfold, V., Martin, G., Dixon-Woods, M., & Jones, P. (2021) Remote care for mental health: qualitative study with service users, carers and staff during the COVID-19 pandemic. *BMJ Open,* 11: e049210.

Lim, M.H., Gleeson, J.F.M., Rodebaugh, T.L., Eres, R., Long, K.M., Casey, K., Abbott, J-A.M., Thomas, N., & Penn, D.L. (2021) A pilot digital intervention targeting loneliness in young people with psychosis. *Social Psychiatry and Psychiatric Epidemiology*, 55(7): 877-889.

Lim, S., & Reeves, B. (2009) Being in the game: effects of avatar choice and point of view on psychophysiological responses during play. *Media Psychology,* 12(4): 348-370.

Lin, A., Wood, S. J., Nelson, B., Brewer, W. J., Spiliotacopoulos, D., Bruxner, A., Broussard, C., Pantelis, C. & Yung, A. R. (2011) Neurocognitive predictors of functional outcome two to 13 years after identification as ultra-high risk for psychosis. *Schizophrenia Research*, 132(1): 1-7.

Lincoln, T. M., Rief, W., Westermann, S., Ziegler, M., Kesting, M.-L., Heibach, E. & Mehl, S. (2014) Who stays, who benefits? Predicting dropout and change in cognitive behaviour therapy for psychosis. *Psychiatry Research*, 216(2): 198-205.

Linden Lab (2021) Second Life. Available at: https://secondlife.com [Accessed 7 May 2021].

Lindner, P. (2020) Better, virtually: the past, present, and future of virtual reality cognitive behavior therapy. *International Journal of Cognitive Therapy*, 14: 23-46.

Litleskare, S., & Calogiuri, G. (2019) Camera stabilization in 360° videos and its impact on cyber sickness, environmental perceptions, and psychophysiological responses to a simulated nature walk: a single-blinded randomized trial. *Frontiers in Psychology,* 10:2436.

Liu, Y., Pencheon, E., Hunter, R.M., Moncrieff, J., & Freemantle, N. (2018) Recruitment and retention strategies in mental health trials – a systematic review. *PLoS ONE*, 13(8): e0203127.

Locher, M.A., Jucker, A.H., & Berger, M. (2015) IMPlementation of an online relatives' toolkit for psychosis or bipolar (IMPART study): iterative multiple case study to identify key factors impacting on staff uptake and use. *BMC Health Services Research,* 20: 219.

Lo Iacono, V., Symonds, P., & Brown, D. (2016) Skype as a research tool for qualitative research interviews. *Sociological Research Online,* 21:12.

Locher, M.A., Jucker, A.H., & Berger, M. (2015) Negotiation of space in Second Life newbie interaction. *Discourse, Context & Media,* 9: 34-45.

López-Luengo, B., & Muela-Martinez, J. (2016) Preliminary study of a rehabilitation program based on attentional processes to treat auditory hallucinations. *Cognitive Neuropsychiatry,* 21(4): 315-334.

Lopez, A. (2015) An investigation of the use of internet based resources in support of the therapeutic alliance. *Clinical Social Work Journal,* 43: 189-200.

Lopez, A., Schwenk, S., Schneck, C.D., Griffin, R.J., & Mishkind, M.C. (2019) Technology-based mental health treatment and the impact on the therapeutic alliance. *Current Psychiatry Reports,* 21(76): 1-7.

Lucas, U., & Zender, R. (2011) 3D interactions between virtual worlds and real life in an E-learning community. *Advances in Human-Computer Interaction,* 37: 94-100.

Lucke, U., Gratch, J., King, A., & Morency, L.-P. (2014) It's only a computer: virtual humans increase willingness to disclose. *Computers in Human Behavior,* 684202.

Lustria, M.L.A., Noar, S.M., Cortese, J., Stee, S.K.V., Glueckauf, R.L., & Lee, J. (2013) A meta-analysis of web-delivered tailored health behavior change interventions. *Journal of Health Communication*, 18: 1039–1069.

MacCormack, T. (2001) Let's get personal: exploring the professional persona in health care. *The Qualitative Report,* 6(3): 1-14.

MacDorman, K. (2006). Subjective ratings of robot video clips for human likeness, familiarity, and eeriness: An exploration of the uncanny valley. *ICCS/CogSci 2006 Long Symposium: Toward Social Mechanisms of Android Science*: 1-4.,

Macedo, M., Marques, A., Queiros, C. (2015) Virtual reality in assessment and treatment of schizophrenia: a systematic review. *Jornal Brasileiro de*

Psiquiatria, 64(1): 70-81.

MacQuarrie, A., & Steed, A. (2017) Cinematic virtual reality: evaluating the effect of display type on the viewing experience for panoramic video. *Proceedings – IEEE Virtual Reality,* 45-54.

Maheu, M., Drude, K., Hertlein, K., Hilty, D.M. (2017) An interdisciplinary framework for telebehavioral health competencies. *Journal of Technology in Behavioral Science,* 3(2): 190-210.

Maheu, M.M., Pulier, M.L., Wilhelm, F.H., McMenamin, J.P., & Brown-Connolly, N.E. (2004) *The Mental Health Professional and the New Technologies: A Handbook for Practice Today*. USA: Erlbaum.

Maister, L., Slater, M., Sanchez-Vives, M. V., & Tsakiris, M. (2014) Changing bodies changes minds: Owning another body affects social cognition. *Trends in Cognitive Sciences*, 19: 6–12.

Malla, A. & Payne, J. (2005) First-episode psychosis: Psychopathology, quality of life, and functional outcome. *Schizophrenia Bulletin*, 31(3): 650-671.

Malterud, K. (2001) Qualitative research: standards, challenges, and guidelines. *The Lancet*, 358(9280): 483-488.

Man, D.W.K., & Li, R. (2001) Assessing Chinese adults' memory abilities: validation of the Rivermead Behavioural Memory Test. *Clinical Gerontologist*, 24: 27–36.

Mania, K. & Chalmers, A. (2001) The effects of levels of immersion on memory and presence in virtual environments: A reality centered approach. *Cyberpsychology & Behavior*, 4(2): 247-264.

Mann, R.J., & Flowers, J.V. (1978) An investigation of the validity and reliability of the Rathus Assertion Schedule. *Psychological Reports*, 42(2): 632-634.

Mantovani, F., Castelnuovo, G., Gaggioli, A. & Riva, G. (2003) Virtual reality training for health-care professionals. *Cyberpsychology & Behavior*, 6(4): 389-395.

Maples-Keller, J.L., Bunnell, B.E., Kim, S.J., & Rothbaum, B.O. (2017) The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. *Harvard Review of Psychiatry,* 25(3): 103-113.

Marks, I.M., Mataix-Cols, D., Kenwright, M., Cameron, R., Hirsch, S., & Gega, L. (2003) Pragmatic evaluation of computer-aided self-help for anxiety and depression. *The British Journal of Psychiatry,* 183(1): 57-65.

Marlett, N., Shklarov, S., Marshall, D., Santana, M.J., & Wasylak, T. (2015) Building new roles and relationships in research: a model of patient engagement research. *Quality of Life Research: an international journal of quality of life aspects of treatment, care and rehabilitation,* 24(5): 1057-1067.

Martens, M.A.G., Antley, A., Freeman, D., Slater, M., Harrison, P.J., & Tunbridge, E.M. (2019) It feels real: physiological responses to stressful virtual reality environment and its impact on working memory. *Journal of Psychopharmacology,* 33(10): 1264-1273.

Martin, H.M., & Larsen, J. (2012) Patient involvement in patient safety: a literature review about European primary care. Available at: https://pure.vive.dk/ws/files/2060933/dsi-3479.pdf [Accessed 15 May 2020].

Martinez-Martin, N., Dasgupta, I., Carter, A., Chandler, J.A., Kellmeyer, P., Kreitmair, K., Weiss, A., & Cabrera, L.Y. (2020) Ethics of digital mental health during COVID-19: crisis and opportunities. *JMIR Mental Health,* 7(12): e23776.

May, C.R., Mair, F., Finch, T., MacFarlane, A. Dowrick, C., Treweek, S., Rapley, T., Ballini, L., Ong, B.N., Rogers, A., Murray, E., Elwyn, G., Legare, F., Gunn, J., & Montori, V.M. (2009) Development of a theory of implementation and integration: normalization process theory. *Implementation Science,* 4(29): 1-9.

Mazza, M., Lucci, G., Pacitti, F., Pino, M.C., Mariano, M., Casacchia, M., & Roncone, R. (2010) Could schizophrenic subjects improve their social cognition abilities only with observation and imitation of social situations? *Neuropsychological Rehabilitation,* 20: 675–703.

McBeath, A.G., du Plock, S. & Bagel-Charleson, S. (2020) The challenges and experiences of psychotherapists working remotely during the coronavirus pandemic. *Journal of Medical Internet Research,* 00: 1-12.

McCashin, D., Coyle, D. & O'Reilly, G. (2019) Qualitative synthesis of young people's experiences with technology-assisted cognitive behavioural therapy: systematic review. *Journal of Medical Internet Research,* 21(11): e13540.

McCurdie, T., Taneva, S., Casselman, M., Yeung, M., McDaniel, C., Ho, W., & Cafazzo, J. (2012) mHealth consumer apps: the case for user-centred design. *Biomedical Instrumentation & Technology,* 46: 49-56.

McGrath, J.J., Saha, S., Al-Hamzawi, A.O., Alonso, J., Andrade, L., Borges, G., Bromet, E.J., Browne, M.O., Bruffaerts, R., Caldas de Almeida, J.M., Fayyad, J., Florescu, S., de Girolamo, G., Gureje, O., Hu, C., de Jonge, P., Kovess-Masfety, V., Lepine, J.P., Lim, C.C.W., Navarro-Mateu, F., Piazza, M., Sampson, N., Posada-Villa, J., Kendler, K.S., & Kessler, R.C. (2016) Age of Onset and Lifetime Projected Risk of Psychotic Experiences: Cross-National Data From the World Mental Health Survey, *Schizophrenia Bulletin*, 42 (4): 933–941.

Mcilveen, P. (2008) Autoethnography as a method for reflexive research and practice in vocational psychology. *Australian Journal of Career Development,* 17(2): 13-20.

McKenna, K. Y. A. (2007) Through the Internet looking glass: Expressing and validating the true self. In: Joinson, A., McKenna, K., Postmes, T., &

Reips, U. eds. *The Oxford handbook of Internet psychology.* Oxford: Oxford University Press: 205-222.

Mediavilla R, Muñoz-Sanjose A, Rodriguez-Vega B, Bayon C, Lahera G, Palao A and Bravo MF (2019) Mindfulness-based social cognition training (SocialMind) for people with psychosis: a feasibility trial. *Frontiers in Psychiatry*, 10: 299.

Meehan, M., Insko, B., Whitton, M., & Brooks Jr, F. P. (2002) Physiological measures of presence in stressful virtual environments. *Acm transactions on graphics (tog)*, 21(3): 645-652.

Meglic, M., Furlan, M., Kuzmanic, M., Kozel, D., Baraga, D., Kuhar, I., et al. (2010) Feasibility of an eHealth service to support collaborative depression care: Results of a pilot study. *Journal of Medical Internet Research*, 12(5): e63.

Mehl, S., Werner, D., & Lincoln, T.M. (2015) Does cognitive behaviour therapy for psychosis (CBTp) show a sustainable effect on delusions? A meta-analysis. *Frontiers in Psychology,* 6(1450): 1-14.

Meins, E., McCarthy-Jones, S., Fernyhough, C., Lewis, G., Bentall, R.P., & Alloy, L.B. (2012) Assessing negative cognitive style: development and validation of a short-form version of cognitive style questionnaire. *Personality and Individual Differences,* 52(5): 581-585.

Meisel, S.F., Drury, H., & Perara-Delcourt, R.P. (2018) Therapists' attitudes to offering eCBT in an inner-city IAPT service: a survey study. *Cognitive Behaviour Therapy,* 11: e11.

Meyer, B., Berger, T., Caspar, F., Beevers, C.G., Andersson, G., & Weiss, M. (2009) Effectiveness of a novel integrative online treatment for depression (Deprexis): Randomized controlled trial. *Journal of Medical Internet Research*, 11(2): e15

Miller, B.J., Stewart, A., Schrimsher, J., Peeples, D., & Buckley, P.F. (2015) How connected are people with schizophrenia? Cell phone, computer, email, and social media use. *Psychiatry Research,* 225: 458-463.

Mishkind, M.C., Norr, A.M., Katz, A.C., & Reger, G.M. (2017) Review of virtual reality treatment in psychiatry: evidence versus current diffusion and use. *Current Psychiatry Reports,* 19: 80.

Mitchell, N., & Gordon, P.K. (2007) Attitudes towards computerised CBT for depression amongst a student population. *Behavioural and Cognitive Psychotherapy,* 35(04): 421-430.

Mitra, B., & Golz, P. (2016) Exploring intrinsic gender identity using Second Life. *Journal of Virtual Worlds Research,* 9(2): 1-17.

Mockford, C., Staniszewska, S., Griffiths, F., & Herron-Marx, S. (2012) The impact of patient and public involvement on UK NHS health care: a systematic review. *International Journal for Quality in Health Care*, 24(1): 28-38.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D.G. (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Medicine,* 6(7): e1000097.

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L.A., & PRISMA-P Group (2015) Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews,* 4(7): e1000097.

Mohr, D.C., Weingardt, K.R., Reddy, M., & Schueller, S.M. (2017) Three problems with current digital mental health research…and three things we can do about them. *Psychiatric Services,* 68(5): 427-429.

Moreno-Küstner, B., Martin, C., & Pastor, L. (2018) Prevalence of psychotic disordes and its association with methodological issues. A systematic review and meta-analysis. *PLoS ONE,* 13(4): e0195687.

Moreno, A., Wall, K.J., Thangavelu, K., Craven, L., Ward, E., & Dissanayaka, N.N. (2019) A systematic review of the use of virtual reality and its effects on cognition in individuals with neurocognitive disorders. *Alzheimer's & Dementia,* 5: 834-850.

Moreno, C., Wykes, T., Galderisi, S., Nordentoft, M., Crossley, N., Jones, N., Cannon, M., Correll, C.U., Byrne, L., Carr, S., Chen, E.Y.H., Gorwood, P., Johnson, S., Kärkkäinen, H., Krystal, J.H., Lee, J., Lieberman, J., López-Jaramillo, C., Männikkö, M., Phillips, M.R., Uchida, H., Vieta, E., Vita, A., & Arango, C. (2020) How mental health care should change as a consequence of the COVID-19 pandemic. *Lancet Psychiatry*, 7: 813-824.

Morgan, C., Burns, T., Fitzpatrick, R., Pinfold, V., & Priebe, S. (2007) Social exclusion and mental health: conceptual and methodological review. *British Journal of Psychiatry,* 191: 477-483.

Morgan, C., Charalambides, M., Hutchinson, G., Murray, R.M. (2010) Migration, ethnicity, and psychosis: toward a sociodevelopmental model. *Schizophrenia Bulletin,* 36(4): 655-664.

Morgan, C., Kirkbride, J., Hutchinson, G., Craig, T., Morgan, K., Dazzan, P., Boydell, J., Doody, G.A., Jones, P.B., Murray, R.M., Leff, J., & Fearon, P. (2008) Cumulative social disadvantage, ethnicity and first-episode psychosis: a case-control study. *Psychological Medicine,* 38(12): 1701-1715.

Morgan, H., Thomson, G., Crossland, N., Dykes, F., Hoddinott, P., & 'BIBS' study team (2016). Combining PPI with qualitative research to engage 'harder-to-reach' populations: service user groups as co-applicants on a platform study

Mori, M., MacDorman, K., & Kageki, N. (2012) The uncanny valley [from the field]. *IEEE Robotics & Automation Magazine*, 19(2): 98–100.

for a trial. *Research Involvement and Engagement*, 24(2): 7.

Moriarty, J. (2018) Empowering students as researchers: teaching and learning autoethnography and the value of self-narratives. In Jacobs,

R. (ed) *Teaching Narrative. Teaching the New English.* London: Palgrave Macmillan: 175-189.

Moritz, S., Voigt, M., Kother, U., Leighton, L., Kjahili, B., Babur, Z., Jungclaussen, D., Veckenstedt, R. & Grzella, K. (2014) Can virtual reality reduce reality distortion? Impact of performance feedback on symptom change in schizophrenia patients. *Journal of Behavior Therapy and Experimental Psychiatry*, 45(2): 267-271.

Moser, C., & Fang, X. (2015) Narrative structure and player experience in role-playing games. *International Journal of Human-Computer Interaction,* 31: 146-156.

Mosher, L.R., & Keith, S.J. (1979) Research on the psychosocial treatment of schizophrenia: a summary report. *The American Journal of Psychiatry,* 136(5): 623-631.

Mueller, J., Kiernan, R., & Langston, W. (2001) *Manual for Cognistat*. The Northern California Neurobehavioral Group, Inc.: Fairfax, CA.

Mummah, S.A., Robinson, T.N., King, A.C., Gardner, C.D., & Sutton, S. (2016) IDEAS (Integrate, Design, Access, and Share): a framework and toolkit of strategies for the development of more effective digital interventions to change health behaviour. *Journal of Medical Internet Research,* 16(18): e317.

Munoz, R.F., Bunge, E.L., Chen, K., Schueller, S.M., Bravin, J.I., Shaughnessy, E.A., & Perez-Stable, E.J. (2016) Massive open online interventions: a novel model for delivering behavioural-health services worldwide. *Clinical Psychological Science*, 4(2): 194-205.

Murad, M. H., Katabi, A., Benkhadra, R., & Montori, V. M. (2018) External validity, generalisability, applicability and directness: A brief primer. *BMJ Evidence - Based Medicine, 23*(1): 17.

Musiat, P., & Tarrier, N. (2014) Collateral outcomes in e-mental health: a systematic review of the evidence for added benefits of computerized cognitive behavior therapy interventions for mental health. *Psychological Medicine,* 44(15): 3137-3150.

Naeem, F., Khoury, B., Munshi, T., Ayub, M., Lecomte, T., Kingdon, D. & Farooq, S. (2016) Brief Cognitive Behavioral Therapy for Psychosis (CBTp) for Schizophrenia: Literature Review and Meta-analysis. *International Journal of Cognitive Therapy*, 9(1): 73-86.

Naeem, F., Syed, Y., Xiang, S., Shokraneh, F., Munshi, T., Yang, M., Adams, C.E., & Farooq, S. (2016) Development, testing and reporting of mobile apps for psycho-social interventions: lessons from the pharmaceuticals. *Journal of Medical Diagnostic Methods*, 4(4): 1000191.

Nagel, D.M. (2008) Filling the void in the virtual consulting room. *Voices,* 44(3): 98-102.

Nakarada-Kordic, I., Hayes, N., Reay, S.D., Corbet, C., & Chan, A. (2017) Co-designing for mental health: creative methods to engage young people experiencing psychosis. *Design for Health,* 1(2): 229-244.

National Institute for Health and Care Excellence (2014) Psychosis and schizophrenia in adults: prevention and management [Online] Available at: https://www.nice.org.uk/guidance/cg178/chapter/introduction (Accessed 17 January 2020).

National Institute for Health and Care Excellence (2015a) Psychosis and schizophrenia in adults [Online] Available at: https://www.nice.org.uk/guidance/qs80/chapter/Quality-statement-2-Cognitive-behavioural-therapy (Accessed 16 January 2020).

National Institute for Health Research (2015b) Going the extra mile: improving the nation's health and wellbeing through public involvement in research. [online] Available from: https://www.nihr.ac.uk/documents/about-us/our-contribution-to-research/how-we-involve-patients-carers-and-the-public/Going-the-Extra-Mile.pdf (Accessed 2nd June 2018).

National Institute for Health Research (2021) Going the extra mile: improving the nation's health and wellbeing through public involvement in research. [online] Available from: https://www.nice.org.uk/corporate/ecd7/resources/evidence-standards-framework-for-digital-health-technologies-pdf-1124017457605 (Accessed 19th June 2021).

National Institute for Health Research (2017) INVOLVE. [online] Available from: http://www.invo.org.uk (Accessed 2nd August 2017).

Nelson, H.E. (1982) *National adult reading tart (NART): test manual*. Windsor: Nelson.

Neng, L.A.R., & Chambel, T. (2010) Get around 360° hypervideo. *Proceedings of the 14th International Academic MindTreck Conference: Envisioning Future Media Environments,* 119-122.

Neo, J.R.L., Won, A.S., & Shepley, M.M. (2021) Designing immersive virtual environments for human behaviour. *Frontiers in Virtual Reality,* 2: 603750.

Nerur, S., & Balijepally, V. (2007) Theoretical reflections on agile development methodologies. *Communications of the ACM,* 50(3): 79-83.

Nicholas, J., Bell, I.H., Thompson, A., Valentine, L., Simsir, P., Sheppard, H., & Adams, S. (2021) Implementation lessons from the transition to telehealth during COVID-19: a survey of clinicians and young people from youth mental health services. *Psychiatry Research*, 299: 113848.

Nielson, J. (1993) *Usability Engineering.* Boston: Academic Press.

Nijman, S.A., Veiling, W., Greaves-Lord, K., Vos, M., Zandee, C.E.R., Rot, M.A.H., Geraets, C.N.W., & Pijnenborg, G.H.M. (2020) Dynamic interactive social cognition training in virtual reality (DISCoVR) for people with a psychotic disorder: single-group feasibiity and acceptability study. *JMIR Mental Health*, 7(8): e17808.

Nijman, S.A., Veiling, W., van der Stouwe E.C.D., & Pijnenborg, G.H.M. (2020) Social cognition training for people with a psychotic disorder: a network meta-analysis. *Schizophrenia Bulletin,* 46(5): 1086 – 1103.

Nisbett, R.E., & Wilson, T.D. (1977) Telling more than we can know: verbal reports on mental processes. *Psychological Review,* 84(3): 231-259.

Nissen, E.R., Bregnballe, V., Mehlsen, M.Y., Muldbjerg, A.K.O., O'Connor, M., & Lomborg, K.E. (2018) Patient involvement in the development of a psychosocial cancer rehabilitation intervention: evaluation of a shared working group with patients and researchers. *Research Involvement and Engagement*, 4(24): 1-16.

Nobis, S., Lehr, D., Ebert, D.D., Baumeister, H., Snoek, F., Riper, H., & Berking, M. (2015) Efficacy of a web-based intervention with mobile phone support in treating depressive symptoms in adults with type 1 and type 2 diabetes: a randomised controlled trial. *Diabetes Care,* 38(5): 776-783.

Nominet (2019) Today's youth, tomorrow's internet: a nominet digital futures report [online] Available from: https://media.nominet.uk/wp-content/uploads/2019/06/DFI-Youth-Report.pdf?_ga=2.157458234.1431651126.1624058271-1075317392.1624058271 (Accessed 19th June 2021).

Nowak, K.L., & Fox, J. (2018) Avatars and computer-mediated communication: a review of the definitions, uses and effects of digital representations. *Review of Communication Research,* 6: 30-53.

Nuechterlein, K.H., & Dawson, M.E. (1984) A heuristic vulnerability/stress model of schizophrenic episodes. *Schizophrenia Bulletin,* 10(2): 300-312.

Nuechterlein, K.H., Green, M.F., Kern, R.S., Baade, L.E., Barch, D.M., Cohen, J.D., Essock, S., Fenton, W.S., Frese 3rd, F.J., Gold, J.M., Goldberg, T., Heaton, R.K., Keefe, R.S.E., Kraemer, H., Mesholam-Gately, R., Seidman, L.J., Stover, E., Weinberger, D.R., Young, A.S., Zalcman, S., & Marder, L.J. (2008) The MATRICS Consensus Cognitive Battery, part 1: test selection, reliability, and validity. *American Journal of Psychiatry,* 165(2): 203-13.

Ocloo, J., Garfield, S., Franklin, B.D., & Dawson, S. (2021) Exploring the theory, barriers and enablers for patient and public involvement across health, social care and patient safety: a systematic review of reviews. *Health Research Policy and Systems,* 19: 8.

O'Cathain, A., Murphy, E., & Nicholl, J. (2007) Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. *BMC Health Services Research,* 7(85): 1-11.

O'Hanlon, P., Aref-Adib, G., Fonseca, A., Lloyd-Evans, B., Osborn, D., & Johnson, S. (2016) Tomorrow's world: current developments in the therapeutic of technology for psychosis. *BJPsych Advances,* 22: 301-310.

Office for National Statistics (2019) Exploring the UK's digital divide. [Online] Availableat:https://www.ons.gov.uk/peoplepopulationandcommunity/householdcharacteristics/homeinternetandsocialmediausage/articles/exploringtheuksdigitaldivide/2019-03-04 [Accessed 15 January 2020].

Oh, C.S., Bailenson, J.N., & Welch, G.F. (2018) A systematic review of social presence: definition, antecedents and implications. *Frontiers inn Robotics and AI,* 5: 114.

Oh, J., & Sundar, S.S. (2015) How does interactivity persuade? An experimental test of interactivity on cognitive absorption, elaboration, and attitudes. *Journal of Communication,* 65(2): 213-236.

Oh, J., Kang, H., Sudarshan, S., & Lee, J.A. (2020) Can liking, commenting, and sharing enhance persuasion? The interaction effect between modality interactivity and agency affordances on smokers' quitting intentions. *Health Communication,* 35(13): 1593-1604.

Ohmuro, N., Matsumoto, K., Ishii, Y., Katsura, M., Obara C., Kikuchi, T., Hamaie, Y., Ito, F., & Matsuoka, H. (2017) The associations between quality of life and clinical symptoms in individuals with an at-risk mental state and first-episode psychosis. *Psychiatry Research,* 54-59.

Oing, T., & Prescott, J. (2018) Implementations of virtual reality for anxiety-related disorders: systematic review. *JMIR Serious Games,* 6(4): e10965.

Orlowski, S.K., Lawn, S., Venning, A., Winsall, M., Jones, G.M., Wyld, K., Damarell, R.A., Antezana, G., Schrader, G., Smith, D., Collin, P., & Bidargaddi, N. (2015) Participatory research as one piece of the puzzle: a systematic review of consumer involvement in design of technology-based youth mental health and well-being interventions. *Journal of Internet Medical Research Human Factors*, 2(2): e12.

Orsmond, G.I., & Cohn, E.S. (2015) The distinctive features of a feasibility study: objectives and guiding questions. *Occupation, Participation and Health,* 1-9.

Ortega, L., Montalvo, I., Monseny, R., Burjales-Marti, M.D., Martorell, L., Sanchez-Gistau, V., Vilella, E., & Labad, J. (2020) Perceived stress, social functioning and quality of life in first-episode psychosis: a 1-yellow follow-up study. *Early Intervention in Psychiatry,* 1-9.

Otkhmezuri, B., Boffo, M., Siriaraya, P., Matsangidou, M., Wiers, R.W., Mackintosh, B., Ang, C.S., & Salemink, E. (2019) Believing is seeing: a proof-of-concept semiexperimental study on using mobile virtual reality to boost the effects of interpretation bias modification for anxiety. *JMIR Mental Health,* 6(2): e11517.

Osborne, S. P., Radnor, Z., & Strokosch, K. (2016) Co-production and the co-creation of value in public services: A suitable case for treatment? *Public Management Review*, 18(5): 639–653.

Osterrieth, P.A. (1944) Le test de copie d’une figure complexe, contribution à l’étude de la perception de la mémoire. *Archives de Psychologie*, 30: 286–356.

Overall, J., & Gorham, D. (1962) The brief psychiatric rating scale. *Psychological Reports,* 10: 799-812.

Pace, R., Pluye, P., Bartlett, G., Macaulay, A.C., Salsberg, J., Jagosh, J., & Seller, R. (2012) testing the reliability and efficiency of the pilot Mixed Methods Appraisal Tool (MMAT) for systematic mixed studies review. *International Journal of Nursing*, 49(1): 47-53.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N. & Hoagwood, K. (2015) Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5): 533-544.

Pallavicini, F., & Pepe, A. (2020) Virtual reality games and the role of body involvement in enhancing positive emotions and decreasing anxiety: within-subjects pilot study. *JMIR Serious Games*, 8(2): e15635.

Pan, X., & Hamilton, A.F.D.C. (2018) Why and how to use virtual to study human social interaction: The challenges of exploring a new research landscape. *British Journal of Psychology,* 109: 395-417.

Pan, X., Gillies, M., Barker, C., Clark, D. M., & Slater, M. (2012). Socially anxious and confident men interact with a forward virtual woman: An experimental study. *PLoS One*, 7(4): e32931.

Panchuk, D., Klusemann, M.J., & Hadlow, S.M. (2018) Exploring the effectiveness of immersive video for training decision-making capability in elite, youth basketball players. *Frontiers in Psychology,* 9: 1-9.

Parish, M.B., Fazio, S., Chan, S., & Yellowlees, P.M. (2017) Managing psychiatrist-patient relationships in the digital age: a summary re- view of the impact of technology-enabled care on clinical processes and rapport. *Curr Psychiatry Rep*, 19(11): 90.

Park, K.-M., Ku, J., Choi, S.-H., Jang, H.-J., Park, J.-Y., Kim, S. I. & Kim, J.-J. (2011) A virtual reality application in role-plays of social A randomized, controlled trial. *Psychiatry Research*, 189(2): 166-172.

Park, K.-M., Ku, J., Park, I-H., Park, J-Y., Kim, S.I., & Kim, J-J. (2009) Improvement in social competence in patients with schizophrenia: a pilot study using a performance-based measure using virtual reality. *Human Psychopharmacology,* 24: 619-627.

Parpio, Y., Malik, S., Punjani, N.S., & Farooq, S. (2013) Critical realism: tenets and application in nursing. *International Journal of Innovative Research & Development,* 2 (11): 490-493.

Pascoe, M.C., Thompson, D.R., & Ski, C.F. (2017) Yoga, mindfulness-based stress reduction and stress-related physiological measures: a meta-analysis. *Psychoneuroendocrinology,* 86: 152-168.

Patrick, D.L., Burns, T., Morosini, P., Rothman, M., Gagnon, D.D., Wild, D., & Adriaenssen, I. (2009) Reliability, validity and ability to detect change of the clinician-rated personal and social performance scale in patients with acute symptoms of schizophrenia. *Current Medical Research and Opinion,* 25(2): 325-338.

Paul, C.L., Piterman, L., Shaw, J.E., Kirby, C., Forshaw, K.L., Robinson, J., Thepwongsa, I., Sanson-Fisher, R.W. (2017) Poor uptake of an online intervention in a cluster randomised controlled trial of online diabetes education for rural generation practioners. *Trials,* 18(1): 137.

Pavlenko, A. (2007) Autobiographic narratives as data in applied linguistics. *Applied Linguistics,* 28(2): 63-188.

Peck, T.C., Seinfeld, S., Aglioti, S.M., & Slater, M. (2013) Putting yourself in the skin of a black avatar reduces implicit racial bias. *Counsciousness and Cognition,* 22(3): 779-787.

Pedersen, J., & Buur, J. (2000) Games and movies: towards innovative co-design with users. In: Scrivener, S.A.R., Ball, L.J., & Woodcock, A. eds. *Collaborative design: proceedings of codesigning 2000.* London: Springer: 93-100.

Pellerin, K.A., Costa, N.M., Weems, C.F., & Dalton, R.F. (2010) An examination of treatment completers and non-completers at a child and adolescent community mental health clinic. *Community Mental Health Journal*, 46: 273-281.

Penn, D. L., Roberts, D. L., Combs, D. & Sterne, A. (2007) The development of the social cognition and interaction training program for schizophrenia spectrum disorders. *Psychiatric Services*, 58(4): 449-451.

Penn, D., Roberts, D. L., Munt, E. D., Jones, N. & Sheitman, B. (2005) Pilot study of social cognition and interaction training (SCIT) for schizophrenia. *Schizophrenia Research*, 80(2-3): 357-359.

Perala, J., Saarni, S. I., Ostamo, A., Pirkola, S., Haukka, J., Harkanen, T., Koskinen, S., Lonnqvist, J. & Suvisaari, J. (2008) Geographic variation and sociodemographic characteristics of psychotic disorders in Finland. *Schizophrenia Research*, 106(2-3): 337-347.

Perez-Marcos, D. (2018) Virtual reality experiences, embodiment, videogames and their dimensions in neurorehabilitation. *Journal of NeuroEngineering and Rehabilitation*, 15: 113.

Peterson, A.L. (2014) A case for the use of autoethnography in nursing research. *Journal of Advanced Nursing*, 71 (1): 226-233.

Perski, O., & Short, C.E. (2021) Acceptability of digital health interventions: embracing the complexity. *Translational Behavioral Medicine*: ibab048.

Peyroux, E., & Franck, N. (2016) Improving social cognition in people with schizophrenia with RC2S: two single-case studies. *Frontiers in Psychiatry,* 7(66): 1-16.

Philip, L., Cottrill, C., Farrington, J., Williams, F., & Ashmore, F. (2017) The digital divide: patterns, policy and scenarios for connecting the 'final few' in rural communities across Great Britain. *Journal of Rural Studies,* 54: 386-398.

Pimentel, D., Foxman, M., Davis, D.Z., & Markowitz, D.M. (2021) Virtually real, but not quite there: social and economic barriers to meeting virtual reality's true potential for mental health. *Virtual Real,* 2: 627059.

Pinkham, A.E., Penn, D.L., Green, M.F., & Harvey, P.D. (2016) Social cognition psychometric evaluation: results of the initial psychometric study. *Schizophrenia Bulletin,* 42(4): 494-504.

Polillo, A., Voineskos, A.N., Foussias, G., Kidd, S.A., Sav, A., Hawley, S., Soklaridis, S., Stergiopoulos, V., & Kozloff, N. (2021) Using digital tools to engage with psychosis and their families in research: survey recruitment and completion in an early psychosis intervention program. *JMIR Mental Health,* 8(5): e24567.

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006) *Guidance on the conduct of narrative synthesis in systematic reviews*. Swindon: ESRC Methods Programme.

Postel, M.G., de Haan, H.A., ter Huurne, E.D., Becker, E.S., & de Jong, C.A.J. (2010) Effectiveness of a web-based intervention for problem drinkers and reasons for dropout: randomized controlled trial. *Journal of Medical Internet Research,* 12(4): e68.

Pot-Kolder, R.M.C.A., Geraets, C.N.W., van Beilen, M., Staring, A.B.P., Gijsman, H.J., Delespaul, P.A.E.G., & van der Gaag, M. (2019) Virtual-reality-based cognitive behavioural therapy versus waiting list control for paranoid ideation and social avoidance in patients with psychotic disorders: a single-blind randomised controlled trial. *Lancet Psychiatry,* 5: 217-226.

Pot-Kolder, R., Veiling, W., Counotte, J., & van der Gaag, M. (2018) Anxiety partially mediates cybersickness symptoms in immersive virtual reality environments. *Cyberpsychology, behavior and social networking,* 21(3): 187-193.

Powell, B.J., Waltz, T.J., Chinman, M.J., Damschroder, L.J., Smith, J.L., Matthieu, M.M., Proctor, E.K., & Kirchner, J.E. (2015) A refined compliation of implemented strategies: results from the expert recommendations for implementing change (ERIC) project. *Implementation Science,* 10(21).

Pratt, D.R., Zyda, M., & Kelleher, K. (1995) Virtual reality: In the mind of the beholder. *IEEE Computer,* 28(7): 17-9.

Price, M. & Anderson, P. (2007) The role of presence in virtual reality exposure therapy. *Journal of Anxiety Disorders*, 21(5): 742-751.

Public Health England (2021) Severe Mental Illness. Available at: https://fingertips.phe.org.uk/profile-group/mental-health/profile/severe-mental-illness/data#page/0/gid/1938132719/pat/15/ati/165/are/E38000004/iid/90581/age/1/sex/4/cid/4/tbm/1 (Accessed 16 June 2021).

Pulijala, Y., Ma, M., Pears, M., Peebles, D., & Ayoub, A. (2018) An innovative virtual reality training tool for orthognathic surgery. *International Journal of Oral and Maxillofacial Surgery,* 47: 1199-1205.

Rabin, M., & Schrag, J.L. (1999) First impressions matter: a model of confirmatory bias. *The Quarterly Journal of Economics,* 114(1): 37-82.

Rábu, M., Binder, P-E. & Haavind, H. (2013) Negotiating ending: a qualitative study of the process of ending psychotherapy. *European Journal of Psychotherapy and Counselling,* 15(3): 274-295.

Radianti, J., Majchrzak, T.A., Fromm, J., & Wohlgenannt, I. (2020) A systematic review of immersive virtual reality applications for higher education: design elements, lessons learned, and research agenda. *Computers & Education,* 147: 103778.

Rajguru, C., Obrist, M., & Memoli, G. (2020) Spatial soundscapes and virtual worlds: challenges and opportunities*. Frontiers in Psychology*, 11: 569056.

Ramon, S., Shera, W., Healy, B., Lachman, M., & Renouf, N. (2009) The rediscovered concept of recovery in mental illness. *International Journal of Mental Health,* 38: 106-126.

Ratan, R., & Dawson, M. (2015) When Mii is me: a psychophysiological examination of avatar self-relevance. *Communication Research*: 1-30.

Read, J., Fink, P.J., Rudegeair, T., Felitti, V., & Whitfield, C.L. (2008) Child maltreatment and psychosis: a return to a genuinely integrated bio-psycho-social model. *Clinical Schizophrenia & Related Psychoses*, 2(3):235–254.

Realpe, A., Elahi, F., Bucci, S., Birchwood, M., Vlaev, I., Taylor, D., & Thompson, A. (2020) Co-designing a virtual world with young people to deliver social cognition therapy in early psychosis. *Early Intervention in Psychiatry,* 14(1): 37-43

Reason, J.T. (1970) Motion sickness: A special case of sensory rearrangement. *Advancement in Science,* 26: 386-393.

Reed, S. I. (2008) First-episode psychosis: A literature review. *International Journal of Mental Health Nursing*, 17(2): 85-91.

Rehm, I. C., Foenander, E., Wallace, K., Abbott, J. M., Kyrios, M. & Thomas, N. (2016). What Role Can Avatars Play in e-Mental Health Interventions? Exploring New Models of Client-Therapist Interaction. *Front Psychiatry,* 7(186): 1-6.

Repper, J., & Carter, T. (2011). A review of the literature on peer support in mental health services. *Journal of Mental Health,* 4: 392-411.

Rheingold, H. (1993) *The virtual community: Homesteading on the electronic frontier*. Cambridge, MA: MIT Press.

Richards, D., & Richardson, T. (2012) Computer-based psychological treatments for depression: A systematic review and meta-analysis. *Clinical Psychology Review,* 32: 329-42.

Richards, P., Simpson, S., Bastiampillai, T., Pietrabissa, G., & Castelnuovo, G. (2018) The impact of technology on therapeutic alliance and engagement in psychotherapy: The therapist's perspective. *Clinical Psychologist,* 22(2): 171–81.

Riches, S., Garety, P., Rus-Calafell, M., Stahl, D., Evans, C., Sarras, N., Yeboah, K., & Valmaggia, L. (2019) Using virtual reality to assess associations between paranoid ideation and components of social performance: a pilot validation study. *Cyberpsychology, Behavior and Social Networking,* 22(1): 51–59.

Riches, S., Pisani, S., Bird, L., Rus-Calafell, M., Garety, P., & Valmaggia, L. (2021) Virtual reality-based assessment and treatment of social functioning impairments in psychosis: a systematic review. *International Review of Psychiatry,* 33(3): 337-362.

Ridings, C. M., & Gefen, D. (2004) Virtual community attraction: Why people hang out online. *Journal of Computer-Mediated Communication*, 10(1).

Riper, H., Andersson, G., Christensen, H., Cuijpers, P., Lange, A., & Eysenbach, G. (2010) Theme issue on e-mental health: a growing field in internet research. *Journal of Medical Internet Research,* 12(5): e74.

Riper, H., Kramer, J., Smit, F., Conijin, B., Schippers, G., & Cuijpers, P. (2008) Web-based self-help for problem drinkers: a pragmatic randomized trial. *Addiction,* 103(2): 218-227.

Riva, G., Bacchetta, M., Cesa, G., Conti, S., & Molinari, E. (2003) Six-month follow up of in-patient experiential-cognitive therapy for binge eating disorders. *Cyberpsychology Behavior,* 6(3): 251-258.

Riva, G., Mantovani, F., Capidevilla, C.S., Preziosa, A., Morganti, F., Villani, D., Gaggioli, A., Botella, C., & Alcaniz, M. (2007) Affective interactions using virtual reality: the link between presence and emotions. *Cyberpsychology and Behaviour,* 10(1): 45-56.

Robbins, S. (2007) A futurist's view of Second Life education: a developing taxonomy of digital spaces. In: Livingstone, D., & Kemp, J. (eds). *Proceedings of the Second Life Education Workshop,* Chicago, IL: 27–33.

Roberts, D., Fiszdon, J., & Tek, C. (2011) Initial validity of the social cognition screening questionnaire (SCSQ). *Schizophrenia Bulletin,* 31(1): 280.

Roberts, D.L., Liu, P. Y-T., Busanet, H., Maples N., & Velligan, D. (2017) A tablet-based intervention to manipulate social cognitive bias in schizophrenia. *American Journal of Psychiatric Rehabilitation*, 20(2): 143-155.

Roberts, D. L. & Penn, D. L. (2009) Social cognition and interaction training (SCIT) for outpatients with schizophrenia: A preliminary study. *Psychiatry Research*, 166(2-3): 141-147.

Robertson, L., Smith, M., Castle, D., & Tannenbaum, D. (2006) Using the Internet to enhance the treatment of depression. *Australasian Psychiatry*, 14(4): 413-417.

Robinson, D.G., Woerner, M.G., McMeniman, M., Mendelowitz, A., & Bilder, R.M. (2004) Symptomatic and functional recovery from a first episode of schizophrenia or schizoaffective disorder. *American Journal of Psychiatry,* 161: 473-479.

Robinson, N. (1999) The use of focus group methodology – with selected examples from sexual health research. *Journal of Advanced Nursing,* 29(4): 905-913.

Robotham, D., Satkunanathan, S., Doughty, L., & Wykes, T. (2016) Do we still have a digital divide in mental health? A five-year survey follow-up. *Journal of Medical Internet Research,* 18(11): e309.

Rocha, N.B., Campos, C., Figueiredo J.M., Saraiva, S., Almedia, C., Moreira, C., Pereira, G., Telles-Correia, D., & Roberts, D. (2020) Social cognition and interaction training for recent-onset schizophrenia: a preliminary randomized trial. *Early Intervention in Psychiatry,* 1 – 7.

Rose, D. (2017) Service user/survivor-led research in mental health: epistemological possibilities. *Disability and Society*, 32(6): 773-789.

Royal College of Psychiatrists (2021) *National Clinical Audit of Psychosis.* [online] Available from: https://www.rcpsych.ac.uk/improving-care/ccqi/national-clinical-audits/national-clinical-audit-of-psychosis/core-audit-tools-reports (Accessed 08 July 2021).

Rubak, S., Sandback, A., Lauritzen, T., & Christensen, B. (2005) Motivational interviewing: a systematic review and meta-analysis. *British Journal of General Practice,* 55(513): 305-312.

Rugkása, J., & Canvin, K. (2010) Researching mental health in minority ethnic communities: reflections on recruitment. *Qualitative Health Research,* 21(1): 132-143.

Rus-Calafell, M., Garety, P., Sason, E., Craig, T.J.K., & Valmaggia, L.R. (2018) Virtual reality in the assessment and treatment of psychosis: a systematic review of its utility, acceptability and effectiveness. *Psychological Medicine,* 48: 362-391.

Rus-Calafell, M., Gutierrez-Maldonado, J. & Ribas-Sabate, J. (2012) Improving social behaviour in schizophrenia patients using an integrated virtual reality programme: a case study. *Annual Review of Cybertherapy and Telemedicine,* 181: 283-286.

Rus-Calafell, M., Gutierrez-Maldonado, J. & Ribas-Sabate, J. (2014) A virtual reality-integrated program for improving social skills in patients with schizophrenia: A pilot study. *Journal of Behavior Therapy and Experimental Psychiatry*, 45(1): 81-89.

Rus-Calafell, M., & Schneider, S. (2019) Are we there yet?! – a literature review of recent digital technology advances for the treatment of early psychosis. *mhealth,* 6(3): 1-12.

Rus-Calafell, M., Ward, T., Zhang, X.C., Edwards, C.J., Garety, P., & Craig, T. (2020) The role of sense of voice presence and anxiety reduction in AVATAR therapy. *Journal of Clinical Medicine*, 9: 2748.

Ryan, K., Dockray, S., & Linehan, C. (2019) A systematic review of tailored eHealth interventions for weight loss. *Digital Health,* 5: 1-13.

Sabaté E. (2003) *Adherence to long-term therapies: evidence for action*. Geneva: World Health Organization.

Saha, S., Whiteford, H., & McGrath, J. (2013) Modelling the incidence and mortality of psychotic disorders: data from the second Australian national survey of psychosis. *Australian & New Zealand Journal of Psychiatry,* 48(4): 352-359.

Sanchez-Vives, M.V., & Slater, M. (2005) From presence to consciousness through virtual reality. *Nature reviews Neuroscience,* 6: 332-339.

Sander Wint, S., Eshelman, D., Steele, J., & Guzzetta, C.E. (2002) Effects of distraction using virtual reality glasses during lumbar punctures in adolescents with cancer. *Oncology nursing forum,* 29(1): E8-E15.

Sander, L., Paganini, S., Lin, J., Schlicker, S., Ebert, D.D., Buntrock C., & Baumeister, H. (2017) Effectiveness and cost-effectiveness of a guided Internet- and mobile-based intervention for the indicated prevention of major depression in patients with chronic back pain-study protocol of the PROD-BP multicentre pragmatic RCT. *BMC Psychiatry,* 17(36).

Sanjek, R. (1990) *Fieldnotes: the makings of anthropology*. New York: Cornell University Press.

Santesteban-Echarri, O., Paino, M., Rice, S., Gonzalez-Blanch, C., McGorry, P., Gleeson, J., & Alvarez-Jimenez, M. (2017) Predictors of functional recovery in first-episode psychosis: a systematic review and meta-analysis of longitudinal studies. *Clinical Psychology Review,* 58: 59-75.

Santesteban-Echarri, O., Rice, S., Gonzalez-Blanch, C., & Alvarez-Jimenez, M. (2020) Promoting psychological functioning and recovery schizophrenia spectrum and other psychotic disorders. In: Badcock, J., & Paulik, G. (eds). *A clinical introduction to psychosis.* London: Elsevier: 419-445.

Sarac, H.S. (2014) Benefits and challenges of using Second Life in English teaching: experts' opinions. *14th International Language, Literature and Stylistics Symposium,* 158: 326-330.

Savage, J. (2000) Ethnography and health care. *The British Medical Journal,* 321(7273): 1400-1402.

Savin-Baden, M., Gourlay, L., Tombs, C., Steils, N., Tombs, G., & Mawer, M. (2010) Situating pedagogies, positions and practices in immersive virtual worlds. *Educational Research*, 52(2): 123–33.

Saygin, A. P., Chaminade, T., Ishiguro, H., Driver, J., & Frith, C. D. (2012) The thing that should not be: Predictive coding and the uncanny valley in perceiving human and humanoid robot actions. *Social Cognitive and Affective Neuroscience*, 7: 413–22.

Scharff, J.S. (2013) Technology-assisted psychoanalysis. *Journal of the American Psychoanalytic Association,* 61(3): 491-510.

Scheel, M.J., Davis, C.K., & Henderson, J.D. (2013) Therapist use of client strengths: a qualitative study of positive processes. *The Counseling Psychologist,* 20(10): 1-36.

Schmid, J. (2019) Autoethnography: locating the self as standpoint in post-apartheid South Africa. In S. Laher, A. Flynn, & S. Kramer (eds.).

Transforming research methods in the social sciences. South Africa: Wits University Press: 265-279.

Schlögl, S., Bergmann, M.E.R., Eder, V., Achleitner, M., & Evangelator, P. (2017) Google cardboard in social science research – exploring low-cost virtual reality and its potential. *Proceedings of the Forschungsforum der Österreichischen Fachhochschulen*, 18: 1-5.

Schlosser, D.A., Campellone, T.R., Truong, B., Etter, K., Vergani, S., Komaiko, K., & Vinogradov, S. (2018) Efficacy of PRIME, a mobile app intervention designed to improve motivation in young people with schizophrenia. *Schizophrenia Bulletin,* 44(5): 1010-1020.

Schueller, S.M., Tomasino, K.N., & Mohr, D.C. (2016) Integrating human support into behavioral intervention technologies: the efficiency model of support. *Clinical Psychology: Science and Practice,* 24(1): 27–45.

Schueller, S.M., Washburn, J.J., & Price, M. (2016) Exploring mental health providers' interest in using web and mobile-based tools in their practices. *Internet Interventions,* 4: 145–51.

Schuster, R., Topooco, N., Keller, A., Radvogin, E., & Laireiter, A-R. (2020) Advantages and disadvantages of online and blended therapy: replication and extension of findings on psychotherapists' appraisals. *Internet Interventions,* 21: 100326.

Schwandt, T.A. (2007) *The Sage dictionary of qualitative enquiry* (3rd ed.). UK: Sage.

Schwind, V., Knierim, P., Haas, N., & Henze, N. (2019) Using presence questionnaires in virtual reality. *ACM CHI Conference on Human Factors in Computing Systems,* 360: 1–11.

Scopes, L. (2011) A Cybergogy of Learning Archetypes and Learning Domains: Practical Pedagogy for 3D Immersive Virtual Worlds. In: Hinrichs, R., & Wankel, C. eds. *Transforming Virtual World Learning*. Bingley: Emerald Group Publishing Limited: 3-28.

Secher, R.G., Hjorthoj, C.R., Austin, S.F., Thorup, A., Jeppesen, P., Mors, O., & Nordentoft, M. (2015) Ten-year follow-up of the OPUS specialized early intervention trial for patients with a first episode of psychosis. *Schizophrenia Bulletin,* 41(3): 617-626.

Second Life (2017) *Second Life*. [online] Available from: http://secondlife.com (Accessed 10 October 2017).

Segal, R., Bhatia, M., & Drapeau, M. (2011) Therapists' perception of benefits and costs of using virtual reality treatments. *Cyberpsychology, Behavior, and Social Networking,* 14(1-2): 29-34.

Segawa, T., Baudry, T., Bourla, A., Blanc, J., Peretti, C., Mouchabac, S., & Ferreri, F. (2019) Virtual reality (VR) in assessment and treatment of addictive disorders: a systematic review. *Frontiers in Neuroscience,* 13: 1409.

Sekhon, M., Cartwright, M., & Francis, J.J. (2017) Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. *BMC Health Services Research,* 17:88.

Shafi, R., Shuai. W., & Younus, M.U. (2020) 360-degree video streaming: a survey of the state of the art. *Symmetry,* 12: 1491.

Shah, J., Mizrahi, R., & McKenzie, K. (2011) The four dimensions: a model for the social aetiology of psychosis. *The British Journal of Psychiatry,* 199(1): 11-14.

Sharp, N.L., Bye, R.A., & Cusick, A. (2019) Narrative analysis. In P. Liamputtong (ed). *Handbook of research methods in health social sciences.* Singapore: Springer: 861-880.

Sharples, S., Cobb, S., Moody, A., & Wilson, J.R. (2008) Virtual reality induced symptoms and effects (VRISE): comparison of head mounted display (HMD): desktop and projection display systems. *Display,* 29(2): 58-69.

Sheridan, A., O'Callaghan, E., Drennan, J., Coughlan, B., O'Keeffe, D., Nee, J., Frazer, K., & Kemple, M. (2012) Enabling recovery: the benefits of supporting socialisation: report of a randomised controlled trial. *University College Dublin,* 1-100.

Sheridan, T. B. (1992) Musings on telepresence and virtual presence. *Presence: Teleoperators and Virtual Environments*, 1(1): 120–126.

Shokraneh, F., & Adams, C.E. (2017) Increasing value and reducing waste in data extraction for systematic reviews: tracking data in data extraction forms. *Systematic Reviews,* 6(153).

Shi, Y., Du, J., Ahn, C.R., & Ragan, E. (2019) Impact assessment of reinforced learning methods on construction workers' fall risk behavior using virtual reality. *Automation in Construction*, 104: 197–214.

Silvia, P. J., & Duval, T. S. (2001). Objective self-awareness theory: Recent progress and enduring problems. *Personality and Social Psychology Review, 5*, 230–241.

Sim, K., Chua, T.H., Chan, Y.H., Mahendran, R., & Chong, S.A. (2006) Psychiatric comorbidity in first episode schizophrenia: a 2 year longitudinal outcome study. *Journal of Psychiatric Research,* 40(7): 656-663.

Sim, K., Swapna, V., Mythily, S., Mahendran, R., Kua, E.H., McGorry, P., & Chong, S.A. (2003) Psychiatric comorbidity in first episode psychosis: the early psychosis intervention (EPIP) experience. *Acta Psychiatrica Scandinavica,* 109(1): 23-29.

Simblett, S., Greer, B., Matcham, F., Curtis, H., Polhemus, A., Ferrao, J., Gamble, P., & Wykes, T. (2018) Barriers to and facilitators of engagement with remote measurement technology for managing health: systematic review and content analysis of findings. *Journal of Medical Internet Research*, 20(7): e10480.

Simpson, S.G., & Reid, C.L. (2014) Therapeutic alliance in videoconferencing psychotherapy: a review. *Australian Journal of Rural Health*, 22(6): 280–99.

Sin, J., Henderson, C., Woodham, L.A., Hernández, A.S., & Gillard, S. (2019) A multicomponent eHealth intervention for family carers for people affected by psychosis: a coproduced design and build study. *Journal of Medical Internet Research*, 21(8): e14374.

Sinclair, C., Holloway, K., Riley, G., & Auret, K. (2013) Online mental health resources in rural Australia: clinician perceptions of acceptability. *Journal of Medical Internet Research*, 15(9): e193.

Skeva, R., Gregg, L., Jay, C., & Pettifer, S. (2021) Views of practitioners and researchers on the use of virtual reality in treatment for substance use disorders. *Frontiers in Psychology*, 12: 606761.

Slater, M. (2009) Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 364(1535): 3549–3557.

Slater, M., & Wilbur, S. (1997) A framework for immersive virtual environments (five): speculations on the role of presence in virtual environments. *Presence*, 6(6): 603–616.

Slattery, P., Saeri, A.K., & Bragge, P. (2020) Research co-design in health: a rapid overview of reviews. *Health Research Policy and Systems*, 18:17.

Slay, J. & Stephens, L. (2013). *Co-production in mental health: A literature review.* London: New Economics Foundation.

Smith, J.W. (2015) Immersive virtual environment technology to supplement environmental perception, preference and behaviour research: a review with applications. *International Journal of Environmental Research and Public Health,* 12: 11486-11505.

Smith, M. J., Fleming, M. F., Wright, M. A., Roberts, A. G., Humm, L. B., Olsen, D. & Bell, M. D. (2015) Virtual reality job interview training and 6-month employment outcomes for individuals with schizophrenia seeking employment. *Schizophrenia Research*, 166(1-3): 86-91.

Smith, M.J., Fleming, M.F., Wright, M.A., Jordan, N., Humm, L.B., Olsen, D., & Bell, M.D. (2015) Job offers to individuals with severe mental illness after participation in virtual reality job interview training. *Psychiatric Services,* 66(11): 1173-1179.

Smith, M.J., Ginger, E.J., Wright, M., Wright, K., Humm, L.B., Olsen, D., Bell, M.D., & Fleming, M.F. (2014) Virtual reality job interview training for individuals with psychiatric disabilities. *The Journal of Nervous and Mental Disease,* 202(9): 659-667.

Smits, M., Staal, J.B., & van Goor, H. (2020) Could virtual reality play a role in the rehabilitation after COVID-19 infection?. *BMJ Open Sport & Exercise Medicine,* 6: e000943.

Snelson, C., & Hsu, Y. (2019) Educational 360-Degree videos in virtual reality: a scoping review of the emerging research. *TechTrends.*

Snyder, M., & Swann, W.B. (1978) Behavioral confirmation in social interaction: from social perception to social reality. *Journal of Experimental Social Psychology,* 14: 148-162.

Sohn, B. K., Hwang, J. Y., Park, S. M., Choi, J. S., Lee, J. Y. & Jung, H. Y. (2016) Developing a Virtual Reality-Based Vocational Rehabilitation Training Program for Patients with Schizophrenia. *Cyberpsychology Behavior and Social Networking*, 19(11): 686-691.

Solmi, M., Radua, J., Olivola, M., Croce, E., Soardo, L., Salazar de Pablo, G., Il Shin, J., Kirkbride, J.B., Jones, P., Kim, J.H., Kim, J.Y., Carvalho, A.F., Seeman, M.V., Correll, C.U., & Fusar-Poli, P. (2021) Age of onset of mental disorders worldwide: large-scale meta-analysis of 192 epidemiological studies. *Molecular Psychiatry.*

Soneson, E., Russo, D., Stochl, J., Heslin, M., Galante, J., Knight, C., Grey, N., Hodgekins, J., French, P., Fowler, D., Lafortune, L., Byford, S., Jones, P.B., & Perez, J. (2020) Psychological interventions for people with psychotic experiences: a systematic review and meta-analysis of controlled and uncontrolled effectiveness and economic studies. *Australian & New Zealand Journal of Psychiatry,* 00(0): 1 – 23.

Sousa, V.E.C., & Lopez, K.D. (2017) Towards usable e-health. *Applied Clinical Informatics,* 8: 470-490.

Spanakis, P., Peckham, E., Mathers, A., Shiers, D., & Gilbody, S. (2021) The digital divide: amplifying health inequalities for people with severe mental illness in the time COVID-19. *The British Journal of Psychiatry,* 1-3.

Spanlang, B., Normand, J-M., Borland, D., Kilteni, K., Giannopoulos, E., Pomés, A., González-Franco, M., Perez-Marcos, D., Arroyo-Palacios, J., Muncunill, X.N., & Slater, M. (2014) How to build an embodiment lab: achieving body representation illusions in virtual reality. *Frontiers in Robotics and AI,* 1(9).

Sparkes, A. (1996) The fatal flaw: a narrative of the fragile body-self. *Qualitative Inquiry,* 2: 463-494.

Sponsiello, M., & Gallego-Arrufat, M-J. (2015) Ethnographic approach to Second Life in education: a focus on technological difficulties. *Ethnography and Education,* 11(3): 283-297.

Sprong, M., Schothorst, P., Vos, E., Hox, J., & Van Engeland, H. (2007) Theory of mind in schizophrenia-meta-anaysis. *British Journal of Psychiatry,* 191: 5-13.

Staley, K. (2013) A series of case studies illustrating the impact of service user and carer involvement on research. *National Institute for Health Research*. [online] Available from http://www.invo.org.uk/wp-content/uploads/documents/MHRN_CaseStudiesAugust_2013.pdf (Accessed 30 October 2020).

Staniszewska, S., Brett, J., Simera, I., Seers, K., Mockford, C., Goodlad, S., Altman, D.G., Moher, D., Barber, R., Denegri, S., Entwistle, A., Littlejohns, P., Morris, C., Suleman, R., Thomas, V., & Tysall, C. (2017) GRIPP2 reporting checklists: tools to improve reporting of patient and public involvement in research. *The British Medical Journal,* 358: j3453

Staniszewska, S., Jones, N., Newburn, M., & Marshall, S. (2007) User involvement in the development of a research bid: barriers, enablers and impacts. *Health Expectations,* 10: 173-183.

Stanney, K. M., Hale, K. S., Nahmens, I., & Kennedy, R. S. (2003) What to expect from immersive virtual environment exposure: Influences of gender, body mass index, and past experience. *Human Factors: The Journal of the Human Factors and Ergonomics Society,* 45, 504–20.

Starr, L.J. (2010) The use of autoethnography in educational research: locating who we are in what we do. *Canadian Journal for New Scholars in Education,* 3(1): 1-9.

Steare, T., O'Hanlon, P., Eskinazi, M., Osborn, D., Lloyd-Evans, B., Jones, R., Rostill, H., Amani, S., & Johnson, S. (2021) Smartphone-delivered self-management for first-episode psychosis: the ARIES feasibility randomised controlled trial. *BMJ Open*, 10: e034927.

Steed, A., Pan, Y., Zisch, F., & Steptoe, W. (2016) The impact of a self-avatar on cognitive load in immersive virtual reality. *In 2016 IEEE Virtual Reality (VR):* 67–76.

Stefaniak, I., Sorokosz, K., Janicki, A., Wciórka, J. (2017) Use of an avatar in cognitive-behavioural therapy of a person who is chronically experiencing negative auditory hallucinations – case study. *Advances in Psychiatry and Neurology,* 26(4): 275-289.

Strand, M., Eng, L.S., & Gammon, D. (2020) Combining online and offline peer support groups in community mental health care settings: a qualitative study of service users' experiences. *International Journal of Mental Health Systems,* 14: 39.

Stefaniak, I., Sorokosz, K., Janicki, A., & Wciórka, J. (2019) Therapy based on avatar-therapist synergy for patients with chronic auditory hallucinations: a pilot study. *Schizophrenia Research,* 211: 115-117.

Stefanidou, T., Wang, J., Morant, N., Lloyd-Evans, B., & Johnson, S. (2021) Loneliness in early psychosis: a qualitative study exploring the views of mental health practitioners in early intervention services. *BMC Psychiatry,* 21: 134.

Stupar-Rutenfrans, S., Ketelaars, L.E.H., & van Gisbergen, M.S. (2017) Beat the fear of public speaking: mobile 360° video virtual reality exposure training in home environment reduces public speaking anxiety. *Cyberpsychology, Behavior and Social Networking,* 20: 624-633.

Su, Y-C., & Grauman, K. (2017) Making 360° video watchable in 2D: learning videography for click free viewing. *In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR),* 1-9.

Sucala, M. Schnur, J.B., Constantino, M.J., Miller, S.J., Brackman, E.H., & Montgomery, G.H. (2012) The therapeutic relationship in e-therapy for mental health: a systematic review. *Journal of Medical Internet Research,* 14(4): e110.

Suh, K.S., Kim, H., & Suh, E.K. (2011) What if your avatar looks like you? Dual congruity perspectives for avatar use. *MIS Quarterly,* 35(3): 711-729.

Suler, J. (2004) The online disinhibition effect. *CyberPsychology & Behavior,* 7: 312-326.

Sullivan, J.R. (2012) Skype: an appropriate method of data collection for qualitative interviews? *The Hilltop Review,* 6: 54-60.

Sullivan, S., Lewis, G., Wiles, N., Thompson, A. & Evans, J. (2013) Psychotic experiences and social functioning: a longitudinal study. *Social Psychiatry and Psychiatric Epidemiology*, 48(7): 1053-1065.

Sundermann, O., Onwumere, J., Kane, F., Morgan, C., & Kuipers, E. (2013) Social networks and support in first-episode psychosis: exploring the role of loneliness and anxiety. *Social Psychiatry and Psychiatric Epidemeology,* 49: 359-366.

Svartvatten, N., Segerlund, M., Dennhag, I., Andersson, G., & Carlbring, P. (2015) A content analysis of client e-mails in guided internet-based cognitive behavior therapy for depression. *Internet interventions,* 2(2): 121-127.

Switzer, F., & Harper, S.F. (2019) A narrative review of the barriers to the implementation of cognitive behavioural therapy for psychosis. *Psychosis,* 11(2): 151-161.

Taksal, A., Sudhir, P.M., Janakiprasad, K.K., Viswanath, D., & Thirthalli, J. (2016) Impact of the integrated psychological treatment (IPT) on social cognition, social skills and functioning in persons diagnosed with schizophrenia: a feasibility study from India. *Psychosis*, 8(3): 214-225.

Tal, A., & Torous, J. (2017) The digital mental health revolution: opportunities and risks. *American Psychological Association,* 40(3): 263-265.

Tan, H.L.E., Chng, C.M.L., Lau, Y., & Klainin-Yobas, P. (2020) Investigating the effects of a virtual reality-based stress management programme on inpatients with mental disorders: a pilot randomised controlled trial. *International Journal of Psychology,* 1-10.

Tan, X.W., Shahwan, S., Satghare, P., Chua, B.Y., Verma, S., Tang, C., Chong, S.A. and Subramaniam, M. (2019) Trends in subjective quality of life among patients with first episode psychosis – a 1 year longitudinal study. *Frontiers in Psychiatry*, 10: 53.

Tarrier, N. (2014) CBT for psychosis: effectiveness, diversity, dissemination, politics, the future and technology. *World Psychiatry*, 13(3): 256-257.

Tart, C. (1990) Multiple personality, altered states and virtual reality; The world simulation process approach. *Dissociation*, 3(4): 222-233.

Tas, C., Danaci, A.E., Cubukcuoglu, Z., & Brune, M. (2012) Impact of family involvement on social cognition in clinically stable outpatients with schizophrenia – a randomized pilot study. *Psychiatry Research,* 195: 32-38.

Tausch, A.P., & Menold, N. (2016) Methodological aspects of focus groups in health research: results from qualitative interviews with focus group moderators. *Global Qualitative Nursing Research,* 14(3): 1-12.

Taylor, R., Cella, M., Csipke, E., Heriot-Maitland, C., Gibbs, C., & Wykes, T. (2016) Tackling social cognition in schizophrenia: a randomized feasibility trial. *Behavioural and Cognitive Psychotherapy,* 44(3): 306-317.

Tennant, M., McGillivrary, J.A., Youssef, G.J., McCarthy, M.C., & Clark, T-J. (2020) *Journal of Pediatric Oncology Nursing,* 37(4): 265-277.

Thabrew, H., Fleming, T., Hetrick, S., & Merry, S. (2018) Co-design of ehealth interventions with children and young people. *Frontiers in Psychiatry,* 9: 481.

Thase, M.E., Wright, J.H., Eells, T.D., Barrett, M.S., & Wisniewski, S.R., Balasubramani, G.K., McCrone, P., & Brown, G.K. (2018) Improving the efficiency of psychotherapy for depression: computer-assisted versus standard CBT. *The American Journal of Psychiatry,* 175(3): 242-250.

The UK Caldicott Guardian Council (2020) The eight caldicott principles. Available at: https://www.ukcgc.uk/manual/principles [Accessed May 20, 2021].

Thomas, N., Bless, J.J., Alderson-Day, B., Bell, I.H., Cella, M., Craig, T., Delespaul, P., Hugdahl, K., Laloyaux, J., Larøi, F., Lincoln, T.M., Schlier, B., Urwyler, P., van der Berg, D., & Jardri, R. (2019) Potential applications of digital technology in assessment, treatment and self-help for hallucinations. *Schizophrenia Bulletin,* 45(1): S32-S42.

Thomas, N., Hayward, M., Peters, E., Van Der Gaag, M., Bentall, R.P., Jenner, J., Strauss, C., Sommer, I.E., Johns, L.C., Varese, F., Garcia-Montes, J.M., Waters, F., Dodgson, G., & McCarthy-Jones, S. (2014) Psychological therapies for auditory hallucinations (voices): current status and key directions for future research. *Schizophrenia Bulletin,* 40(4): S202-S212.

Thompson, A., Elahi, F., Realpe, A., Birchwood, M., Taylor, D., Vlaev, I., Leahy, F., & Bucci, S. (2020). A feasibility and acceptability trial of social cognitive therapy in early psychosis delivered through a virtual world: The VEEP study. *Frontiers in Psychiatry*, 11: 219.

Thompson, A., Gleeson, J., & Alvarez-Jimenez, M. (2018) Should we be using digital technologies in the treatment of psychotic disorders? *Australian & New Zealand Journal of Psychiatry*, 52(3): 225-226.

Thompson, A., Papas, A., Bartholomeusz, C., Allott, K., Amminger, G. P., Nelson, B., Wood, S. & Yung, A. (2012) Social cognition in clinical "at risk" for psychosis and first episode psychosis populations. *Schizophrenia Research*, 141(2-3): 204-209.

Titov, N., Dear, B., Nielssen, O., Staples, L., Hadjistavropoulos, H., Nugent, M., Adlam, K., Nordgreen, T., Bruvik, K.H., & Hovland, A. (2018) ICBT in routine care: a descriptive analysis of successful clinics in five countries. *Internet Interventions,* 26(13): 108-115.

Titov, N., Dear, B.F., Staples, L.G., Bennett-Levy, J., Klein, B., Rapee, R.M., Anderssen, G., Purtell, C., Bezuidenhout, G., & Nielssen, O.B. (2017) The first 30 months of the MindSpot Clinic: evaluation of a national e-mental health service against project objectives. *Australian and New Zealand Journal of Psychiatry,* 51(12): 1227-1239.

Titov, V., Dear, B.F., Staples, L.G., Bennett-Levy, J., Klein, B., Rapee, R.M., Shann, C., Richards, D., Andersson, G., Ritterband, L., Purtell, C., Bezuidenhout, G., Johnston, L., & Nielssen O.B. (2015) MindSpot

Clinic: an accessible, efficient, and effective online treatment service for anxiety and depression. *Psychiatric Services,* 66(10): 1043-1050.

Tolich, M. (2010) A critique of current practice: ten foundational guidelines for auto ethnographers. *Qualitative Health Research,* 20: 1599-1610.

Tomaselli, K. (2013) Visualising different kinds of writing: autoethnography, social sciences. *Visual Anthropology,* 26(2): 165-180.

Tompkins, P. (2003) Truth, trust, and telepresence. *Journal of Mass Media Ethics*. 18(3-4): 194-212.

Tong, A., Sainsbury, P. & Craig, J. (2007) Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, 19(6): 349-357.

Tonkonogy, J. (1997) *The brief neuropsychological cognitive examination*. Psychological Services: Western Los Angeles.

Torous, J., & Hsin, H. (2018) Empowering the digital therapeutic relationship: virtual clinicis for digital health interventions. *Nature Partner Journals Digital Medicine,* 1: 16.

Torous, J., & Keshavan, M. (2016) The role of social media in schizophrenia: evaluating risks, benefits, and potential. *Current Opinion in Psychiatry,* 29: 190-195.

Torous, J., Myrick, K.J., Rauseo-Ricupero, N., & Firth, J. (2020) Digital mental health and COVID-19: using technology today to accelerate the curve on access and quality tomorrow. *JMIR Mental Health,* 7(3): e18848.

Trahan, M.H., Smith, K.S., Talbot, T.B. (2019) Past, present, and future: editorial on virtual reality applications to human services. *Journal of Technology in Human Services,* 37(1): 1-12.

Tremain, H., McEnery, C., Fletcher, K., & Murray, G. (2020) The therapeutic alliance in digital mental health interventions for serious mental illnesses: narrative review. *JMIR Mental Health,* 7(8): e17204.

Triberti, S., Repetto, C., & Riva, G. (2014) Psychological factors influencing the effectiveness of virtual reality-based analgesia: a systematic review. *Cyberpsychology, Behavior, Social Networking,* 17(6): 335-345.

Triegaardt, J., Han, T.S., Sada, C., Sharma, S., & Sharma, P. (2020) The role of virtual reality on outcomes in rehabilitation of Parkinson's disease: meta-analysis and systematic review in 1031 participants. *Neurological Sciences,* 41: 529-536.

Tritter, J.Q., & McCallum, A. (2006) The snakes and ladders of user involvement: moving beyond Arnstein. *Health Policy,* 76(2): 156-168.

Tsang, M. M. Y. & Man, D. W. K. (2013) A virtual reality-based vocational training system (VRVTS) for people with schizophrenia in vocational rehabilitation. *Schizophrenia Research*, 144(1-3): 51-62.

Tse, A., Jennett, C., Moore, J., Watson, Z., & Rigby, J.A. (2017) Was I there? Impact of platform and headphones on 360 video immersion 2017. *Human Factors in Computing Systems,* 2967-2974.

Tsiachristas, A., Thomas, T., Leal, J., & Lennox, B.R. (2016) Economic impact of early intervention in psychosis services: results from a longitudinal retrospective controlled study in England. *BMJ Open,* 6: e012611.

Tuente, S.K., Bogaerts, S., Bulten, E., Vos, M. K-d., Vos, M., Bokern, H., Ijzendoorn, S.v., Geraets, C.N.W., & Weiling, W. (2020) Virtual reality aggression prevention therapy (VRAPT) versus waiting list control for forensic inpatients: a multicenter randomised controlled trial. *Journal of Clinical Medicine,* 9: 2258.

Tuerk, P.W., Schaeffer, C.M., McGuire, J.F., Larsen, M.A., Capobianco, N., & Piacentini, J. (2019) Adapting evidence-based treatments for digital technologies: a critical review of functions, tools, and the use of branded solutions. *Psychiatry in the Digital Age,* 21: 106.

Turkington, D., Wright, N. P. & Tai, S. (2013) Advances in Cognitive Behavior Therapy for Psychosis. *International Journal of Cognitive Therapy*, 6(2): 150-170.

Turner, D. T., van der Gaag, M., Karyotaki, E. & Cuijpers, P. (2014) Psychological Interventions for Psychosis: A Meta-Analysis of Comparative Outcome Studies. *American Journal of Psychiatry*, 171(5): 523-538.

Turner, D. T., Burger, S., Smit, F., Valmaggia, L.R., & van der Gaag, M. (2020) What consistutes sufficient evidence for case formulation-driven CBT for psychosis? Cumulative meta-analysis of the effect on hallucinations and delusions. *Schizophrenia Bulletin*, 46(5): 1072-1085.

Tuttas, C.A. (2015) Lessons learned using web conference technology for online focus group interviews. *Qualitative Health Research,* 25: 122-133.

Uman, L.S. (2011) Systematic reviews and meta-analyses. *Journal of the Canadian Academy of Child and Adolescent Psychiatry,* 20(1): 57–59.

Upitis, R., Abrami, P., Brook, J., Pickup, D., & Johnson, L. (2015) Usability testing for DREAM. *Procedia – Social and Behavioral Sciences,* 171: 543–552.

Usoh, M., Catena, E., Arman, S., & Slater, M. (2000) Using presence questionnaires in reality. *Presence: Teleoperators and Virtual Environments,* 9: 497–503.

Välimäki, M., Hätönen, H.M., Lahti, M.E., Kurki, M., Hottinen, A., Metsäranta, K., Riihimäki, T., & Adams, C.E. (2014) Virtual reality for treatment compliance for people with serious mental illness. *Cochrane Database for Systematic Reviews*, 10.

Valmaggia, L. R., Day, F. & Rus-Calafell, M. (2016) Using virtual reality to investigate psychological processes and mechanisms associated with the onset and maintenance of psychosis: a systematic review. *Social Psychiatry and Psychiatric Epidemiology,* 51(7): 921-936.

Valmaggia, L.R., Latif, L., Kempton, M.J., & Rus-Calafell, M. (2016) Virtual reality in the psychological treatment for mental health problems: an systematic review of recent evidence. *Psychiatry Research,* 236: 189-195.

van Bennekom, M.J., de Koning, P.P., & Denys, D. (2017) Virtual reality objectifies the diagnosis of psychiatric disorders: a literature review. *Frontiers in Psychiatry,* 8: 163.

van der Gaag, M., Valmaggia, L.R., & Smit, F. (2014) The effects of individually tailored formulation-based cognitive behavioural therapy in auditory hallucinations and delusions: a meta-analysis. *Schizophrenia Research,* 156(1): 30-37.

Van Dijk J., & Hacker, K. (2003) The digital divide as a complex and dynamic phenomenon. *The Information Society,* 19: 315-326.

Van Dijk, J. (2005) *The deepening divide: Inequality in the information society.* London: SAGE.

van der Vaart, R., Witting, M., Riper, H., Kooistra, L., Bohlmeijer, E.T., & van Gemert-Pijnen, L.J. & (2014) Blending online therapy into regular face-to-face therapy for depression: content, radio and preconditions according to patients and therapists using a Delphi study. *BMC Psychiatry,* 14(1): 355.

van Gemert-Pijnen, J.E.W.C, Nijland, N., van Limburg, M., Ossebaard, H.C., Kelders, S.M., Eysenbach, G., & Seydel, E.R. (2011) A Holistic Framework to Improve the Uptake and Impact of eHealth Technologies. *Journal of Medical Internet Research,* 13(4): e111.

Vanitha, V., Vijayalakshmi, K., Venkatesan, L., & Sujatha, V. (2018) Virtual reality therapy upon cognition among schizophrenic clients. *International Journal of Advance Research, Ideas and Innovations in Technology,* 4(6): 12-15.

Vasalou, A., & Joinson, A.N. (2009) Me, myself and I: the role of international context on self-presentation through avatars. *Computers in Human Behavior,* 25: 510-520.

Vasalou, A., Joinson, A., Banzinger, T., Goldie, P., & Pitt, J. (2008) Avatars in social media: balancing accuracy, playfulness and embodied messages. *International Journal of Human-Computer Studies,* 66(11): 801-811.

Vasalou, A., Joinson, A.N., & Pitt, J. (2007) Constructing my online self: avatars that increase self-focused attention. *Conference on Human Factors in Computer Systems – Proceedings*: 445-448.

Vasileiou, K., Barnett, J., Thorpe, S., & Young, T. (2018) Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC Medical Research Methodology*, 18: 148.

Vass, E., Simon, V., Fekete, Z., Lencse, L., Ecseri, M., Kis, B., & Simon, L. (2020) A novel virtual reality-based theory of mind intervention for outpatients with schizophrenia: a proof-of-concept pilot study. *Clinical Psychology and Psychotherapy,* 1-12.

Vasser, M., & Aru, J. (2020) Guidelines for immersive virtual reality in psychological research. *Current Opinion in Psychology,* 36: 71-76.

Vaughan, C., Trail, T.E., Mahmud, A., Dellva, S., Tanielian, T., & Friedman, E. (2018) Informal caregivers' experiences and perceptions of a web-based peer support network: mixed-methods study. *Journal of Medical Internet Research*, 20(8): e257.

Veiling, W., Lestestuiver, B., Jongma, M., Hoenders, R., & van Driel, C. (2021)

Virtual reality relaxation for patients with a psychiatric disorder: crossover randomized controlled trial. *Journal of Medical Internet Research,* 23(1): e17233.

Veiling, W., Moritz, S., & van der Gaag, M. (2014) Brand new worlds – review and update on virtual reality treatment in psychosis. *Schizophrenia Bulletin,* 40(6): 1194-1197.

Veltro, F., Mazza, M., Vendittelli, N., Alberti, M., Casacchia, M., & Roncone, R. (2011) A comparison of the effectiveness of problem solving training and of cognitive-emotional rehabilitation on neurocognition, social cognition and social functioning in people with schizophrenia. *Clinical Practice & Epidemiology in Mental Health,* 7: 123-132.

Ventura, S., Baños, R.M., & Botella, C. (2018) Virtual and augmented reality: new frontiers for clinical psychology. In: Mohamudally, N. (ed). *State of the art virtual reality and augmented reality knowhow.* London: IntechOpen.

Vettehen, P.H., Wiltink, D., Huiskamp, M., Schaap, G., & Ketelaar, P. (2019) Taking the full view: how viewers respond to 360-degree video news. *Computers in Human Behavior,* 91: 24-32.

Viera, L., Fisher, P., Lajboschitz, S., Serafin, S., & Nordentoft, M. (2021). The CHALLENGE project: fighting auditory hallucinations by using virtual reality. *IEEE Conference on Virtual reality and 3D User Interfaces Abstracts and Workshops,* 103-108.

Vigerland, S., Ljótsson, B., Gustafsson, F.B., Hagert, S., Thulin, U., Andersson, G., & Serlachius, E. (2014) Attitudes towards the use of computerized cognitive behavior therapy (cCBT) with children and adolescents: a survey among Swedish mental health professionals. *Internet Interventions,* 1: 111-117.

Vinayagamoorthy, V., Brogni, A., Gillies, M., Slater, M., and Steed, A. (2004). An investigation of presence response across variations in visual realism. *The 7th Annual International Presence Workshop (Valencia)*: 148–155.

Vis, C., Mol, M., Kleiboer, A., Bührmann, L., Finch, T., Smit, J., & Riper, H. (2018) Improving implementation of eMental health for mood disorders in routine practice: systematic review of barriers and facilitating factors. *JMIR Mental Health,* 5: e20.

Visser, F.S., Stappers, P.J., Lugt, R.V.D., & Banders, E.B.N. (2005) Contextmapping: experiences from practice. *CoDesign,* 1(2): 119-149.

Wall, S. (2006) An autoethnography on learning about ethnography. *International Journal of Qualitative Methods,* 5(2): 146-160.

Wallace, R., Goodyear-Grant, E., & Bittner, A. (2021) Harnessing technologies in focus group research. *Canadian Journal of Political Science,* 1-21.

Walsh, D. & Evans, K. (2014) Critical realism: an important theoretical perspective for midwifery research. *Midwifery,* 30 (1): e1-e6.

Walshe, N., & Driver, P. (2019) Developing reflective trainee teacher practice with 360-degree video. *Teaching and Teacher Education.* 78: 97-105.

Wang, Y., Roberts, D.L., Xu, B., Cao, R., Yan, M., & Jiang, Q. (2013) Social cognition and interaction training for patients with stable schizophrenia in Chinese community settings. *Psychiatry Research,* 210(3): 751-755.

Watson, D., & Friend, R. (1969) Measurement of social-evaluative anxiety. *Journal of Consulting and Clinical Psychology*, 33(4): 448.

Watson, P., Zhang, J., Rizvi, A., Tamaiev, J., Birnbaum, M.L., & Kane, J. (2018) A meta-analysis of factors associated with quality of life in first episode psychosis. *Schizophrenia Research*, 26-36.

Watt, D. (2007) On becoming a qualitative researcher: the value of reflexivity. *The Qualitative Report*, 12(1): 82–101.

Weibel, R.P., Grübel, J., Zhao, H., Thrash, T., Meloni, D., Hölscher, C., & Schinazi, V.R. (2018) Virtual reality experiments with physiological measures. *Journal of Visualized Experiments,* 29(138): 58318.

Weitz, P. (ed) 2014. *Psychotherapy 2.0 where psychotherapy and technology meet*. Oxon: Routledge.

Wellman, B. (1996) For a social network analysis of computer networks: A sociological perspective on collaborative work and virtual community. *SIGCPR/SIGMIS*, 1-11.

Wells, M., Mitchell, J.K., Finkelhor, D., & Becker-Blease, A.K. (2007) Online mental health treatment: Concerns and considerations. *Cyberpsychology and Behavior,* 10(3): 453-459.

Wengraf, T. (2001) *Qualitative research interviewing: biographic narrative and semi-structured methods*. London: Sage.

Wenrui, D., Die, H., Sheng, X., Xiaoyu, L., Jingwen, Z., Qian, C., Jiayuan, L., Zheng, Z., Wenxiu, J., Lijun, M., Xinyi, H., Shengrong, C., Boya, L., & Xiaoming, L. (2019) The efficacy of virtual reality exposure therapy for PTSD symptoms: a systematic review and meta-analysis. *Journal of Affective Disorders,* 257: 698-709.

Wentzel, J., Vaart, R.V.D., Bohlmeijer, E.T., & Gemert-Pijnen, J.E.W.C.V. (2016). Mixing Online and Face-to-Face Therapy: How to Benefit From Blended Care in Mental Health Care. *Journal of Medical Research*, 3(1): 1– 7.

White, D. (2008) That Was an Interesting Experience. Available at: http://tallblog.conted.ox.ac.uk/index.php/2008/11/27/that-was-an-interesting-experience/ [Accessed May 1, 2017].

White, D. & Le Cornu, A. (2010) Eventedness and disjuncture in virtual worlds. *Educational Research*, 52(2): 183–96.

White, M.P., Yeo, N., Vassiljev, P., Lundstedt, R., Wallergard, M., Albin, M., & Lohmus, M. (2018) A prescription of “nature” – the potential of using virtual nature in therapeutics. *Neuropsychiatric Disease and Treatment,* 14: 3001-3013.

Whitty, M., & Carr, A. (2006) *Cyberspace romance: The psychology of online relationships*. Basingstoke: Palgrave Macmillan.

WHO (2009) *Pharmacological treatment of mental disorders in primary health care*. Geneva: WHO.

WHO (2012) *WHOQOL user manual*. Geneva: WHO.

WHO (2016) International Classification of Diseases 10. Available at: https://icd.who.int/browse10/2016/en (Accessed 10 May 2018).

Wiecha, J., Heyden, R., Sternthal, E. & Merialdi, M. (2010) Learning in a virtual world: experience with using second life for medical education. *Journal of Medical Internet Research*, 12(1): e1.

Wiederhold, B.K., Davis, R., Wiederhold, M.D. (1998) The effects of immersiveness on physiology. *Studies in Health Technology and Informatics*, 58: 52-60.

Wiederhold, B.K., & Wiederhold, M.D. (2003) Three year follow up for virtual reality exposure for fear of flying. *CyberPsychology & Behavior,* 6(4): 441-445.

Williams, A. (1990) EUROQOL – A new facility for the measurement of health-related quality of life. *Health Policy*, 16(3): 199-208.

Williams, A.D., O'Moore, K., Mason, E., & Andrews, G. (2014) The effectiveness of internet cognitive behaviour therapy (iCBT) for social anxiety disorder across two routine practice pathways. *Internet Interventions,* 1(4): 225-229.

Williams, F., Philip, L., Farrington, J., & Fairhurst, G. (2016) Digital by default and the hard to reach: exploring solutions to digital exclusion in remote rural areas. *Local Economy,* 31(7): 757-777.

Wilson, B.A., Cockburn, J., & Baddeley, A.D. (1985) *The Rivermead Behavioral Memory Test*. Thames Valley Test Company: Bury St. Edmunds.

Wind, T.R., Rijkeboer, M., Andersson, G., & Riper, H. (2020) The COVID-19 pandemic: the ‘black swan’ for mental health care and a turning point for e-health. *Internet Interventions,* 20: 100317.

Wirth, W., Hartmann, T., Böcking, S., Vorderer, P., Klimmt, C., Schramm, H., Saari, T., Laarni, J., Ravaja, N., Gouveia, F.R., Biocca, F., Sacau, A., Jäncke, L., Baumgartner, T., & Jäncke, P. (2007) A process model of the formation of spatial presence experiences. *Media Psychology,* 9: 493-525.

Witmer, B. G. & Singer, M. J. (1998) Measuring presence in virtual environments: A presence questionnaire. *Presence-Teleoperators and Virtual Environments*, 7(3): 225-240.

Wolitzky, K., Fivush, R., Zimand, E., Hodges, L., & Rothbaum, B.O. (2005) Effectiveness of virtual reality distraction during a painful medical procedure in pediatric oncology patients. *Psychology and Health,* 20(6): 817-824.

Wood, H.J., Gannon, J.M., Chengappa, K.N.R., & Sarpal, D.K. (2020) Group teletherapy for first-episode psychosis: piloting its integration with coordinated speciality care during the COVID-19 pandemic. *Psychology and Psychotherapy: Theory, Research and Practice.*

Woodford, J., Farrand, P., Bessant, M., & Williams, C. (2011) Recruitment into a guided internet based CBT (iCBT) intervention for depression: lesson learnt from the failure of a prevalence recruitment strategy. *Contemporary Clinical Trials,* 32(5): 641-648.

Woolverton, C. B., Bell, E. K., Moe, A. M., Harrison-Monroe, P. & Breitborde, N. J. K. (2017) Social cognition and the course of social functioning in first-episode psychosis. *Early intervention in psychiatry*, 12: 1151-1156.

Wright, J., Stepney, S., Clark, J.A., & Jacob, J.L. (2005) Formalizing anonymity: a review. *University of York Technical Report YCS,* 389.

Wunderink, L., Sytema, S., Nienhuis, F.J., & Wiersma, D. (2009) Clinical recovery in first-episode psychosis. *Schizophrenia Bulletin,* 35: 362-369.

Wykes, T., & Sturt, E. (1986) The measurement of social behaviour in psychiatric patients: an assessment of the reliability and validity of the SBS schedule. *British Journal of Psychiatry,* 148: 1-11.

XRHealth (2021) XRHealth. Available at: https://www.xr.health [Accessed July 4, 2021].

Yamada, Y., Inagawa, T., Sueyoshi, K., Sugawara, N., Ueda, N., Omachi, Y., Hirabayashi, N., Matsumoto, M., & Sumiyoshi, T. (2019) Social cognition deficits as a target of early intervention for psychoses: a systematic review. *Frontiers in Psychiatry,* 10: 333.

Yardley, L. (2015) Demonstrating validity in qualitative psychology In J. Smith (ed.). *Qualitative psychology: a practical guide to research methods*. London: SAGE Publications Ltd: 257-272.

Yee, N. (2006) The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. *Presence: Teleoperators & Virtual Environments*, 15(3): 309–29.

Yee, N., & Bailenson, J. (2007) The proteus effect: the effect of transformed self-representation on behavior. *Human Communication Research,* 33: 271-290.

Yellowlees, P., Chan, S.R., & Parish, M.R. (2015) The hybrid doctor-patient relationship in the age of technology – telepsychiatry consultations and the use of virtual space. *International Review of Psychiatry,* 27(6): 476-489.

Yellowlees, P., Holloway, K.M., & Parish, M.R. (2012) Therapy in virtual environments – clinical and ethical issues. *Telemedicine and e-health,* 18(7): 558-564.

Yildirim, C. (2020) Don't make me sick: investigating the incidence of cybersickness in commercial virtual reality headsets. *Virtual Reality,* 24: 231-239.

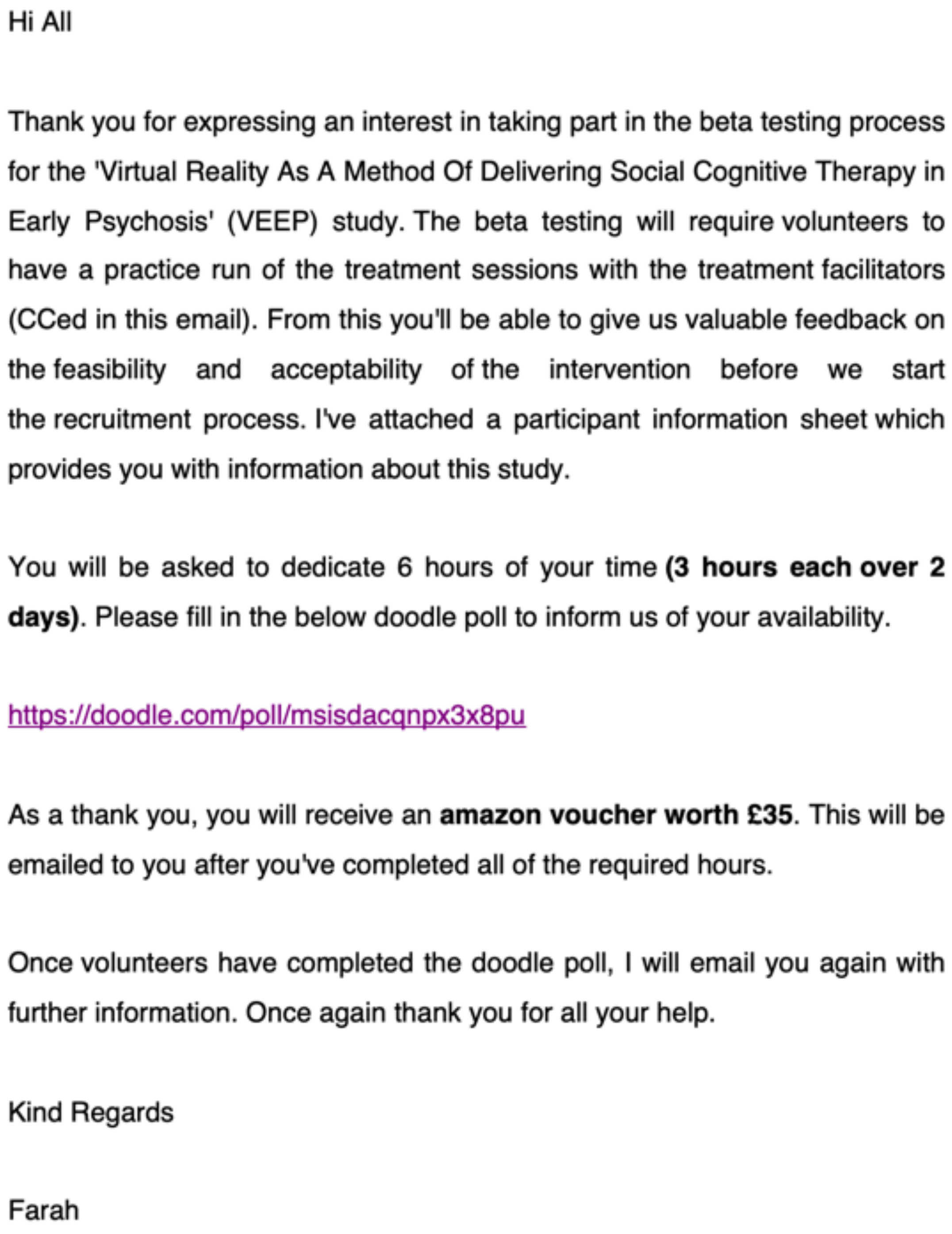
Zantua, L.S.O. (2017) Utilization of virtual reality content in grade 6 social studies using affordable virtual reality technology. *Asia Pacific Journal of Multidisciplinary Research,* 5(2): 1-10.

Zarski, A-C., Lehr, D., Berking, M., Riper, H., Cuijpers, P., & Ebert, D.D. (2016) Adherence to internet-based mobile-supported stress management: a pooled analysis of individual participant data from three randomized controlled trials. *Journal of Medical Internet Research*, 18(6): e146.

Zulkiewicz, B.A., Boudewyns, V., Gupta, C., Kirschenbaum, A., & Lewis, M.A. (2020) Using 360-degree video as a research stimulus in digital health studies: lessons learned. *JMIR Serious Games*, 8(1): e15422.

Appendices

Appendix 1 - VEEP beta testing invite email



Hi All

Thank you for expressing an interest in taking part in the beta testing process for the 'Virtual Reality As A Method Of Delivering Social Cognitive Therapy in Early Psychosis' (VEEP) study. The beta testing will require volunteers to have a practice run of the treatment sessions with the treatment facilitators (CCed in this email). From this you'll be able to give us valuable feedback on the feasibility and acceptability of the intervention before we start the recruitment process. I've attached a participant information sheet which provides you with information about this study.

You will be asked to dedicate 6 hours of your time **(3 hours each over 2 days)**. Please fill in the below doodle poll to inform us of your availability.

https://doodle.com/poll/msisdacqnpx3x8pu

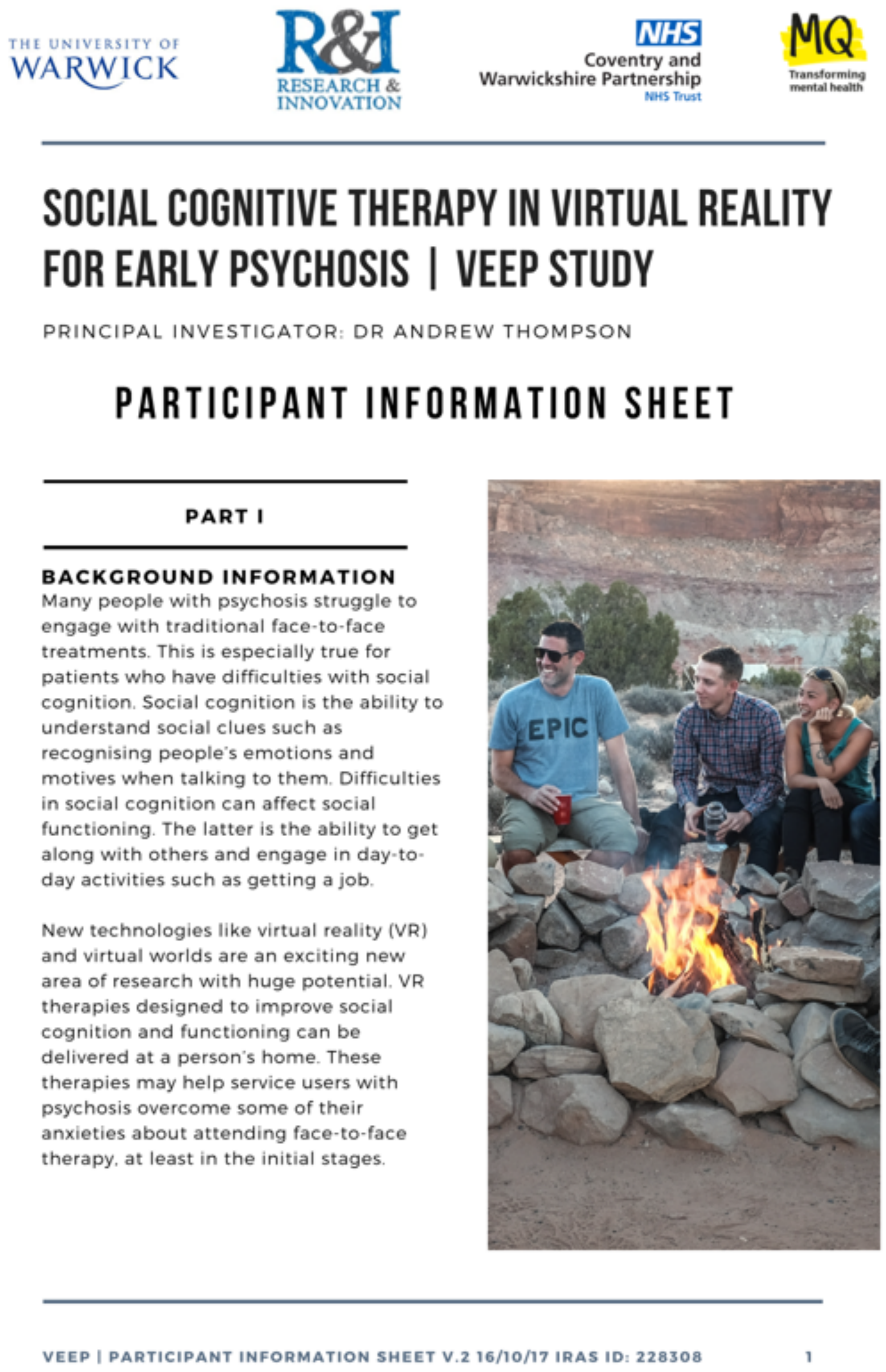
As a thank you, you will receive an **amazon voucher worth £35**. This will be emailed to you after you've completed all of the required hours.

Once volunteers have completed the doodle poll, I will email you again with further information. Once again thank you for all your help.

Kind Regards

Farah

Appendix 2 – VEEP participant information sheet



THE UNIVERSITY OF WARWICK
R&I RESEARCH & INNOVATION
NHS Coventry and Warwickshire Partnership NHS Trust
MQ Transforming mental health

SOCIAL COGNITIVE THERAPY IN VIRTUAL REALITY FOR EARLY PSYCHOSIS | VEEP STUDY

PRINCIPAL INVESTIGATOR: DR ANDREW THOMPSON

PARTICIPANT INFORMATION SHEET

PART I

BACKGROUND INFORMATION

Many people with psychosis struggle to engage with traditional face-to-face treatments. This is especially true for patients who have difficulties with social cognition. Social cognition is the ability to understand social clues such as recognising people's emotions and motives when talking to them. Difficulties in social cognition can affect social functioning. The latter is the ability to get along with others and engage in day-to-day activities such as getting a job.

New technologies like virtual reality (VR) and virtual worlds are an exciting new area of research with huge potential. VR therapies designed to improve social cognition and functioning can be delivered at a person's home. These therapies may help service users with psychosis overcome some of their anxieties about attending face-to-face therapy, at least in the initial stages.

VEEP | PARTICIPANT INFORMATION SHEET V.2 16/10/17 IRAS ID: 228308 1

WHAT IS THE PURPOSE OF THE STUDY?

"THE PURPOSE OF THIS STUDY IS TO TEST WHETHER WE CAN DELIVER THERAPY FOR EARLY PSYCHOSIS USING A VIRTUAL REALITY PLATFORM."

We will test if we can deliver a brief version of a therapy called Social Cognition and Interaction Training (SCIT). We will deliver the SCIT therapy using a commercial virtual reality platform which trademark name is Second Life®.

We would like to know if a small group of patients after a first episode of psychosis find this method of delivering therapy helpful and enjoyable.

SCIT is group psychotherapy for individuals with psychotic symptoms. It is a type of Cognitive Behavioural Therapy (CBT).

The purpose of this therapy is to help people gain skills to understand and respond to social situations. Situations like having conversations with family, friends, co-workers, and people in general. Teaching materials include slide presentations, videos, games, and group discussions.

WHAT WILL HAPPEN IF I TAKE PART?

Snapshot of a street in VEEP virtual world

If you decide to take part you will be asked to sign a consent form. See a step-by-step guide to the study in page 6. The study includes the following activities:

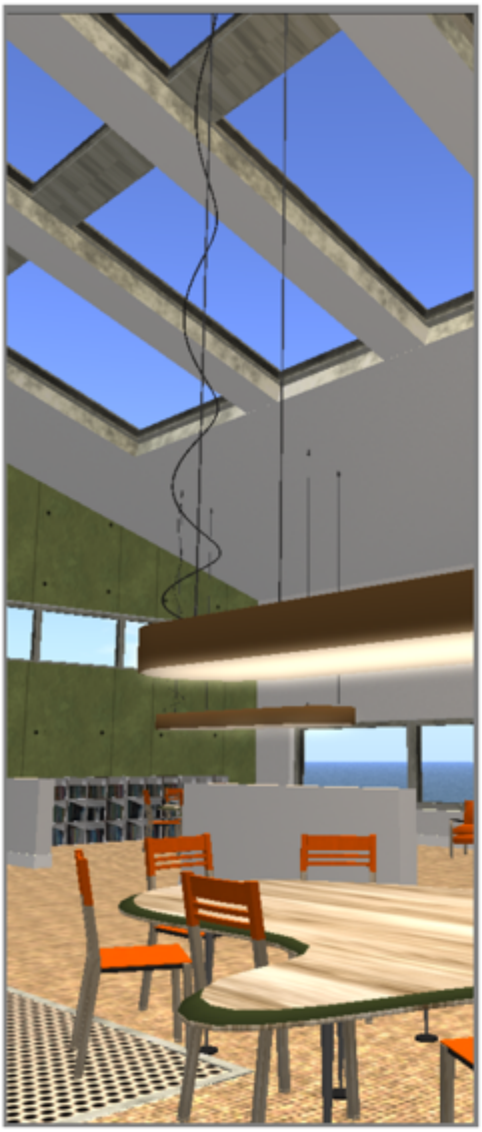
A researcher will ask you to complete a series of questionnaires and video tests. We will ask you about your condition, social life and every day activities.

We will test your abilities to understand different social situations. We will then be able to compare your results before and after therapy. The assessment will take one hour and a half to complete. You will receive a voucher worth £20 pounds for completing the initial assessment.

We will provide you with training and equipment to use the VR environment a week before. Researchers will check if your broadband is strong enough to connect to the online VR platform.

If required, we will give you a dongle to boost your Internet connection and a laptop. You will also receive a pair of headphones.

WHAT WILL HAPPEN IF I TAKE PART? [CONT.]



Snapshot of the library in VEEP virtual world

Researchers will assign you an Avatar. An avatar is a virtual representation of you and is required to attend the therapy sessions. They will also train you to use Second Life® and give you a walk-through of the VR environment.

Researchers will show you how to communicate with other avatars. We will give you instructions on how to keep safe and what to do if you are feeling unwell.

You will join a therapy group with three more people. The researcher will give you a time and date for the start of the therapy. You will then attend the group sessions from home on a date and time agreed.

You will meet the avatars of up to 3 young people and 2 therapists through Second Life® twice a week for four weeks. Each session will last between 30 and 45 minutes. We will send you a reminder the day before the session to your phone as well as one hour before each session.

You will be able to contact the therapist by phone if you have any problems connecting to Second Life® or attending the session.

WHAT WILL HAPPEN IF I TAKE PART? [CONT.]

A relaxing space in the VEEP virtual world

After eight sessions the research team will contact you to schedule another assessment.

Researchers will ask you to complete the same questionnaires and tests you completed at the start. You will receive a voucher worth £20 pounds for completing the final assessment.

If you like, we can provide you with the results of the questionnaires and tests at the end of the study.

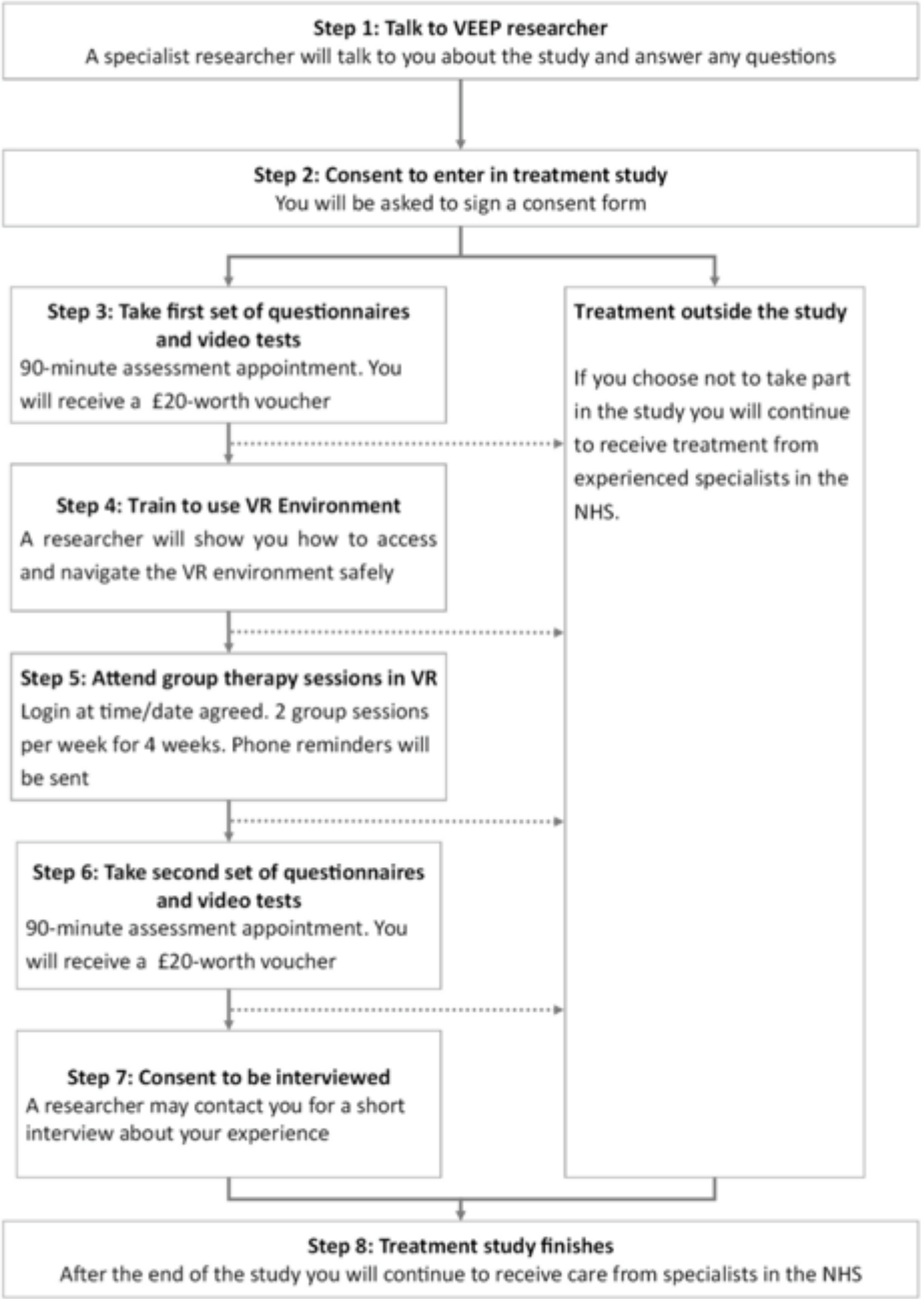
We will also invite 10 participants to an interview to talk about their experience in the study.

We will include young people that did not complete the eight sessions to capture a variety of views.

Researchers will ask you about your views of the delivery and content of the therapy and how it can be improved.

After the study you will continue under the care of your care coordinator and team.

STEP-BY-STEP GUIDE TO THE VEEP STUDY



Step 1: Talk to VEEP researcher
A specialist researcher will talk to you about the study and answer any questions

Step 2: Consent to enter in treatment study
You will be asked to sign a consent form

Step 3: Take first set of questionnaires and video tests
90-minute assessment appointment. You will receive a £20-worth voucher

Step 4: Train to use VR Environment
A researcher will show you how to access and navigate the VR environment safely

Step 5: Attend group therapy sessions in VR
Login at time/date agreed. 2 group sessions per week for 4 weeks. Phone reminders will be sent

Step 6: Take second set of questionnaires and video tests
90-minute assessment appointment. You will receive a £20-worth voucher

Step 7: Consent to be interviewed
A researcher may contact you for a short interview about your experience

Treatment outside the study

If you choose not to take part in the study you will continue to receive treatment from experienced specialists in the NHS.

Step 8: Treatment study finishes
After the end of the study you will continue to receive care from specialists in the NHS

WHAT ARE THE RISKS OF TAKING PART?

The treatment is designed to help you, but, this cannot be guaranteed. Participants will potentially share sensitive information during online therapy. This is because the virtual reality version of the SCIT therapy will be delivered in Second Life®, an online platform. We have taken steps to protect sensitive information to guarantee your safety and privacy (please see part 2 for more details).

Participants will share confidential information during assessments. Every effort will be made to preserve your confidential information. An identification number will be assigned to your questionnaires and test results. We will keep these separate from your personal information.

Participants may feel distress during assessments or therapy sessions. This is an expected reaction of being in therapy. Parts of the clinical assessment interview and therapy may be upsetting for some participants. The interview or participation in the study may be stopped. Consent may be withdrawn by either the researcher or participant at any time if is deemed too distressing for the participant.

We will ask for your permission to contact your care coordinators if we have concerns about your mental wellbeing.

A researcher will give you a call every week to ask how you are and liaise with your care coordinator in the event of you becoming distressed.

At the end of this information sheet you will find a list contact details for seeking help in a crisis (e.g. calling Crisisline, the Samaritans or go to A&E). This information will be also displayed in the VR environment in Second Life®.

But the VR environment is not an emergency tool, it is not monitored for 24 hours a day. Content in the VR environment is for information purposes only. The SCIT therapy is meant to help you self-manage.

Participants may lose connection during the therapy sessions.
To prevent lack of connection, we will assess your connectivity before starting therapy. A telephone line will be available to you one hour before each session and until the end of the session.

WHY HAVE I BEEN INVITED TO TAKE PART IN THE STUDY?

We have invited 20 patients to take part in the study. They are in a stable condition after having a first episode of psychosis. Your treating clinician has checked you are suitable for the study.

DO I HAVE TO TAKE PART?

It is up to you to decide whether or not to take part. If you do take part you can withdraw at any time and this will not affect the care you receive.

WHO HAS REVIEWED THIS PROJECT?

This study has been reviewed and approved by West Midlands Solihull Research Ethics Committee. Approval was granted on 3 November 2017.

WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

All information about you that we collect during the course of the research will be kept strictly confidential. We will not share information with anyone outside of your direct care team. Research data including your name and address will be sent to the University of Warwick.

This way research staff can stay in touch with you over the course of the eight months. All other information about you which leaves the hospital will have your name and address removed so that you cannot be recognised from it. If you agree, your GP and other doctors who may treat you, but are not part of this study, will be notified that you are taking part in this study.

WHAT ARE THE POSSIBLE BENEFITS OF TAKING PART?

SCIT is based on extensive work describing how paranoia starts and develops in people's minds. SCIT focuses on finding alternative responses to unhelpful behaviours.

Therapy will be an opportunity to improve skills and confidence in social situations. Using virtual reality to deliver therapy can improve reach and reduce treatment costs.

WHAT IF SOMETHING GOES WRONG?

This study is covered by the University of Warwick's insurance and indemnity cover. Any complaint about the way you have been dealt with during the study or any possible harm you might have suffered will be addressed. Please address your complaint to the person below, who is a senior University of Warwick official entirely independent of this study:

Deputy Director/ Head of Research Governance
Research & Impact Services
Address:
University House
University of Warwick
Coventry
CV4 8UW
Tel: 024 76 522746
Email:
researchgovernance@warwick.ac.uk

WHERE CAN I GET ADDITIONAL INFORMATION?

Our researchers and your care coordinator who can provide advice and guidance. Also our funders have published a brief description of this work in their website:

https://www.mqmentalhealth.org/research/profiles/virtual-reality-as-a-treatment-for-schizophrenia

This website provides useful information about mental health research in the UK.

For general advice and guidance for NHS, non-staff, participants:
Patient Advice and Liaison Service, PALS.

Local contact details can be found on https://www.covwarkpt.nhs.uk/patient-advice-liaison-service-pals

STUDY CONTACT

If you would like more information about the study, please contact the study coordinator:

Fiona Leahy
t. 02476 573855
e-mail: veep@warwick.ac.uk

PART II

HOW DO I GET ACCESS THE VIRTUAL REALITY ENVIRONMENT?
We will help you to download and install the Second Life® viewer in your computer. The Second Life® viewer is a free program (250 MB) by Linden Lab. The viewer gives you access to the Second Life® VR environment.

HOW SAFE IS THE VIRTUAL REALITY ENVIRONMENT?
To access the platform, you require an individual account and avatar as well as installing a Second Life® viewer in a computer device. We have taken the following steps to protect sensitive information during online therapy:

The research team will create accounts and avatars that will be assigned to you, we will not use your personal information to create these accounts or access Second Life®.

The Second Life® Viewer login uses password-only authentication over an encrypted secure HTTP connection. Linden Lab does not have access to the password itself.

We will carry out therapy sessions in a "Private Region". Only authorised accounts and avatars can enter. It is secure from eavesdropping. The Region is surrounded by an equivalent void space, represented by water; void space cannot be crossed by walking, running, flying, or by camera

MORE INFORMATION ABOUT HOW WE WILL MANAGE YOUR DATA IN THE VEEP STUDY

It is impossible to impersonate other clients or accounts, and multiple logins for the same account is restricted.

Linden Lab employees makes all efforts to only enter a region upon request. If an employee is in our area, the avatar name will show up in the attendee list; no one can go "invisible" in Second Life®.

The Second Life® viewer is the program that allows you to view the virtual world and interact with other avatars through text chat and voice chat.

Data transfers are secured by using standard security protocols (TLS). Voice, web, audio, and video streams do not pass through Linden Lab's servers; they are accessed directly by the Second Life® viewer. Linden Lab only retains data necessary to operate Second Life®.

Chat logs are stored for less than two weeks in the participants' computers, not in remote servers. Voice chat is not saved by servers or local device.

Text chat and voice chat are not currently encrypted but we will be in a private region that can only be access with permission.

WHAT IF NEW INFORMATION BECOMES AVAILABLE?

Sometimes during the course of a study, new information becomes available about the treatments that are being studied.

If this happens, someone from our research team will tell you about it and discuss with you whether you want to continue in the study.

If you decide to withdraw, you can discuss your continued care with your doctor or care coordinator. If you decide to continue in the study you might be asked to sign an updated consent form.

Also, on receiving new information, we might consider it to be in your best interests to withdraw you from the study. If this happens we will explain the reasons to you and arrange for your care to continue.

WHAT HAPPENS WHEN THE RESEARCH STUDY STOPS?

You will be in the study for eight weeks. Your care coordinator and care team will continue to provide support during and after the study has finished.

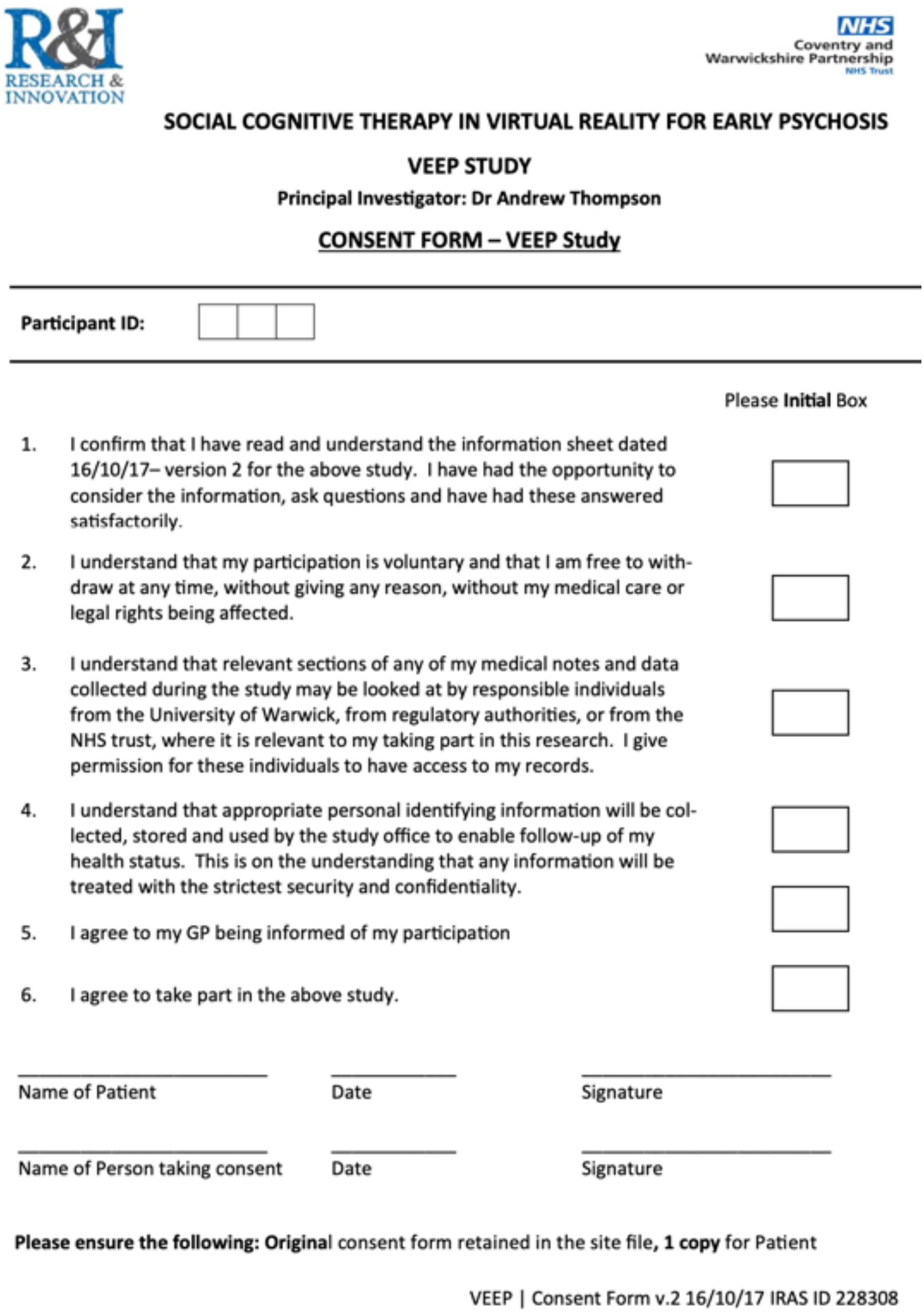
We will publish the findings in medical journals and at medical conferences. You will not be identified in any reports or publications resulting from the study. If you would like to obtain a copy of the published results please contact the study coordinator Alba Realpe by email: veep@warwick.ac.uk.

INFORMATION AND SUPPORT

AGENCY	OPENING TIMES	CONTACT DETAILS
MENTAL HEALTH MATTERS Provides emotional guidance and information.	24 hours	0800 616171 www.mentalhealthmatters.com
SAMARITANS A safe place to talk where calls are confidential.	24 hours	116 123 www.samaritans.org
CALM Specific for men. Emotional support and suicide prevention.	5 pm - 12 pm	0800 585858 www.thecalmzone.net
PAPYRUS UK charity dedicated to the young people suicide prevention.	Mon-Fri 10am-5pm 7-10pm Weekends 2-5pm.	0800 0684141 www.papyrus-uk.org
SANE Provides emotional guidance and information.	4:30 pm - 10:30 pm	0300 3047000 www.sane.org.uk
EMERGENCY GP APPOINTMENT Call your GP and request an urgent appointment	By appointment	Name: ____________________ Phone: ____________________
CALL 999 If you require urgent care and it is life-threatening	24 hours	0800 616171 www.mentalhealthmatters.com

INDIVIDUAL HELP	NAME & CONTACT NUMBER
People whom I can ask for help	Name: ____________________ Phone: ________________ Name: ____________________ Phone: ________________ Name: ____________________ Phone: ________________
Professionals or agencies I can contact during a crisis	Name: ____________________ Phone: ________________ Name: ____________________ Phone: ________________ Name: ____________________ Phone: ________________

Appendix 3 – VEEP participant consent form



R&I RESEARCH & INNOVATION

NHS Coventry and Warwickshire Partnership NHS Trust

SOCIAL COGNITIVE THERAPY IN VIRTUAL REALITY FOR EARLY PSYCHOSIS

VEEP STUDY

Principal Investigator: Dr Andrew Thompson

CONSENT FORM – VEEP Study

Participant ID: ☐☐☐

Please **Initial** Box

1. I confirm that I have read and understand the information sheet dated 16/10/17– version 2 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐
3. I understand that relevant sections of any of my medical notes and data collected during the study may be looked at by responsible individuals from the University of Warwick, from regulatory authorities, or from the NHS trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. ☐
4. I understand that appropriate personal identifying information will be collected, stored and used by the study office to enable follow-up of my health status. This is on the understanding that any information will be treated with the strictest security and confidentiality. ☐
5. I agree to my GP being informed of my participation ☐
6. I agree to take part in the above study. ☐

______________________	__________	______________________
Name of Patient	Date	Signature
______________________	__________	______________________
Name of Person taking consent	Date	Signature

Please ensure the following: Original consent form retained in the site file, **1 copy** for Patient

VEEP | Consent Form v.2 16/10/17 IRAS ID 228308

Appendix 4 – VEEP participant feedback form

Session 1: Participant Feedback

Hello!

Now you have completed **Session 1** of the Social Cognition and Interaction Training in Virtual Reality (SCIT-VR), we would like to know what you thought of the session's content and delivery. There are only 6 questions!

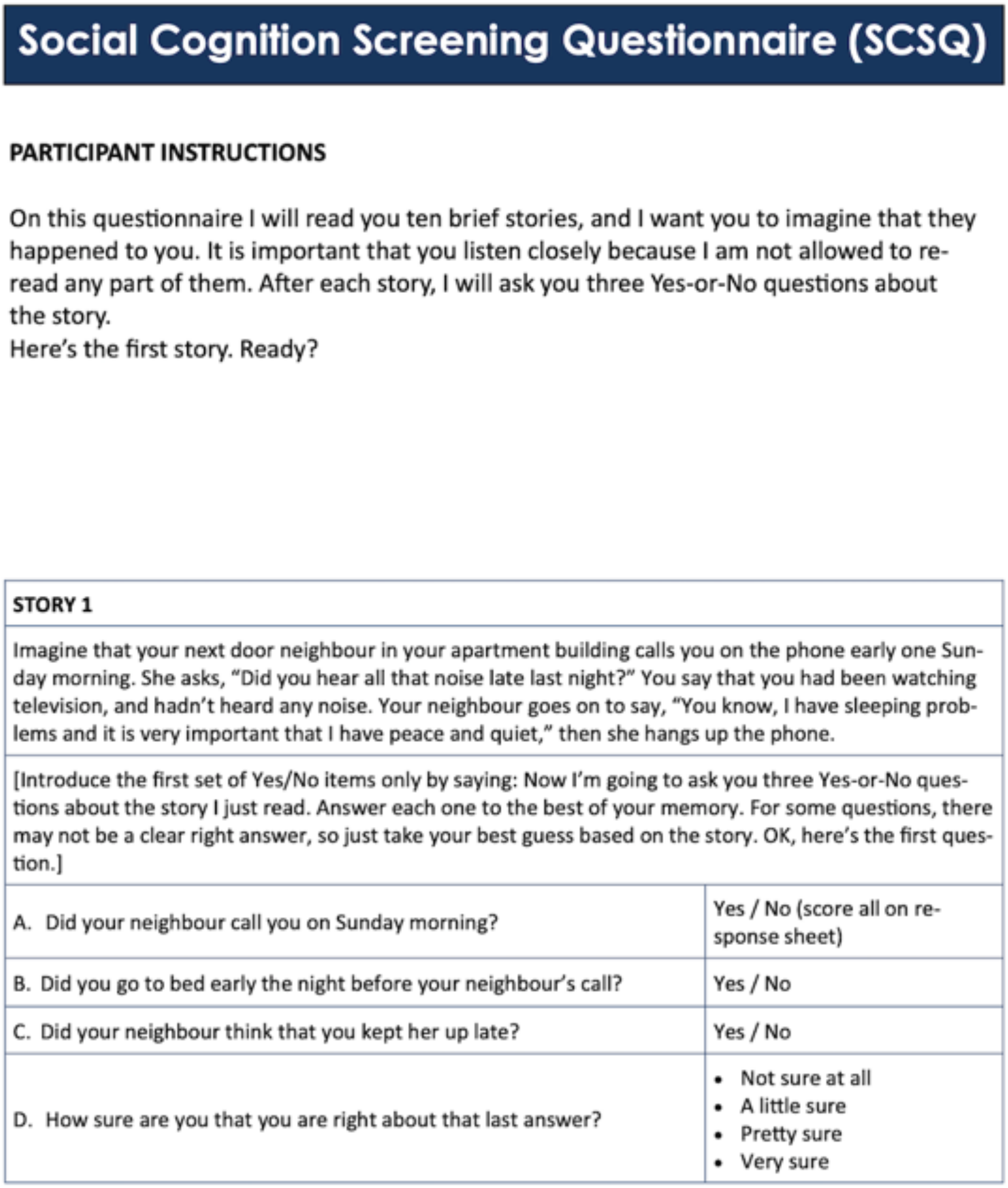
Please score each aspect of the session using the following:

5 star ☆ ☆ ☆ ☆ ☆ = Excellent
4 star ☆ ☆ ☆ ☆ = Good
3 star ☆ ☆ ☆ = Fair
2 star ☆ ☆ = Poor
1 star ☆ = Very poor

Questions:

1. Suitable level of content (e.g. easy to understand)
2. Relevance and value of the content
3. Guidance from the therapist
4. Encouragement to participate and interact
5. Safety of the VR world

Appendix 5 – social cognition screening questionnaire (SCSQ)



Social Cognition Screening Questionnaire (SCSQ)

PARTICIPANT INSTRUCTIONS

On this questionnaire I will read you ten brief stories, and I want you to imagine that they happened to you. It is important that you listen closely because I am not allowed to re-read any part of them. After each story, I will ask you three Yes-or-No questions about the story.
Here's the first story. Ready?

STORY 1	
Imagine that your next door neighbour in your apartment building calls you on the phone early one Sunday morning. She asks, "Did you hear all that noise late last night?" You say that you had been watching television, and hadn't heard any noise. Your neighbour goes on to say, "You know, I have sleeping problems and it is very important that I have peace and quiet," then she hangs up the phone.	
[Introduce the first set of Yes/No items only by saying: Now I'm going to ask you three Yes-or-No questions about the story I just read. Answer each one to the best of your memory. For some questions, there may not be a clear right answer, so just take your best guess based on the story. OK, here's the first question.]	
A. Did your neighbour call you on Sunday morning?	Yes / No (score all on response sheet)
B. Did you go to bed early the night before your neighbour's call?	Yes / No
C. Did your neighbour think that you kept her up late?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure

Social Cognition Screening Questionnaire (SCSQ)

STORY 2

Imagine that you are looking for a job. Your friend tells you that the new restaurant across the street from the police station is hiring. You call the restaurant to set up a job interview. The manager says, "I can squeeze you in tomorrow at 4:45, before the big dinner rush." The next day, the bus is late, and you don't arrive at the restaurant until 5. The manager says, "I'm not going to interview you now." He walks past you and goes into the kitchen. You took the bus all the way to the restaurant for nothing.

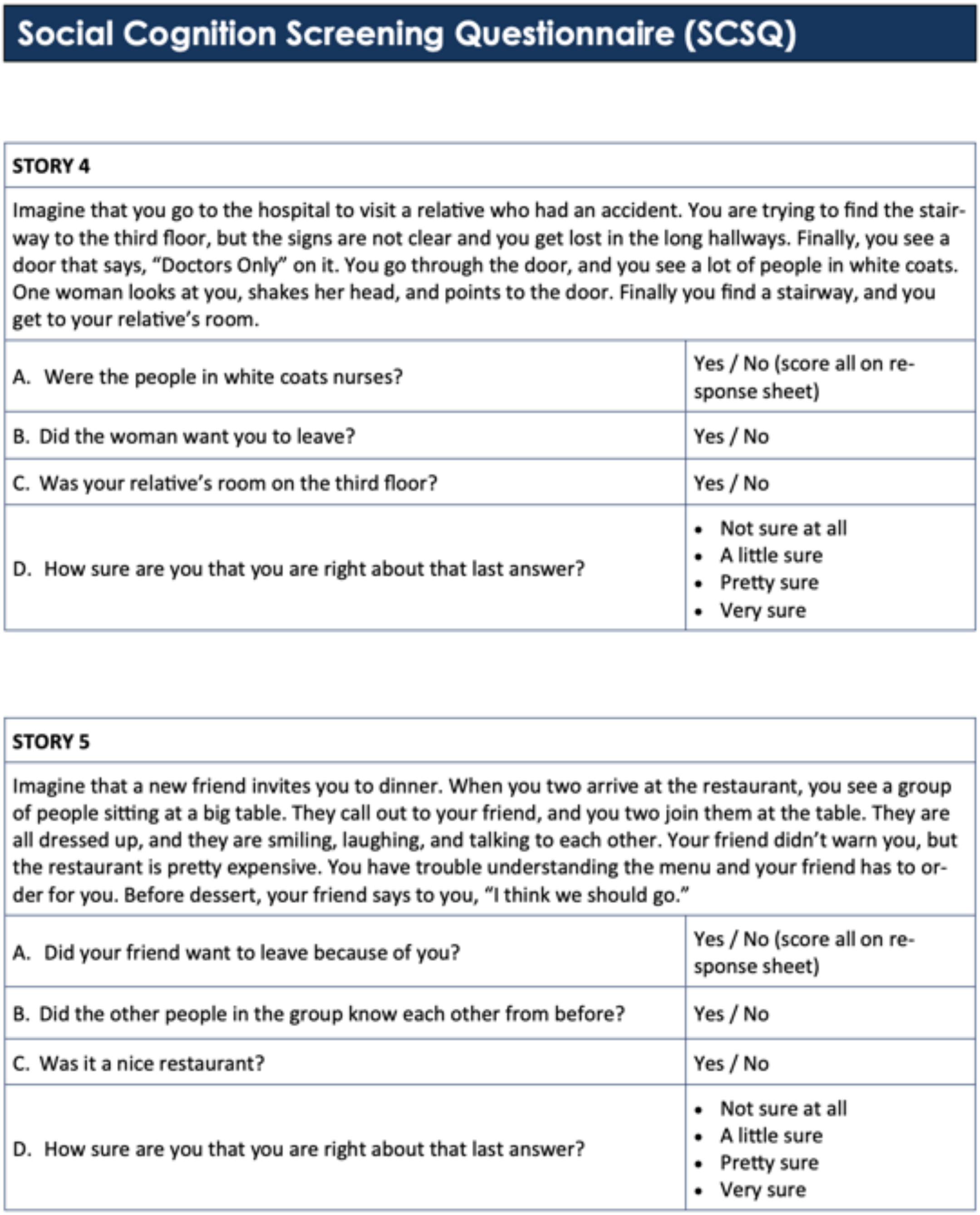
[Here, and for the remainder of the vignettes, say: OK, now here are the three Yes-or-No questions about the story. Ready?]

A. Is the restaurant next door to the police station?	Yes / No (score all on response sheet)
B. Is it a popular restaurant?	Yes / No
C. Was the manager trying to be rude to you?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure

STORY 3

Imagine that one night you accidentally cook too much spaghetti and tomato sauce for dinner. You decide to call your friend and invite him/her to come over and eat with you. S/he doesn't answer the phone, so you leave a message. You wait around until the food is cold, but your friend never shows up for dinner. Finally, you eat cold noodles and then go out for a walk. While walking, you see your friend come out of a movie theatre with another person, smiling and laughing. When they see you, your friend looks surprised.

A. Did you eat dinner early that night?	Yes / No (score all on response sheet)
B. Was your friend hoping that you would not see them at the movie theatre?	Yes / No
C. Did you make pizza for dinner?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure



Social Cognition Screening Questionnaire (SCSQ)

STORY 4	
Imagine that you go to the hospital to visit a relative who had an accident. You are trying to find the stairway to the third floor, but the signs are not clear and you get lost in the long hallways. Finally, you see a door that says, "Doctors Only" on it. You go through the door, and you see a lot of people in white coats. One woman looks at you, shakes her head, and points to the door. Finally you find a stairway, and you get to your relative's room.	
A. Were the people in white coats nurses?	Yes / No (score all on response sheet)
B. Did the woman want you to leave?	Yes / No
C. Was your relative's room on the third floor?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure

STORY 5	
Imagine that a new friend invites you to dinner. When you two arrive at the restaurant, you see a group of people sitting at a big table. They call out to your friend, and you two join them at the table. They are all dressed up, and they are smiling, laughing, and talking to each other. Your friend didn't warn you, but the restaurant is pretty expensive. You have trouble understanding the menu and your friend has to order for you. Before dessert, your friend says to you, "I think we should go."	
A. Did your friend want to leave because of you?	Yes / No (score all on response sheet)
B. Did the other people in the group know each other from before?	Yes / No
C. Was it a nice restaurant?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure

Social Cognition Screening Questionnaire (SCSQ)

STORY 6

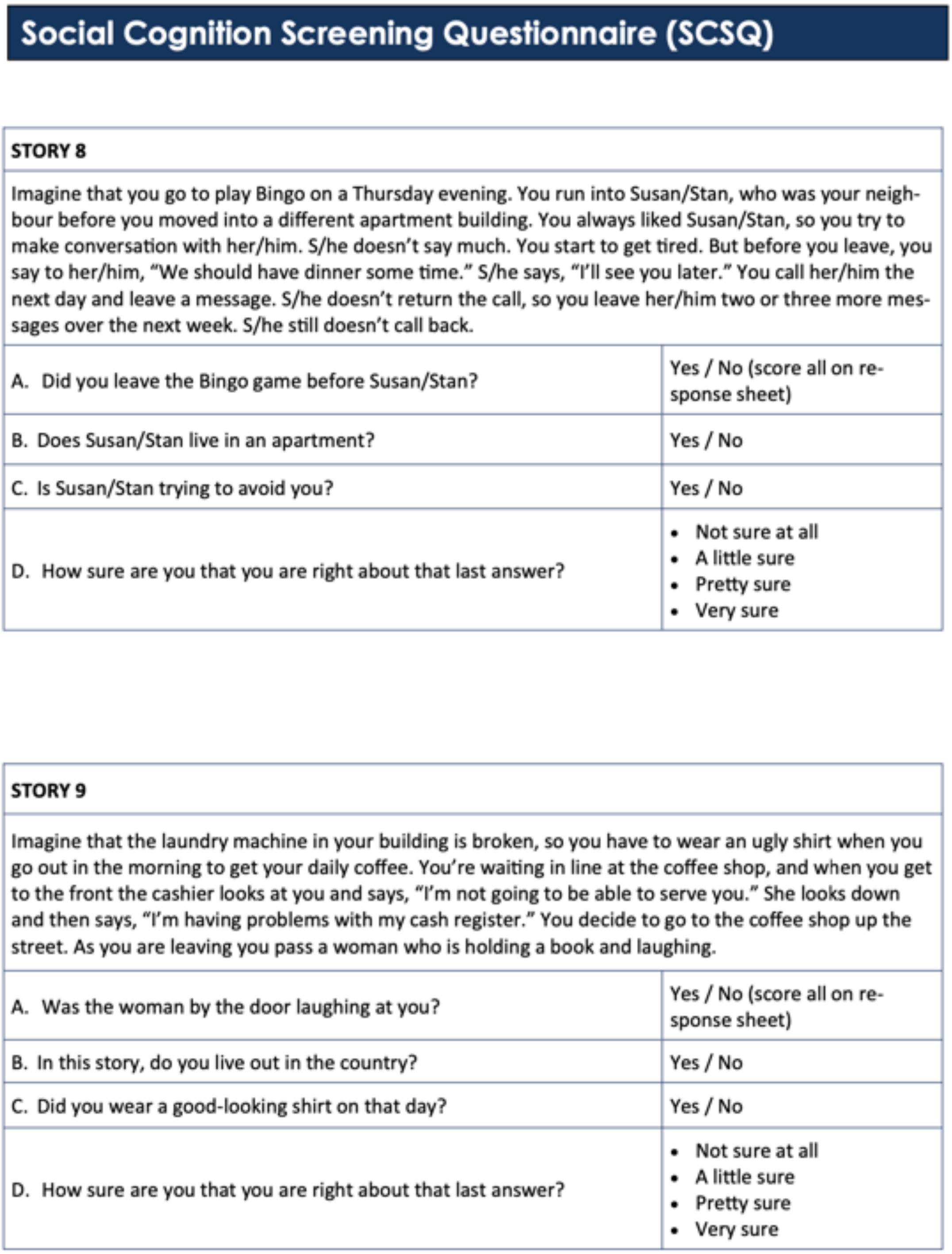
Imagine that you go to a convenience store to buy some toothpaste. There is a long line, and when you get to the front, there is just one employee, working fast. Your toothpaste costs $2. You give the cashier a $10 bill, and she gives you back $3, then says, "Who's next?" When you get outside, you realize that she short changed you. She should have given you $8 in change, but she only gave you $3.

A. Did the cashier short-change you by accident?	Yes / No (score all on response sheet)
B. Did you buy hand lotion in the store?	Yes / No
C. Was it busy at the convenience store?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure

STORY 7

Imagine that it is a rainy day. You go to the library to look through some food magazines. You find the magazines, but there aren't many places left to sit. The only chair you can find is at a table covered with stacks of sports books. You sit down anyway. Then a stranger walks up to you and says, "Hey, didn't you see the books on the table?" He stares at you, shakes his head, and then walks away. You spend the rest of the afternoon looking at your magazines.

A. Was the library busy that day?	Yes / No (score all on response sheet)
B. Were you looking for magazines about food?	Yes / No
C. Was the stranger upset with you?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure



Social Cognition Screening Questionnaire (SCSQ)

STORY 8

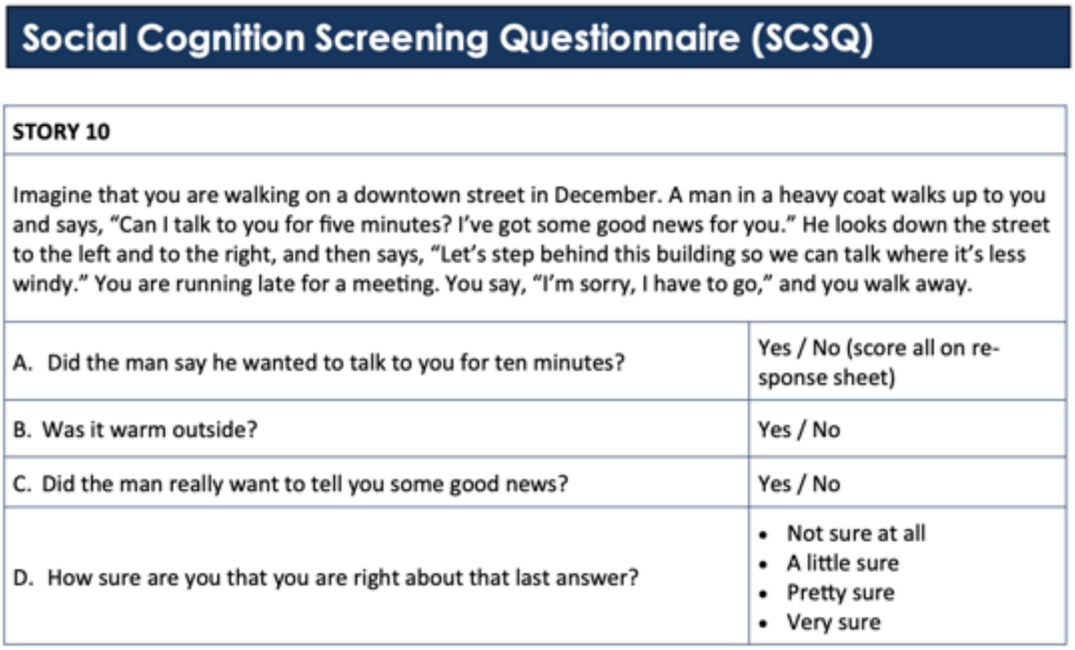
Imagine that you go to play Bingo on a Thursday evening. You run into Susan/Stan, who was your neighbour before you moved into a different apartment building. You always liked Susan/Stan, so you try to make conversation with her/him. S/he doesn't say much. You start to get tired. But before you leave, you say to her/him, "We should have dinner some time." S/he says, "I'll see you later." You call her/him the next day and leave a message. S/he doesn't return the call, so you leave her/him two or three more messages over the next week. S/he still doesn't call back.

A. Did you leave the Bingo game before Susan/Stan?	Yes / No (score all on response sheet)
B. Does Susan/Stan live in an apartment?	Yes / No
C. Is Susan/Stan trying to avoid you?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure

STORY 9

Imagine that the laundry machine in your building is broken, so you have to wear an ugly shirt when you go out in the morning to get your daily coffee. You're waiting in line at the coffee shop, and when you get to the front the cashier looks at you and says, "I'm not going to be able to serve you." She looks down and then says, "I'm having problems with my cash register." You decide to go to the coffee shop up the street. As you are leaving you pass a woman who is holding a book and laughing.

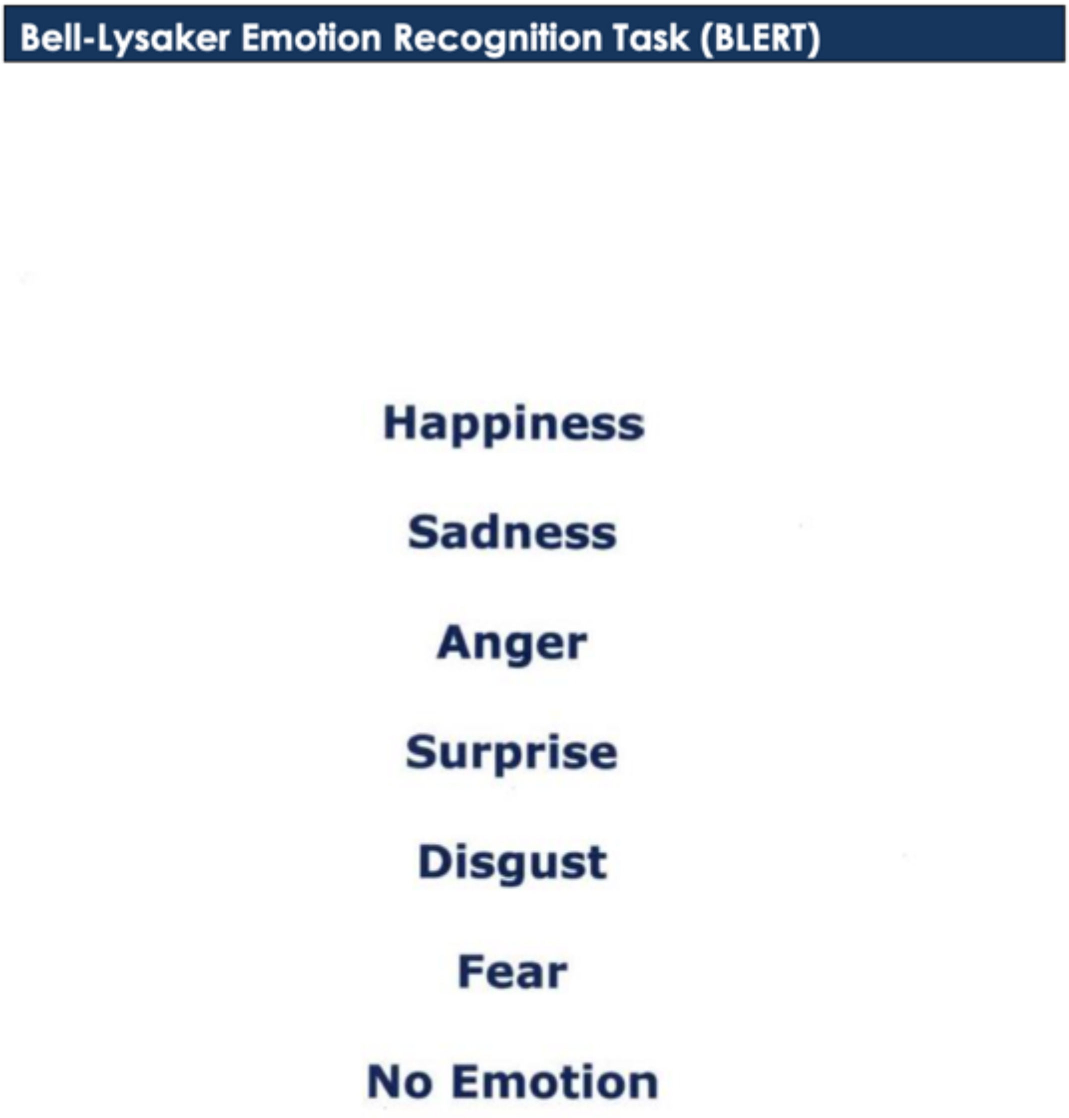
A. Was the woman by the door laughing at you?	Yes / No (score all on response sheet)
B. In this story, do you live out in the country?	Yes / No
C. Did you wear a good-looking shirt on that day?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure



Social Cognition Screening Questionnaire (SCSQ)

STORY 10	
Imagine that you are walking on a downtown street in December. A man in a heavy coat walks up to you and says, “Can I talk to you for five minutes? I’ve got some good news for you.” He looks down the street to the left and to the right, and then says, “Let’s step behind this building so we can talk where it’s less windy.” You are running late for a meeting. You say, “I’m sorry, I have to go,” and you walk away.	
A. Did the man say he wanted to talk to you for ten minutes?	Yes / No (score all on response sheet)
B. Was it warm outside?	Yes / No
C. Did the man really want to tell you some good news?	Yes / No
D. How sure are you that you are right about that last answer?	• Not sure at all • A little sure • Pretty sure • Very sure

Appendix 6– bell-lysaker emotion recognition task (BLERT)



Bell-Lysaker Emotion Recognition Task (BLERT)

Happiness

Sadness

Anger

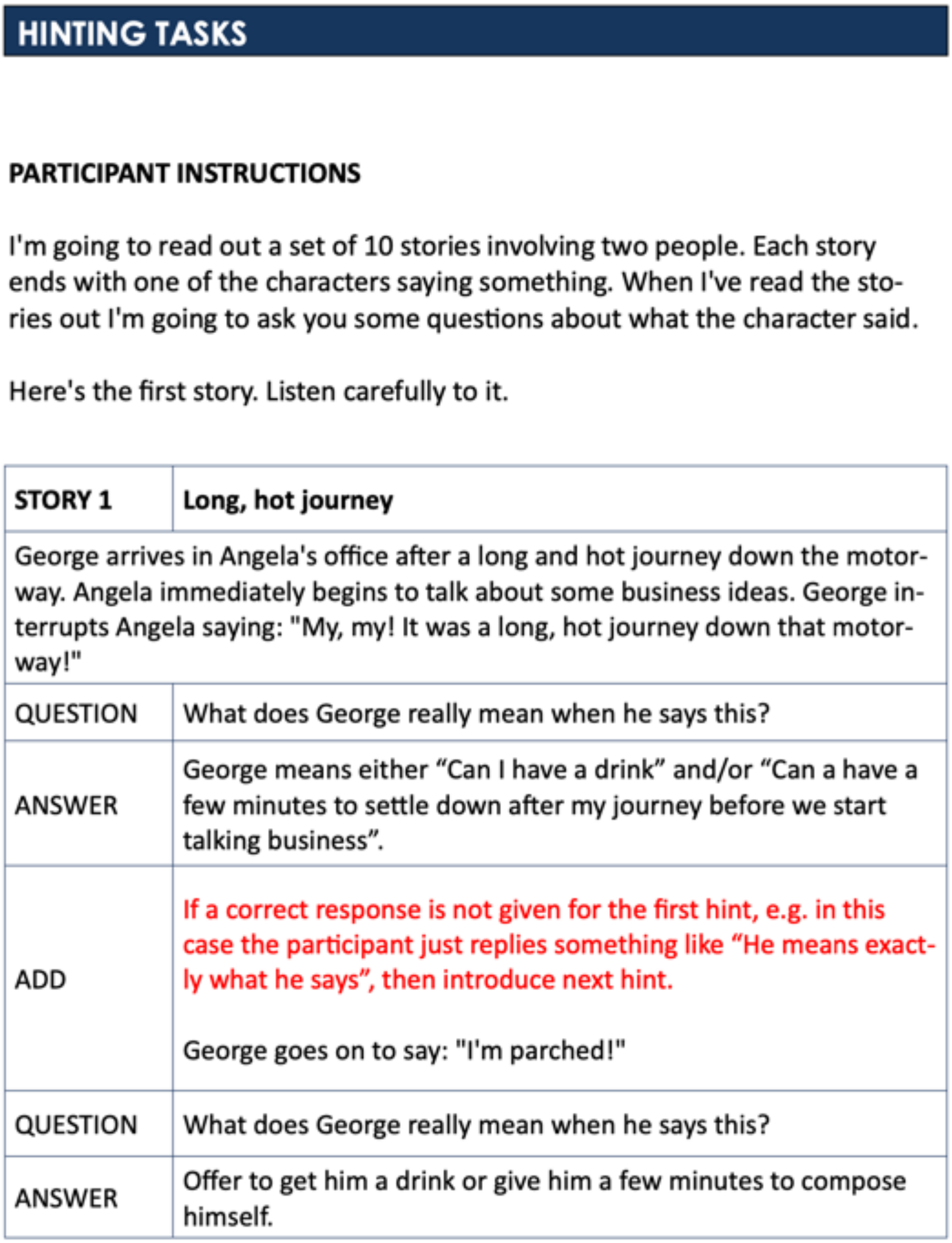
Surprise

Disgust

Fear

No Emotion

Appendix 7 – hinting tasks



HINTING TASKS

PARTICIPANT INSTRUCTIONS

I'm going to read out a set of 10 stories involving two people. Each story ends with one of the characters saying something. When I've read the stories out I'm going to ask you some questions about what the character said.

Here's the first story. Listen carefully to it.

STORY 1	**Long, hot journey**
George arrives in Angela's office after a long and hot journey down the motorway. Angela immediately begins to talk about some business ideas. George interrupts Angela saying: "My, my! It was a long, hot journey down that motorway!"	
QUESTION	What does George really mean when he says this?
ANSWER	George means either "Can I have a drink" and/or "Can a have a few minutes to settle down after my journey before we start talking business".
ADD	If a correct response is not given for the first hint, e.g. in this case the participant just replies something like "He means exactly what he says", then introduce next hint. George goes on to say: "I'm parched!"
QUESTION	What does George really mean when he says this?
ANSWER	Offer to get him a drink or give him a few minutes to compose himself.

HINTING TASKS

STORY 2	**Dirty bath**
Melissa goes to the bathroom for a shower. Anne has just had a bath. Melissa notices the bath is dirty so she calls upstairs to Anne: "Couldn't you find the Ajax, Anne?"	
QUESTION	What does Melissa really mean when she says this?
ANSWER	Melissa means “Why didn’t you clean out the bath” or “Go and clean out the bath now”.
ADD	If a correct response is not given for the first hint, then introduce next hint. Melissa goes on to say: "You're very lazy sometimes, Anne!"
QUESTION	What does Melissa want Anne to do?
ANSWER	Clean out the bath.

STORY 3	**Treacle toffees**
Gordon goes to the supermarket with his mum. They arrive at the sweets aisle. Gordon says: "Cor! Those treacle toffees look delicious."	
QUESTION	What does Gordon really mean when he says this?
ANSWER	Gordon means “Please buy me some sweets, mum”
ADD	If a correct response is not given for the first hint, then introduce next hint. Gordon goes on to say: "I'm hungry, mum."
QUESTION	What does Gordon want his mum to do?
ANSWER	Buy him some sweets.

HINTING TASKS

STORY 4	**Creased shirt**
Paul has to go to an interview and he's running late. While he is cleaning his shoes, he says to his wife, Jane: "I want to wear that blue shirt but it's very creased."	
QUESTION	What does Paul really mean when he says this?
ANSWER	Paul means "Will you iron my shirt for me please?"
ADD	If a correct response is not given for the first hint, then introduce next hint. Paul goes on to say: "It's in the ironing basket."
QUESTION	What does Paul want Jane to do?
ANSWER	Iron his shirt.

STORY 5	**Flat broke!**
Lucy is broke but she wants to go out in the evening. She knows that David has just been paid. She says to him: "I'm flat broke! Things are so expensive these days."	
QUESTION	What does Lucy really mean when she says this?
ANSWER	Lucy means "Will you lend me some money David ?" OR "Will you take me out tonight and pay?"
ADD	If a correct response is not given for the first hint, then introduce next hint. Lucy goes on to say: "Oh well, I suppose I'll have to miss my night out."
QUESTION	What does Lucy want David to do?
ANSWER	She wants David to lend her money or offer to take her out and pay.

HINTING TASKS

STORY 6	**Project at work**
Donald wants to run a project at work but Richard, his boss, has asked someone else to run it. Donald says: "What a pity. I'm not too busy at the moment."	
QUESTION	What does Donald really mean when he says this?
ANSWER	Donald means: "Please change your mind Richard and give the project to me".
ADD	If a correct response is not given for the first hint, then introduce next hint. Donald goes on to say: "That project is right up my street."
QUESTION	What does Donald want Richard to do?
ANSWER	Change his mind and give the project to him to run.

STORY 7	**Birthday present**
Rebecca's birthday is approaching. She says to her Dad: "I love animals, especially dogs."	
QUESTION	What does Rebecca really mean when she says this?
ANSWER	"Will you buy me a dog for my birthday Dad?"
ADD	If a correct response is not given for the first hint, then introduce next hint. Rebecca goes on to say: "Will the pet shop be open on my birthday, Dad?"
QUESTION	What does Rebecca want her dad to do?
ANSWER	To say he'll buy her a dog for her birthday/ buy her a dog for her birthday.

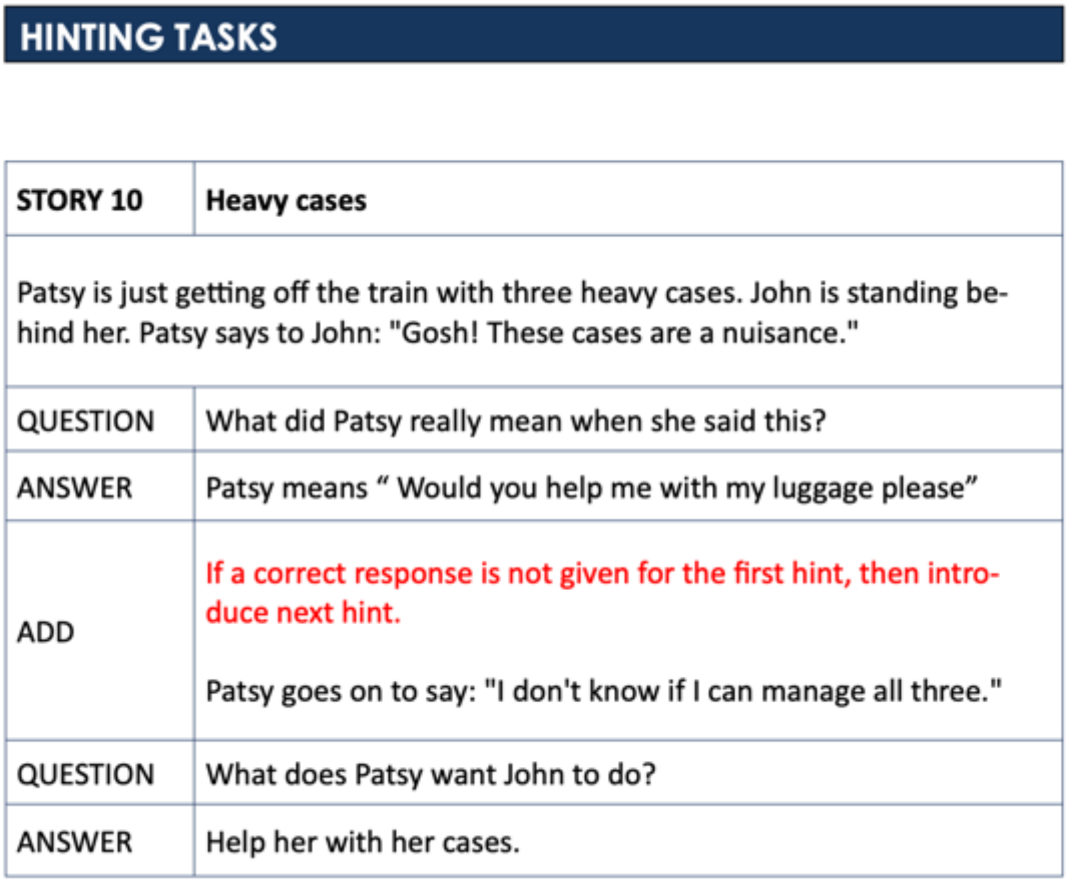
HINTING TASKS

<table>
<tr><th>STORY 8</th><th>Ornaments</th></tr>
<tr><td colspan="2">Betty and Michael moved into their new house a week ago. Betty has been unpacking some ornaments. She says to Michael: “Have you unpacked those shelves we bought, Michael?"</td></tr>
<tr><td>QUESTION</td><td>What does Betty really mean when she says this?</td></tr>
<tr><td>ANSWER</td><td>Betty means “Will you put those shelves up now please?”</td></tr>
<tr><td>ADD</td><td>If a correct response is not given for the first hint, then introduce next hint.

Betty goes on to say: "If you want something doing you have to do it yourself!"</td></tr>
<tr><td>QUESTION</td><td>What does Betty want Michael to do?</td></tr>
<tr><td>ANSWER</td><td>Put the shelves up.</td></tr>
</table>

<table>
<tr><th>STORY 9</th><th>Train set</th></tr>
<tr><td colspan="2">Jessica and Max are playing with a train set. Jessica has the blue train and Max has the red one. Jessica says to Max: "I don't like this train."</td></tr>
<tr><td>QUESTION</td><td>What does Jessica really mean when she says this?</td></tr>
<tr><td>ANSWER</td><td>Jessica means “I want your train and you can have mine.”</td></tr>
<tr><td>ADD</td><td>If a correct response is not given for the first hint, then introduce next hint.

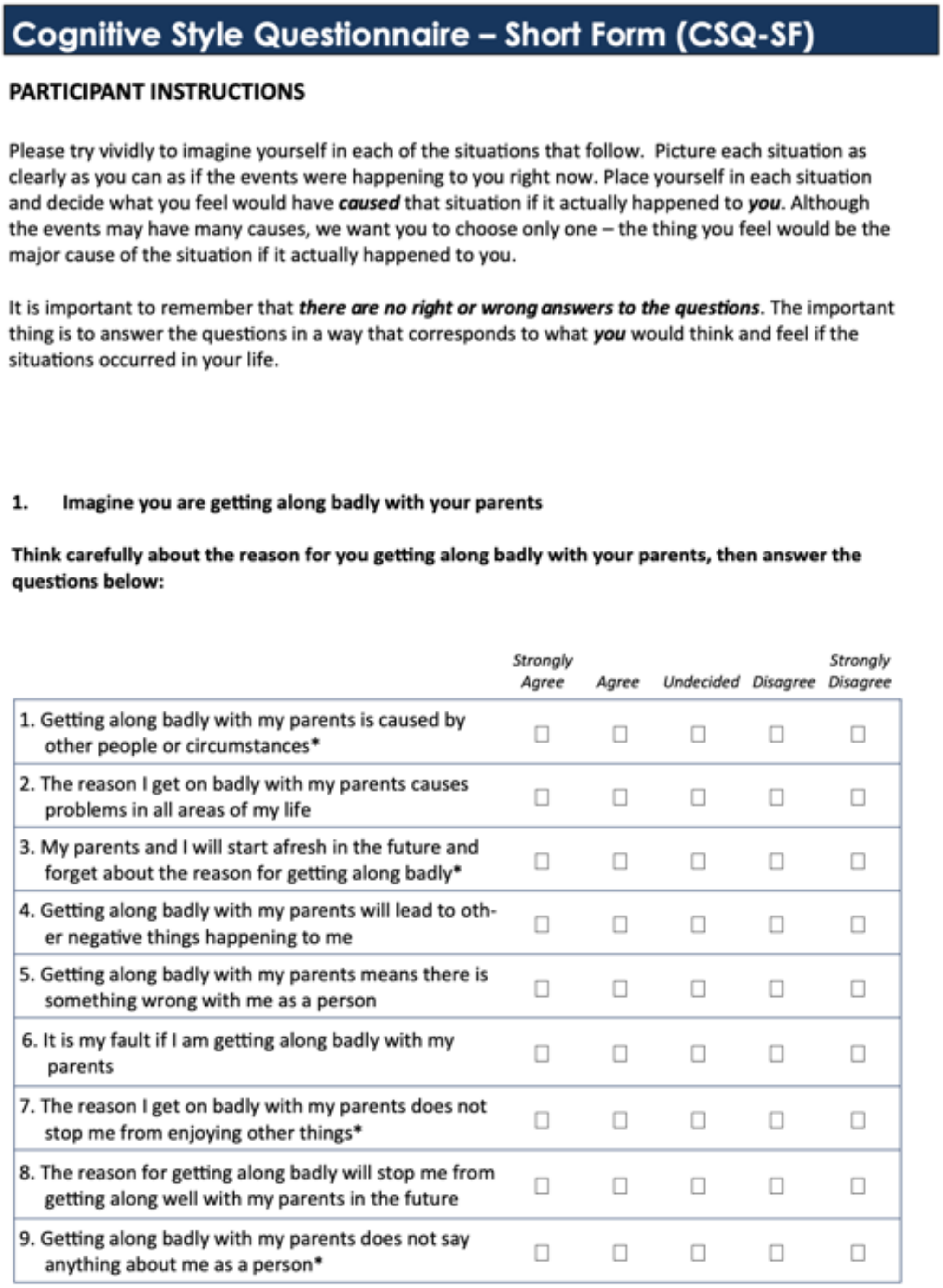
Jessica goes on to say: "Red is my favourite colour."</td></tr>
<tr><td>QUESTION</td><td>What does Jessica want Max to do?</td></tr>
<tr><td>ANSWER</td><td>Swap trains.</td></tr>
</table>



HINTING TASKS

STORY 10	**Heavy cases**
Patsy is just getting off the train with three heavy cases. John is standing behind her. Patsy says to John: "Gosh! These cases are a nuisance."	
QUESTION	What did Patsy really mean when she said this?
ANSWER	Patsy means " Would you help me with my luggage please"
ADD	If a correct response is not given for the first hint, then introduce next hint. Patsy goes on to say: "I don't know if I can manage all three."
QUESTION	What does Patsy want John to do?
ANSWER	Help her with her cases.

Appendix 8 – cognitive style questionnaire – short form (CSQ-SF)



Cognitive Style Questionnaire – Short Form (CSQ-SF)

PARTICIPANT INSTRUCTIONS

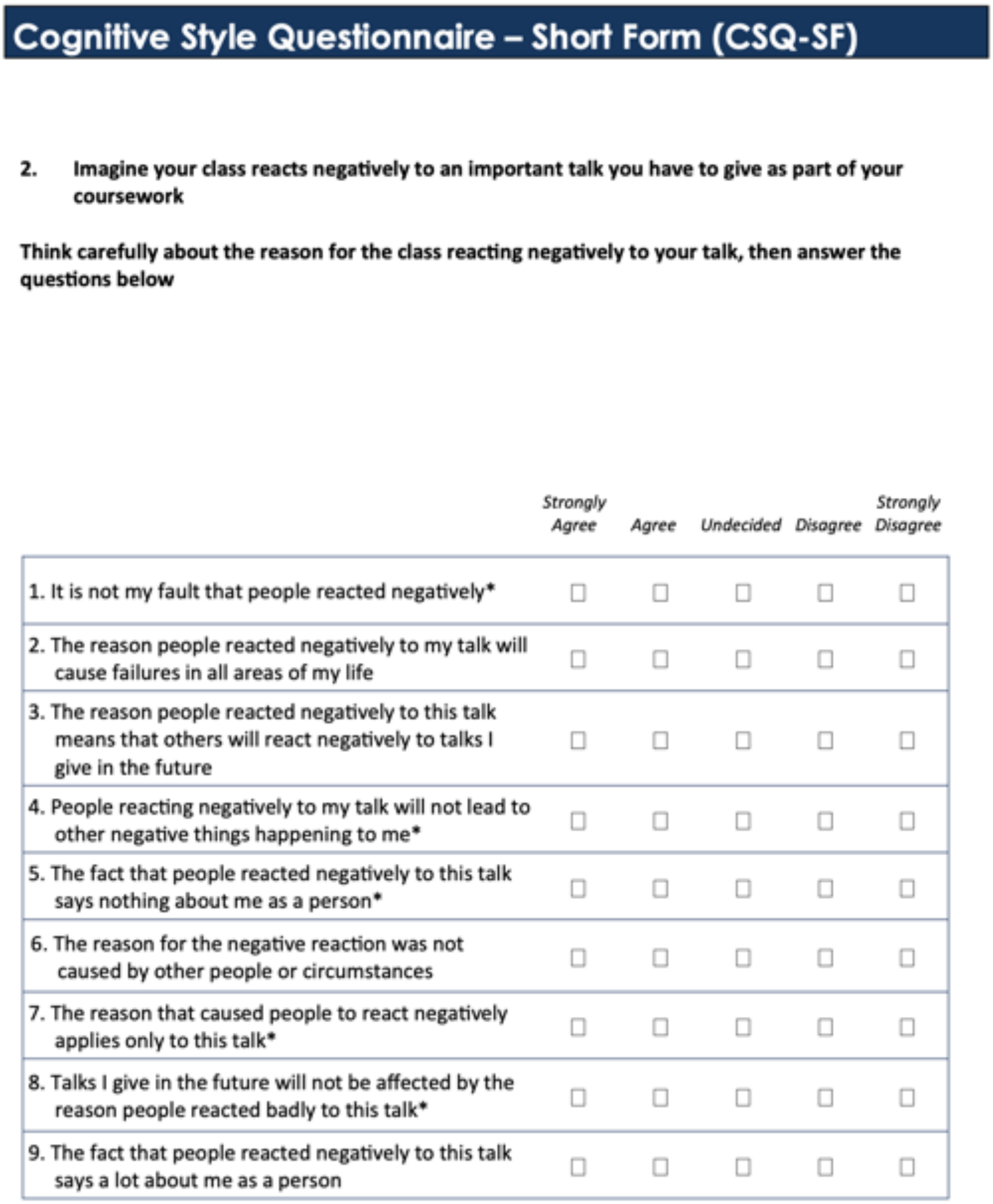
Please try vividly to imagine yourself in each of the situations that follow. Picture each situation as clearly as you can as if the events were happening to you right now. Place yourself in each situation and decide what you feel would have ***caused*** that situation if it actually happened to ***you***. Although the events may have many causes, we want you to choose only one – the thing you feel would be the major cause of the situation if it actually happened to you.

It is important to remember that ***there are no right or wrong answers to the questions***. The important thing is to answer the questions in a way that corresponds to what ***you*** would think and feel if the situations occurred in your life.

1. Imagine you are getting along badly with your parents

Think carefully about the reason for you getting along badly with your parents, then answer the questions below:

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. Getting along badly with my parents is caused by other people or circumstances*	☐	☐	☐	☐	☐
2. The reason I get on badly with my parents causes problems in all areas of my life	☐	☐	☐	☐	☐
3. My parents and I will start afresh in the future and forget about the reason for getting along badly*	☐	☐	☐	☐	☐
4. Getting along badly with my parents will lead to other negative things happening to me	☐	☐	☐	☐	☐
5. Getting along badly with my parents means there is something wrong with me as a person	☐	☐	☐	☐	☐
6. It is my fault if I am getting along badly with my parents	☐	☐	☐	☐	☐
7. The reason I get on badly with my parents does not stop me from enjoying other things*	☐	☐	☐	☐	☐
8. The reason for getting along badly will stop me from getting along well with my parents in the future	☐	☐	☐	☐	☐
9. Getting along badly with my parents does not say anything about me as a person*	☐	☐	☐	☐	☐



Cognitive Style Questionnaire – Short Form (CSQ-SF)

2. Imagine your class reacts negatively to an important talk you have to give as part of your coursework

Think carefully about the reason for the class reacting negatively to your talk, then answer the questions below

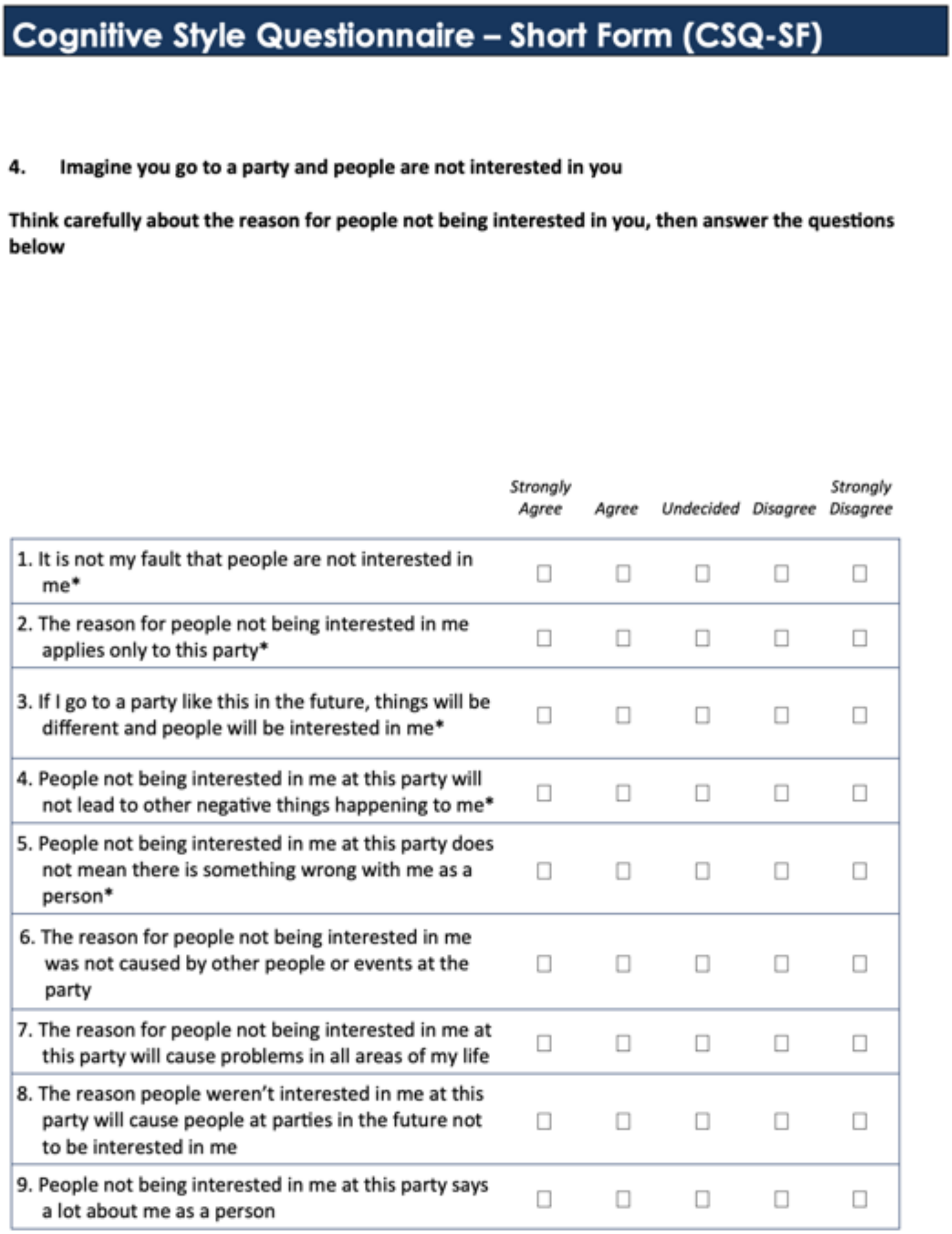
	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. It is not my fault that people reacted negatively*	☐	☐	☐	☐	☐
2. The reason people reacted negatively to my talk will cause failures in all areas of my life	☐	☐	☐	☐	☐
3. The reason people reacted negatively to this talk means that others will react negatively to talks I give in the future	☐	☐	☐	☐	☐
4. People reacting negatively to my talk will not lead to other negative things happening to me*	☐	☐	☐	☐	☐
5. The fact that people reacted negatively to this talk says nothing about me as a person*	☐	☐	☐	☐	☐
6. The reason for the negative reaction was not caused by other people or circumstances	☐	☐	☐	☐	☐
7. The reason that caused people to react negatively applies only to this talk*	☐	☐	☐	☐	☐
8. Talks I give in the future will not be affected by the reason people reacted badly to this talk*	☐	☐	☐	☐	☐
9. The fact that people reacted negatively to this talk says a lot about me as a person	☐	☐	☐	☐	☐

Cognitive Style Questionnaire – Short Form (CSQ-SF)

3. Imagine that during the first year of working in the career of your choice, you receive a negative evaluation of your job performance

Think carefully about the reason for you getting a negative evaluation, then answer the questions below

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. Other people or circumstances did not cause me to get a negative evaluation	☐	☐	☐	☐	☐
2. The reason I got a negative evaluation applies only to this judgement about my job performance*	☐	☐	☐	☐	☐
3. My job evaluations in the future will be affected by the same reason that caused this negative evaluation	☐	☐	☐	☐	☐
4. This negative evaluation will lead to other negative things happening to me	☐	☐	☐	☐	☐
5. This negative evaluation means there is something wrong with me as a person	☐	☐	☐	☐	☐
6. It is my fault that I got this negative evaluation	☐	☐	☐	☐	☐
7. The reason for getting this negative evaluation will not cause failures in all areas of my life*	☐	☐	☐	☐	☐
8. The reason for this negative evaluation will not impact on my future job evaluations*	☐	☐	☐	☐	☐
9. The fact that I got a negative evaluation says nothing about me as a person*	☐	☐	☐	☐	☐

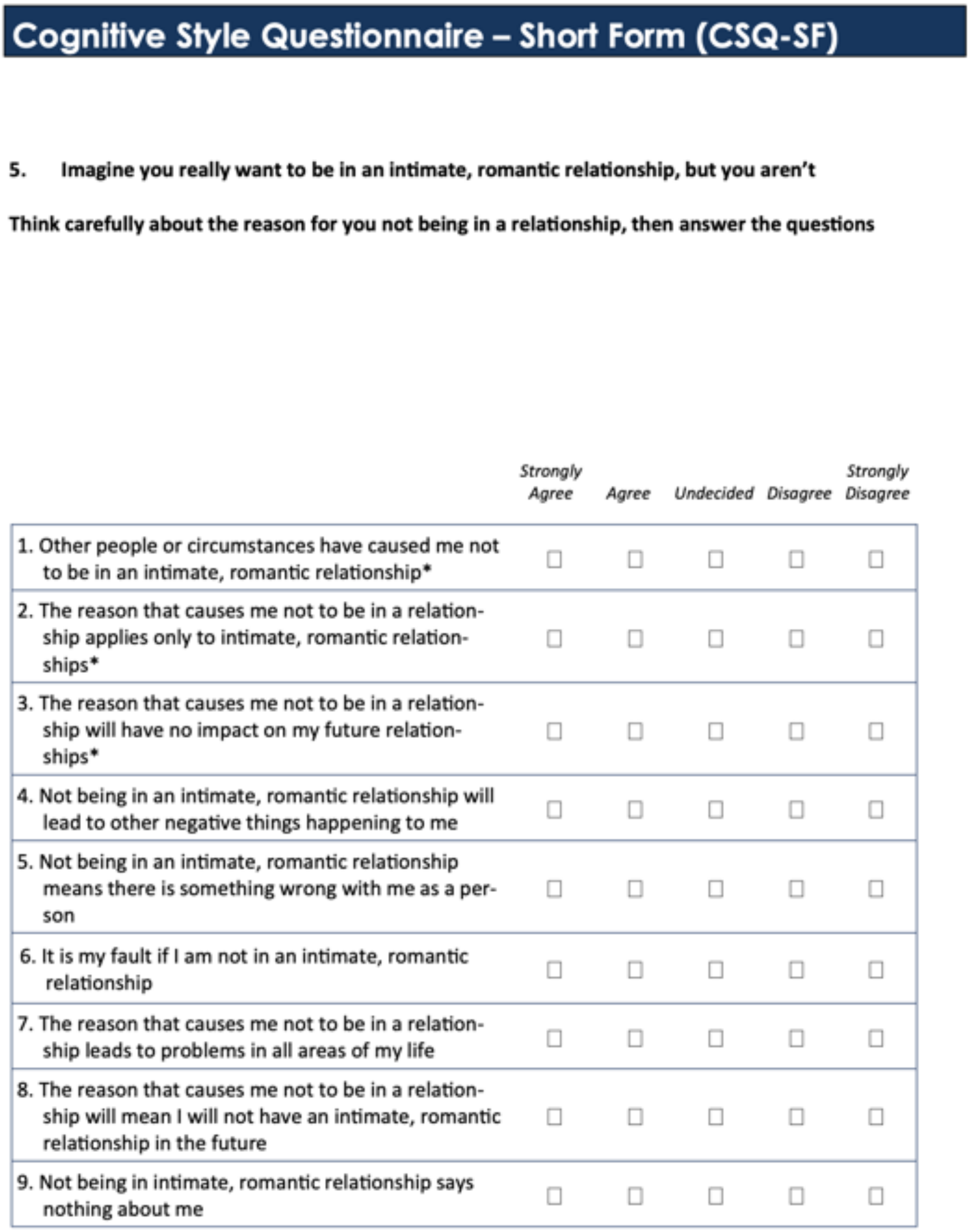


Cognitive Style Questionnaire – Short Form (CSQ-SF)

4. Imagine you go to a party and people are not interested in you

Think carefully about the reason for people not being interested in you, then answer the questions below

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. It is not my fault that people are not interested in me*	☐	☐	☐	☐	☐
2. The reason for people not being interested in me applies only to this party*	☐	☐	☐	☐	☐
3. If I go to a party like this in the future, things will be different and people will be interested in me*	☐	☐	☐	☐	☐
4. People not being interested in me at this party will not lead to other negative things happening to me*	☐	☐	☐	☐	☐
5. People not being interested in me at this party does not mean there is something wrong with me as a person*	☐	☐	☐	☐	☐
6. The reason for people not being interested in me was not caused by other people or events at the party	☐	☐	☐	☐	☐
7. The reason for people not being interested in me at this party will cause problems in all areas of my life	☐	☐	☐	☐	☐
8. The reason people weren't interested in me at this party will cause people at parties in the future not to be interested in me	☐	☐	☐	☐	☐
9. People not being interested in me at this party says a lot about me as a person	☐	☐	☐	☐	☐

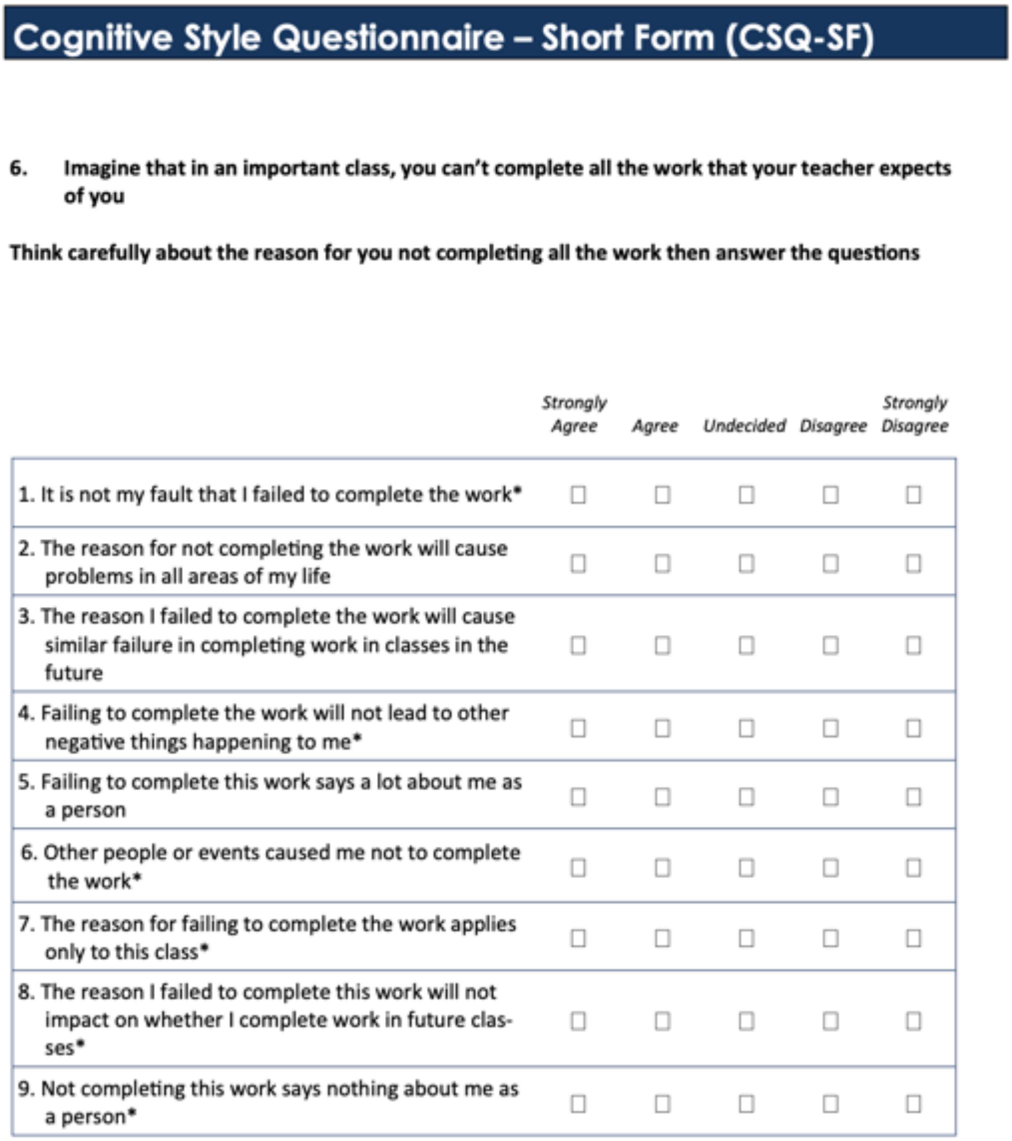


Cognitive Style Questionnaire – Short Form (CSQ-SF)

5. Imagine you really want to be in an intimate, romantic relationship, but you aren't

Think carefully about the reason for you not being in a relationship, then answer the questions

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. Other people or circumstances have caused me not to be in an intimate, romantic relationship*	☐	☐	☐	☐	☐
2. The reason that causes me not to be in a relationship applies only to intimate, romantic relationships*	☐	☐	☐	☐	☐
3. The reason that causes me not to be in a relationship will have no impact on my future relationships*	☐	☐	☐	☐	☐
4. Not being in an intimate, romantic relationship will lead to other negative things happening to me	☐	☐	☐	☐	☐
5. Not being in an intimate, romantic relationship means there is something wrong with me as a person	☐	☐	☐	☐	☐
6. It is my fault if I am not in an intimate, romantic relationship	☐	☐	☐	☐	☐
7. The reason that causes me not to be in a relationship leads to problems in all areas of my life	☐	☐	☐	☐	☐
8. The reason that causes me not to be in a relationship will mean I will not have an intimate, romantic relationship in the future	☐	☐	☐	☐	☐
9. Not being in intimate, romantic relationship says nothing about me	☐	☐	☐	☐	☐

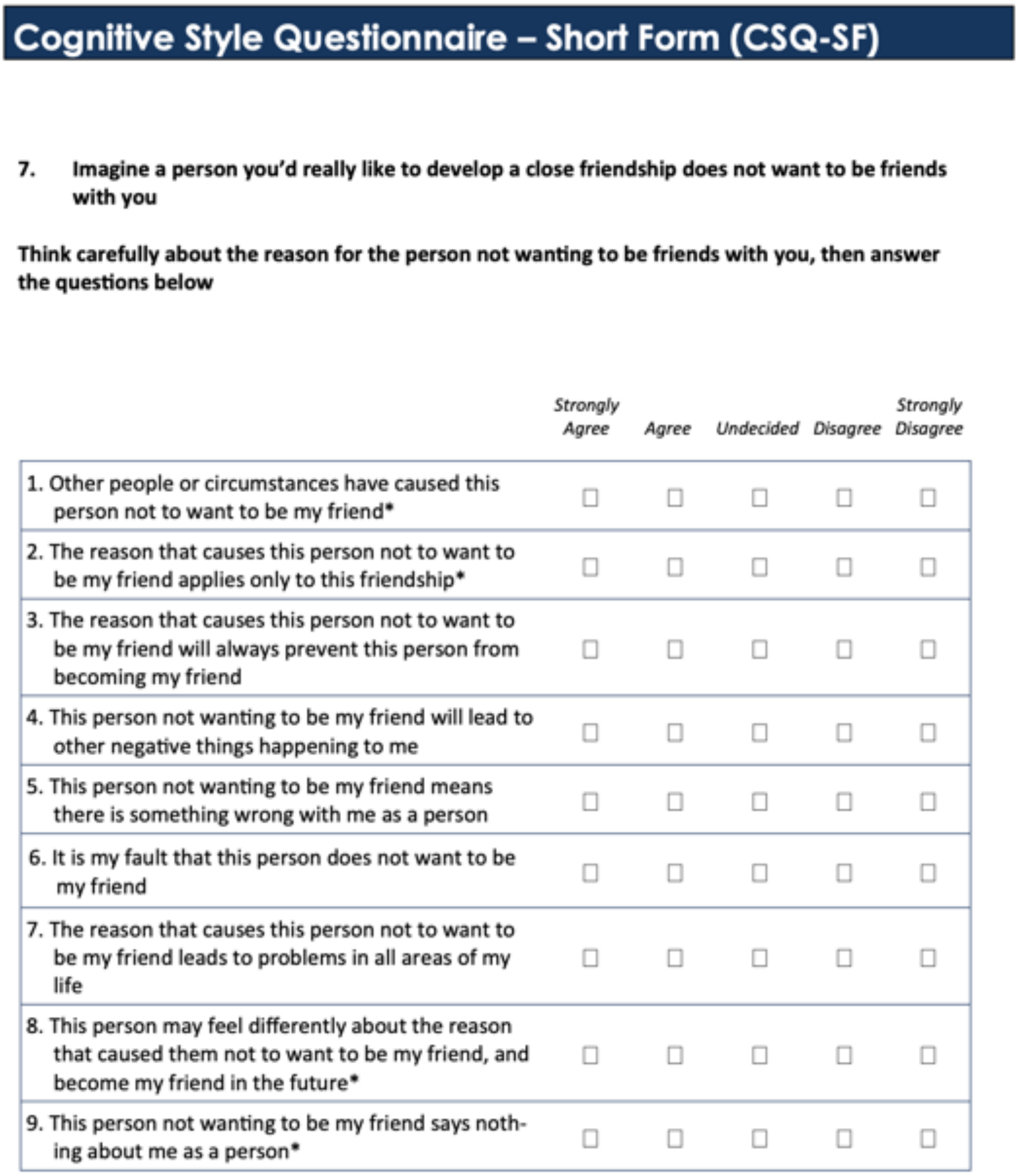


Cognitive Style Questionnaire – Short Form (CSQ-SF)

6. Imagine that in an important class, you can't complete all the work that your teacher expects of you

Think carefully about the reason for you not completing all the work then answer the questions

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. It is not my fault that I failed to complete the work*	☐	☐	☐	☐	☐
2. The reason for not completing the work will cause problems in all areas of my life	☐	☐	☐	☐	☐
3. The reason I failed to complete the work will cause similar failure in completing work in classes in the future	☐	☐	☐	☐	☐
4. Failing to complete the work will not lead to other negative things happening to me*	☐	☐	☐	☐	☐
5. Failing to complete this work says a lot about me as a person	☐	☐	☐	☐	☐
6. Other people or events caused me not to complete the work*	☐	☐	☐	☐	☐
7. The reason for failing to complete the work applies only to this class*	☐	☐	☐	☐	☐
8. The reason I failed to complete this work will not impact on whether I complete work in future classes*	☐	☐	☐	☐	☐
9. Not completing this work says nothing about me as a person*	☐	☐	☐	☐	☐

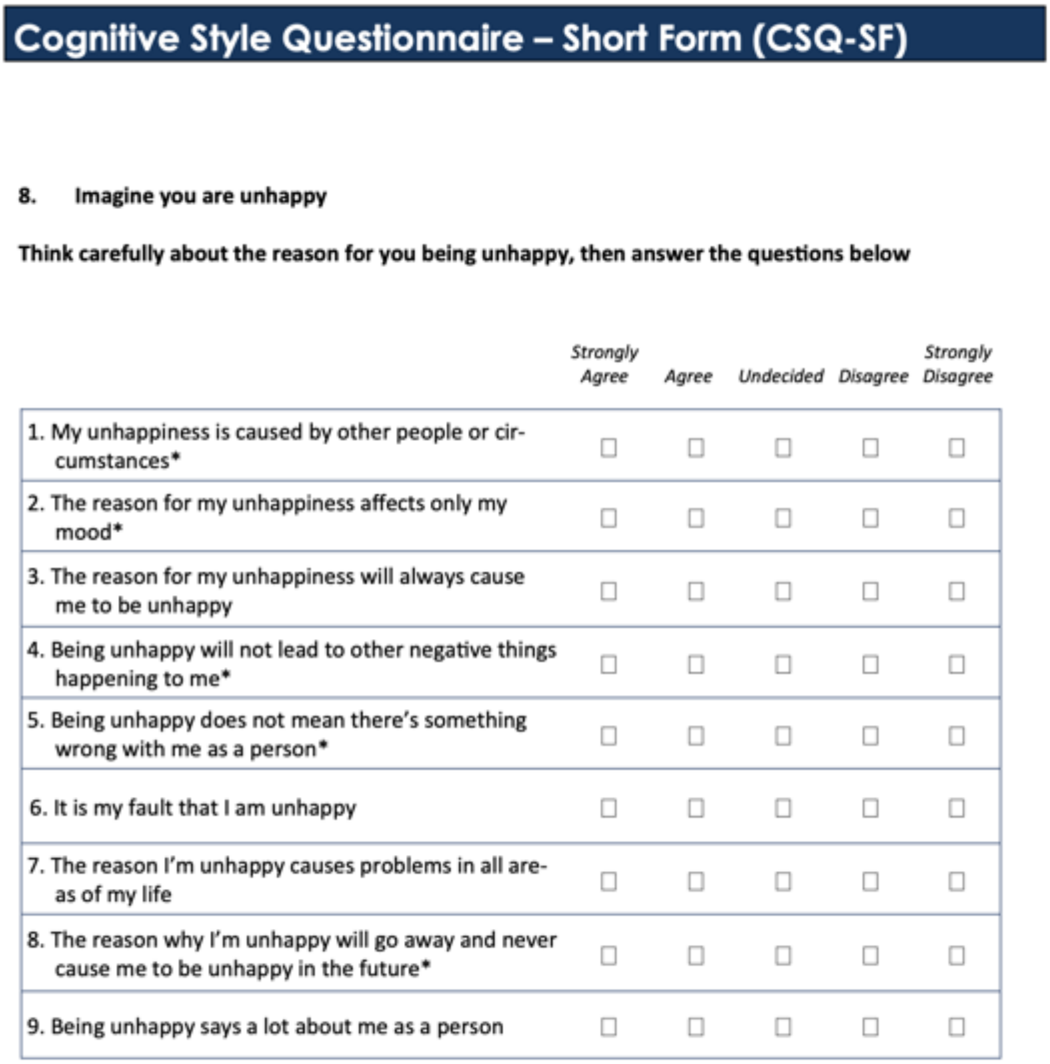


Cognitive Style Questionnaire – Short Form (CSQ-SF)

7. Imagine a person you'd really like to develop a close friendship does not want to be friends with you

Think carefully about the reason for the person not wanting to be friends with you, then answer the questions below

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. Other people or circumstances have caused this person not to want to be my friend*	☐	☐	☐	☐	☐
2. The reason that causes this person not to want to be my friend applies only to this friendship*	☐	☐	☐	☐	☐
3. The reason that causes this person not to want to be my friend will always prevent this person from becoming my friend	☐	☐	☐	☐	☐
4. This person not wanting to be my friend will lead to other negative things happening to me	☐	☐	☐	☐	☐
5. This person not wanting to be my friend means there is something wrong with me as a person	☐	☐	☐	☐	☐
6. It is my fault that this person does not want to be my friend	☐	☐	☐	☐	☐
7. The reason that causes this person not to want to be my friend leads to problems in all areas of my life	☐	☐	☐	☐	☐
8. This person may feel differently about the reason that caused them not to want to be my friend, and become my friend in the future*	☐	☐	☐	☐	☐
9. This person not wanting to be my friend says nothing about me as a person*	☐	☐	☐	☐	☐



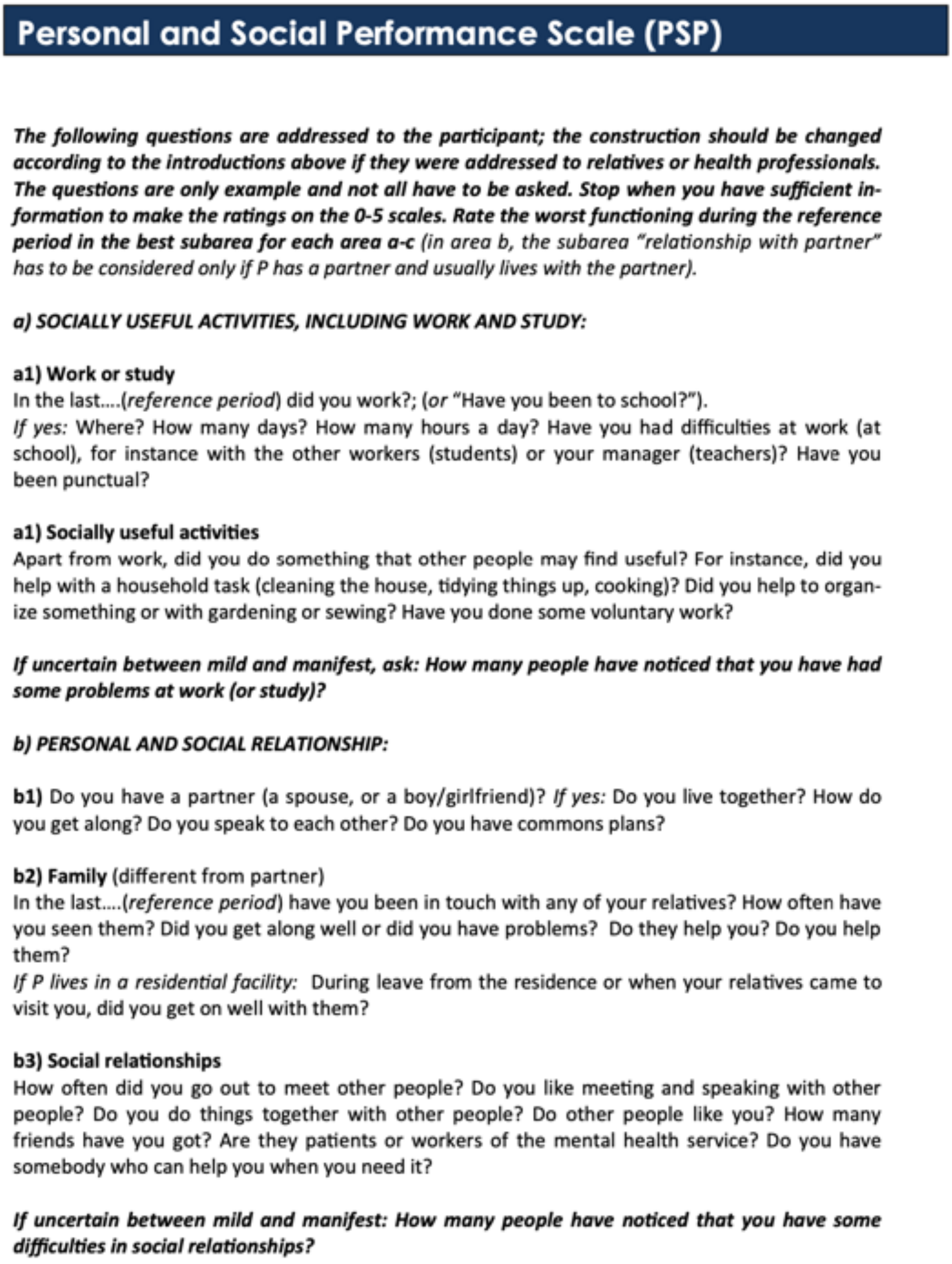
Cognitive Style Questionnaire – Short Form (CSQ-SF)

8. Imagine you are unhappy

Think carefully about the reason for you being unhappy, then answer the questions below

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. My unhappiness is caused by other people or circumstances*	☐	☐	☐	☐	☐
2. The reason for my unhappiness affects only my mood*	☐	☐	☐	☐	☐
3. The reason for my unhappiness will always cause me to be unhappy	☐	☐	☐	☐	☐
4. Being unhappy will not lead to other negative things happening to me*	☐	☐	☐	☐	☐
5. Being unhappy does not mean there's something wrong with me as a person*	☐	☐	☐	☐	☐
6. It is my fault that I am unhappy	☐	☐	☐	☐	☐
7. The reason I'm unhappy causes problems in all areas of my life	☐	☐	☐	☐	☐
8. The reason why I'm unhappy will go away and never cause me to be unhappy in the future*	☐	☐	☐	☐	☐
9. Being unhappy says a lot about me as a person	☐	☐	☐	☐	☐

Appendix 9 – personal and social performance (PSP)



Personal and Social Performance Scale (PSP)

The following questions are addressed to the participant; the construction should be changed according to the introductions above if they were addressed to relatives or health professionals. The questions are only example and not all have to be asked. Stop when you have sufficient information to make the ratings on the 0-5 scales. Rate the worst functioning during the reference period in the best subarea for each area a-c *(in area b, the subarea "relationship with partner" has to be considered only if P has a partner and usually lives with the partner).*

a) SOCIALLY USEFUL ACTIVITIES, INCLUDING WORK AND STUDY:

a1) Work or study
In the last....(*reference period*) did you work?; (*or* "Have you been to school?").
If yes: Where? How many days? How many hours a day? Have you had difficulties at work (at school), for instance with the other workers (students) or your manager (teachers)? Have you been punctual?

a1) Socially useful activities
Apart from work, did you do something that other people may find useful? For instance, did you help with a household task (cleaning the house, tidying things up, cooking)? Did you help to organize something or with gardening or sewing? Have you done some voluntary work?

If uncertain between mild and manifest, ask: How many people have noticed that you have had some problems at work (or study)?

b) PERSONAL AND SOCIAL RELATIONSHIP:

b1) Do you have a partner (a spouse, or a boy/girlfriend)? *If yes:* Do you live together? How do you get along? Do you speak to each other? Do you have commons plans?

b2) Family (different from partner)
In the last....(*reference period*) have you been in touch with any of your relatives? How often have you seen them? Did you get along well or did you have problems? Do they help you? Do you help them?
If P lives in a residential facility: During leave from the residence or when your relatives came to visit you, did you get on well with them?

b3) Social relationships
How often did you go out to meet other people? Do you like meeting and speaking with other people? Do you do things together with other people? Do other people like you? How many friends have you got? Are they patients or workers of the mental health service? Do you have somebody who can help you when you need it?

If uncertain between mild and manifest: How many people have noticed that you have some difficulties in social relationships?

c) SELF CARE:

c1) Personal hygiene

In the last….(reference period) how often have you taken a shower or a bath? Did you wash alone or did somebody remind or help you? Have you cleaned your teeth every day?

c2) Care of one's appearance

For men without a beard: Do you shave regularly? *For women:* Have you used a little make up, at least on special occasions? Have you gone to a hairdresser?

c3) Way of dressing

In the last … (reference period) did you always put on clean clothes? Did you ever go out in pyjama or not properly dressed? Did you ever dress in a way that people might find unusual for the period of the year or the weather?

If the person being asked is not P: Did people ever complained that P had a bad smell?

If uncertain between mild and manifest: How many people have noticed that you were not perfectly clean and rather grubby?

d) DISTURBING AND AGGRESSIVE BEHAVIORS:

d1) Disturbing behaviour

In the last….(reference period*) did you behave in a way that some people may have thought rude or insensitive? Did you take something belonging to others without asking permission? While drunk, dif you do something that could annoy others? Did you ever do something strange that other people may have found worrying? Did you speak to loudly or have your record player or the TV too loud? Did you keep asking other people for money or gifts? Did you complain often about your condition?*

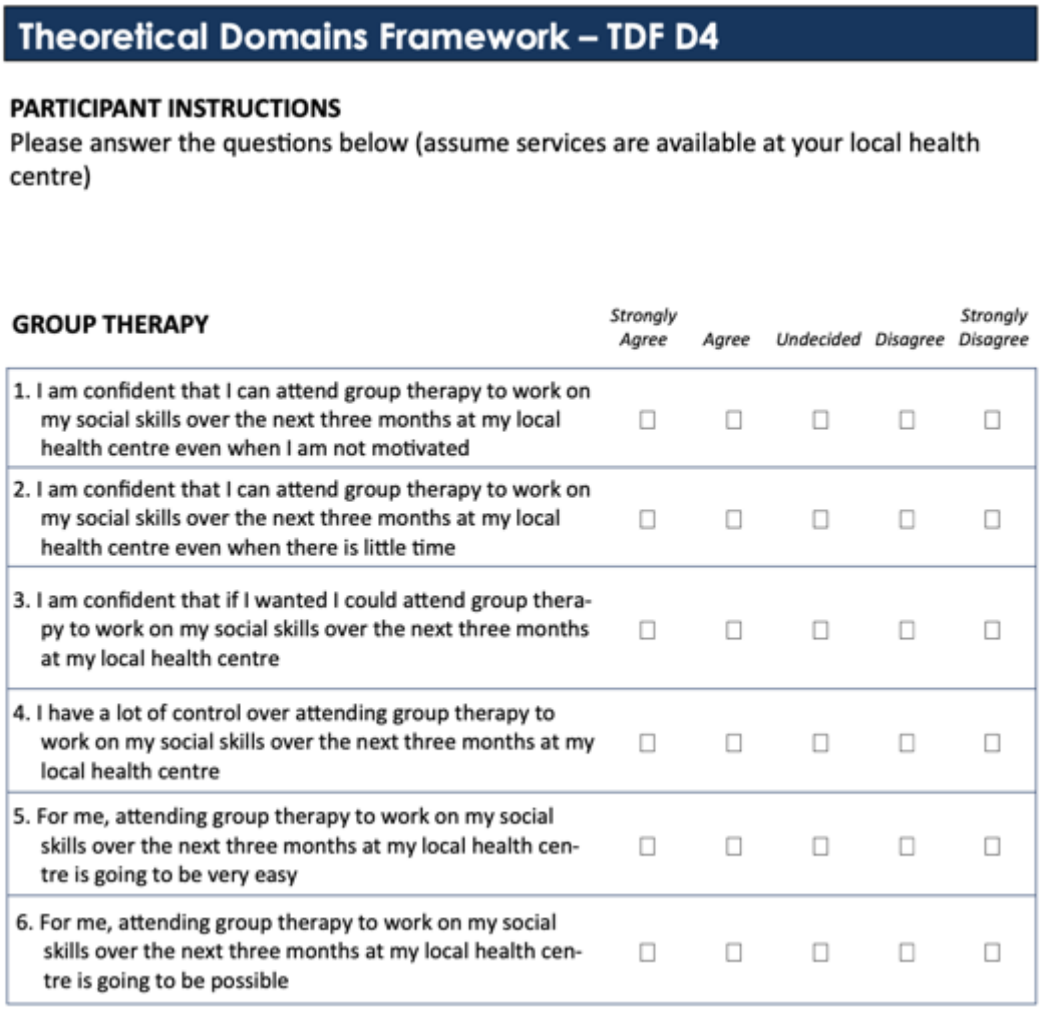
If uncertain between mild and manifest: How many people have noticed that you were behaving in disturbing way for others?

d1) Destructive and aggressive behaviour

In the last….(reference period) *did you ever lose control of your temper? Did you shout at anybody? Did you throw or destroy objects? Did you hit or hurt anybody? How severe was it? Did you really want to hurt them? How often did it happen? Do you think that is going to happen again in the near future?*

If uncertain between mild and manifest: How many people have noticed that you have some difficulties in self-control?

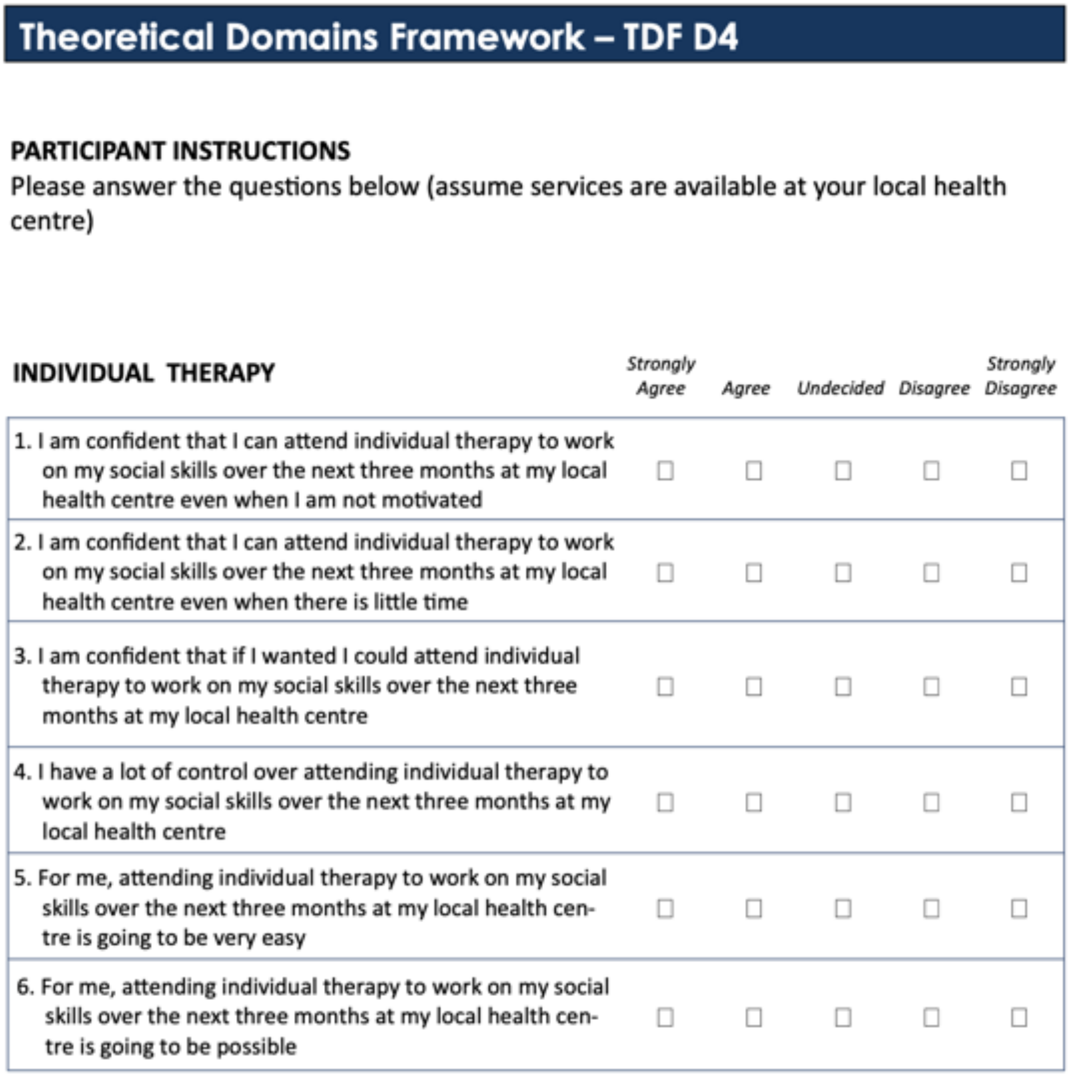
Appendix 10 – theoretical domains framework – TDF D4



Theoretical Domains Framework – TDF D4

PARTICIPANT INSTRUCTIONS
Please answer the questions below (assume services are available at your local health centre)

GROUP THERAPY	*Strongly Agree*	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. I am confident that I can attend group therapy to work on my social skills over the next three months at my local health centre even when I am not motivated	☐	☐	☐	☐	☐
2. I am confident that I can attend group therapy to work on my social skills over the next three months at my local health centre even when there is little time	☐	☐	☐	☐	☐
3. I am confident that if I wanted I could attend group therapy to work on my social skills over the next three months at my local health centre	☐	☐	☐	☐	☐
4. I have a lot of control over attending group therapy to work on my social skills over the next three months at my local health centre	☐	☐	☐	☐	☐
5. For me, attending group therapy to work on my social skills over the next three months at my local health centre is going to be very easy	☐	☐	☐	☐	☐
6. For me, attending group therapy to work on my social skills over the next three months at my local health centre is going to be possible	☐	☐	☐	☐	☐



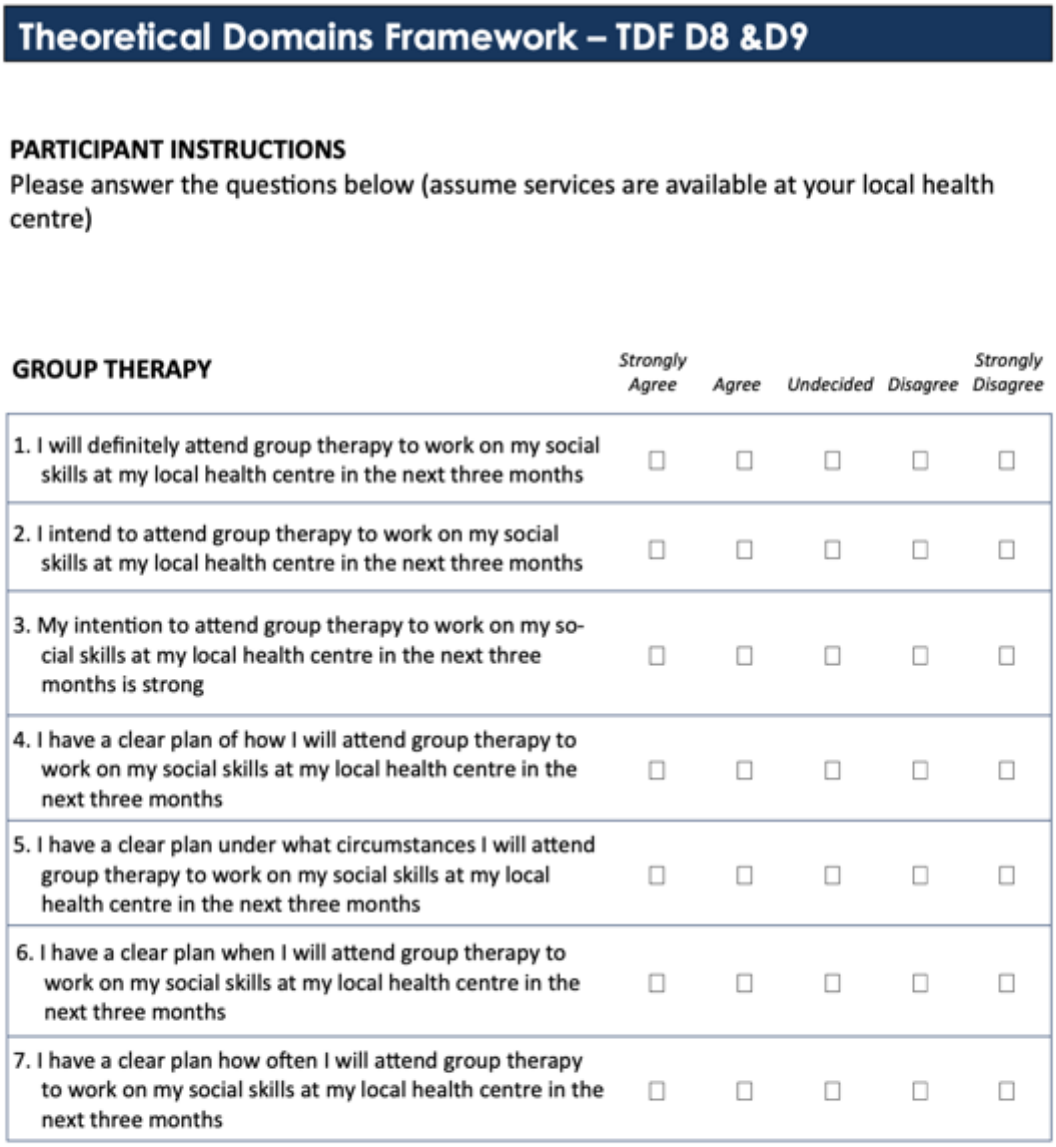
Theoretical Domains Framework – TDF D4

PARTICIPANT INSTRUCTIONS

Please answer the questions below (assume services are available at your local health centre)

INDIVIDUAL THERAPY	*Strongly Agree*	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. I am confident that I can attend individual therapy to work on my social skills over the next three months at my local health centre even when I am not motivated	☐	☐	☐	☐	☐
2. I am confident that I can attend individual therapy to work on my social skills over the next three months at my local health centre even when there is little time	☐	☐	☐	☐	☐
3. I am confident that if I wanted I could attend individual therapy to work on my social skills over the next three months at my local health centre	☐	☐	☐	☐	☐
4. I have a lot of control over attending individual therapy to work on my social skills over the next three months at my local health centre	☐	☐	☐	☐	☐
5. For me, attending individual therapy to work on my social skills over the next three months at my local health centre is going to be very easy	☐	☐	☐	☐	☐
6. For me, attending individual therapy to work on my social skills over the next three months at my local health centre is going to be possible	☐	☐	☐	☐	☐

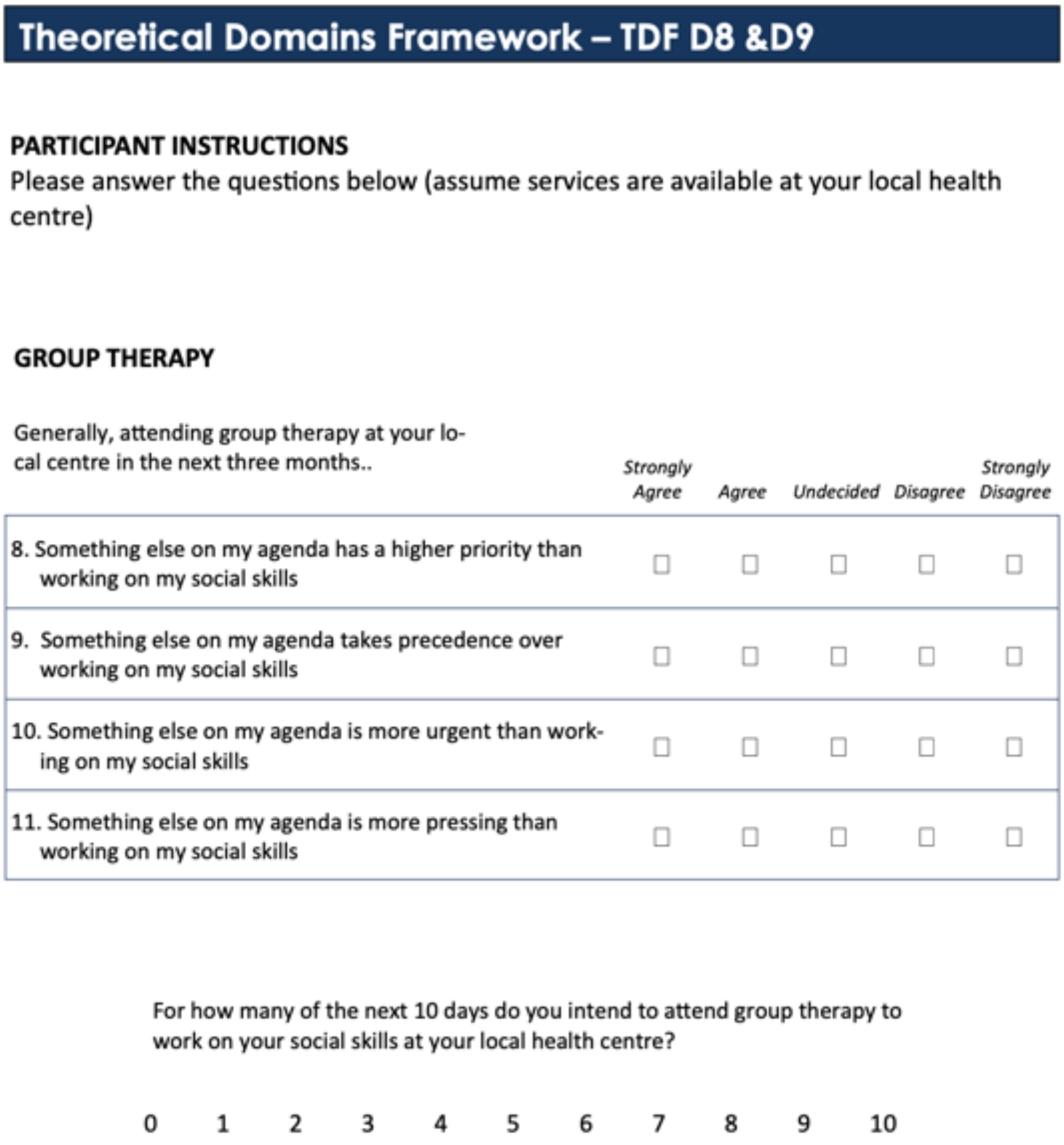
Appendix 11 – theoretical domains framework – TDF D8 & D9



Theoretical Domains Framework – TDF D8 &D9

PARTICIPANT INSTRUCTIONS
Please answer the questions below (assume services are available at your local health centre)

GROUP THERAPY	*Strongly Agree*	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. I will definitely attend group therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
2. I intend to attend group therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
3. My intention to attend group therapy to work on my social skills at my local health centre in the next three months is strong	☐	☐	☐	☐	☐
4. I have a clear plan of how I will attend group therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
5. I have a clear plan under what circumstances I will attend group therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
6. I have a clear plan when I will attend group therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
7. I have a clear plan how often I will attend group therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐



Theoretical Domains Framework – TDF D8 &D9

PARTICIPANT INSTRUCTIONS

Please answer the questions below (assume services are available at your local health centre)

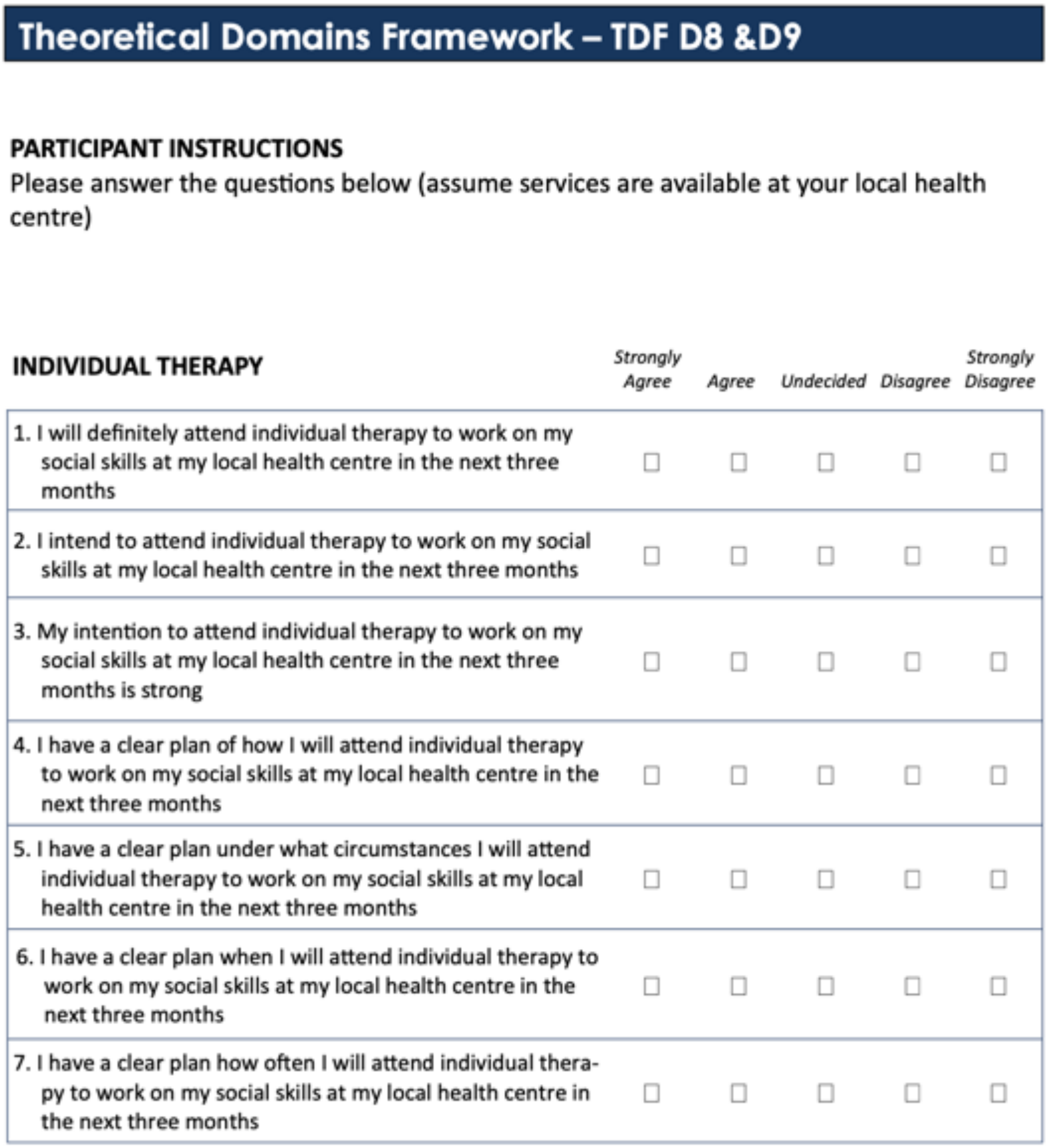
GROUP THERAPY

Generally, attending group therapy at your local centre in the next three months..

	Strongly Agree	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
8. Something else on my agenda has a higher priority than working on my social skills	☐	☐	☐	☐	☐
9. Something else on my agenda takes precedence over working on my social skills	☐	☐	☐	☐	☐
10. Something else on my agenda is more urgent than working on my social skills	☐	☐	☐	☐	☐
11. Something else on my agenda is more pressing than working on my social skills	☐	☐	☐	☐	☐

For how many of the next 10 days do you intend to attend group therapy to work on your social skills at your local health centre?

0 1 2 3 4 5 6 7 8 9 10



Theoretical Domains Framework – TDF D8 &D9

PARTICIPANT INSTRUCTIONS
Please answer the questions below (assume services are available at your local health centre)

INDIVIDUAL THERAPY	*Strongly Agree*	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
1. I will definitely attend individual therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
2. I intend to attend individual therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
3. My intention to attend individual therapy to work on my social skills at my local health centre in the next three months is strong	☐	☐	☐	☐	☐
4. I have a clear plan of how I will attend individual therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
5. I have a clear plan under what circumstances I will attend individual therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
6. I have a clear plan when I will attend individual therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐
7. I have a clear plan how often I will attend individual therapy to work on my social skills at my local health centre in the next three months	☐	☐	☐	☐	☐

Theoretical Domains Framework – TDF D8 &D9

PARTICIPANT INSTRUCTIONS

Please answer the questions below (assume services are available at your local health centre)

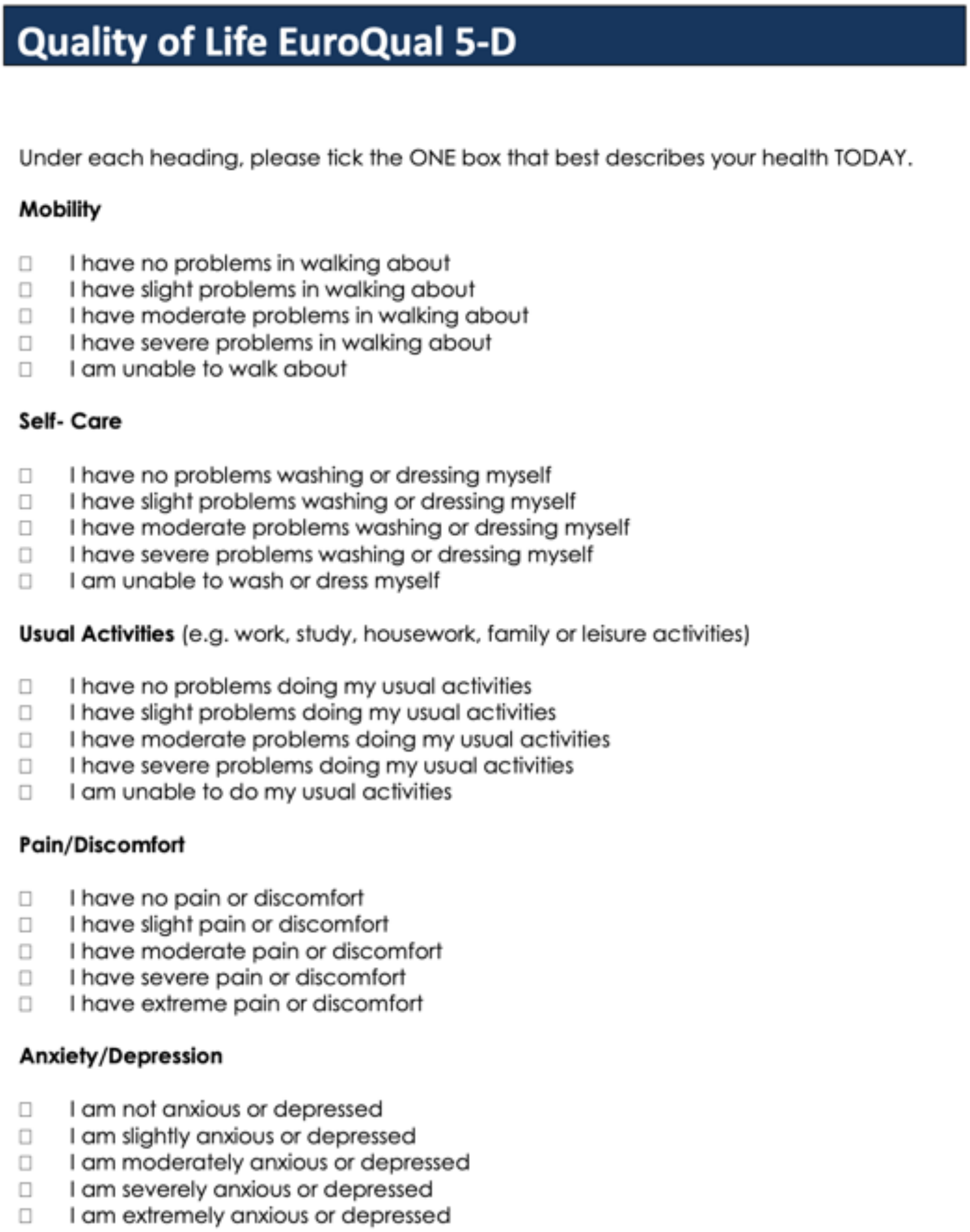
INDIVIDUAL THERAPY

Generally, attending individual therapy at your local centre in the next three months..	*Strongly Agree*	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
8. Something else on my agenda has a higher priority than working on my social skills	☐	☐	☐	☐	☐
9. Something else on my agenda takes precedence over working on my social skills	☐	☐	☐	☐	☐
10. Something else on my agenda is more urgent than working on my social skills	☐	☐	☐	☐	☐
11. Something else on my agenda is more pressing than working on my social skills	☐	☐	☐	☐	☐

For how many of the next 10 days do you intend to attend individual therapy to work on your social skills at your local health centre?

0 1 2 3 4 5 6 7 8 9 10

Appendix 12 – quality of life EUROQUAL 5-D



Quality of Life EuroQual 5-D

Under each heading, please tick the ONE box that best describes your health TODAY.

Mobility

☐ I have no problems in walking about
☐ I have slight problems in walking about
☐ I have moderate problems in walking about
☐ I have severe problems in walking about
☐ I am unable to walk about

Self- Care

☐ I have no problems washing or dressing myself
☐ I have slight problems washing or dressing myself
☐ I have moderate problems washing or dressing myself
☐ I have severe problems washing or dressing myself
☐ I am unable to wash or dress myself

Usual Activities (e.g. work, study, housework, family or leisure activities)

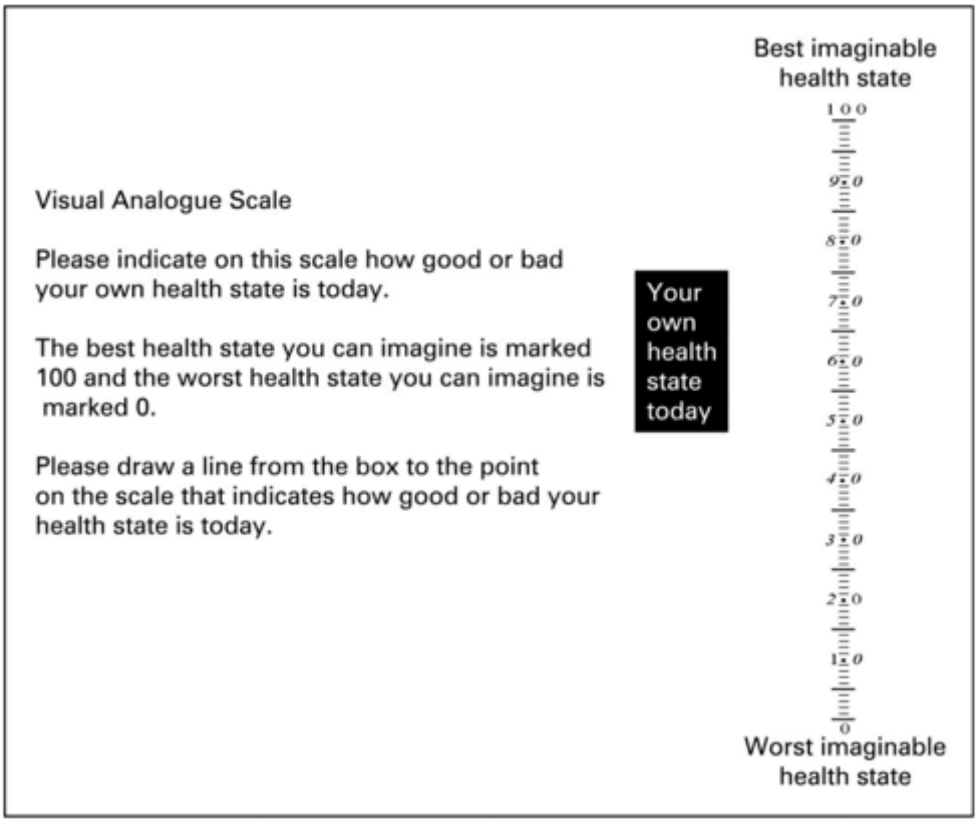
☐ I have no problems doing my usual activities
☐ I have slight problems doing my usual activities
☐ I have moderate problems doing my usual activities
☐ I have severe problems doing my usual activities
☐ I am unable to do my usual activities

Pain/Discomfort

☐ I have no pain or discomfort
☐ I have slight pain or discomfort
☐ I have moderate pain or discomfort
☐ I have severe pain or discomfort
☐ I have extreme pain or discomfort

Anxiety/Depression

☐ I am not anxious or depressed
☐ I am slightly anxious or depressed
☐ I am moderately anxious or depressed
☐ I am severely anxious or depressed
☐ I am extremely anxious or depressed



Visual Analogue Scale

Please indicate on this scale how good or bad your own health state is today.

The best health state you can imagine is marked 100 and the worst health state you can imagine is marked 0.

Please draw a line from the box to the point on the scale that indicates how good or bad your health state is today.

Appendix 13 – national audit reading test (NART)

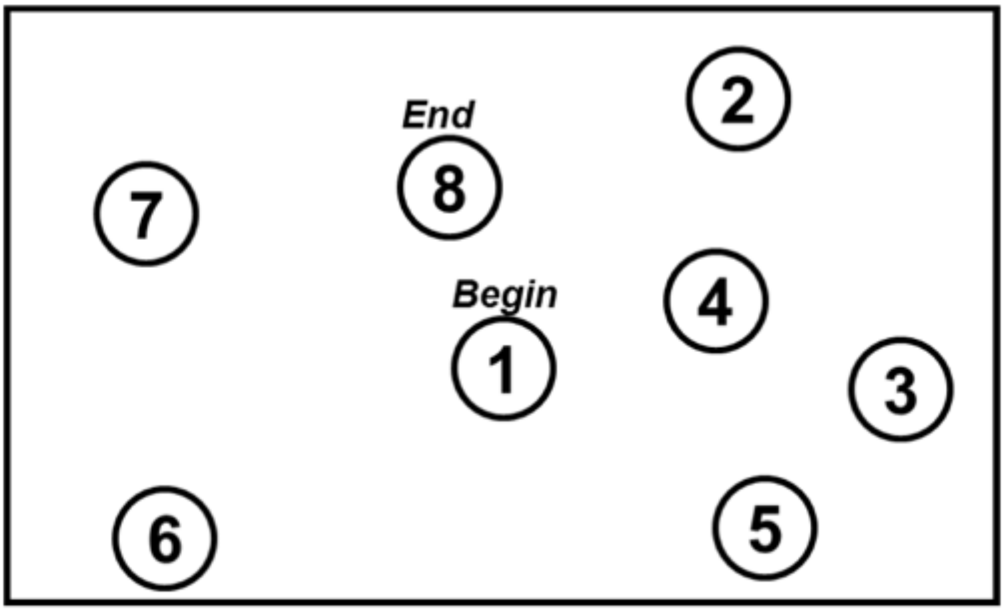
CHORD
ACHE
DEPOT
AISLE
BOUQUET
PSALM
CAPON
DENY
NAUSEA
DEBT
COURTEOUS
RAREFY
EQUIVOCAL
NAÏVE
CATACOMB
GAOLED
THYME
HEIR
RADIX
ASSIGNATE
HIATUS
SUBTLE
PROCREATE
GIST
GOUGE

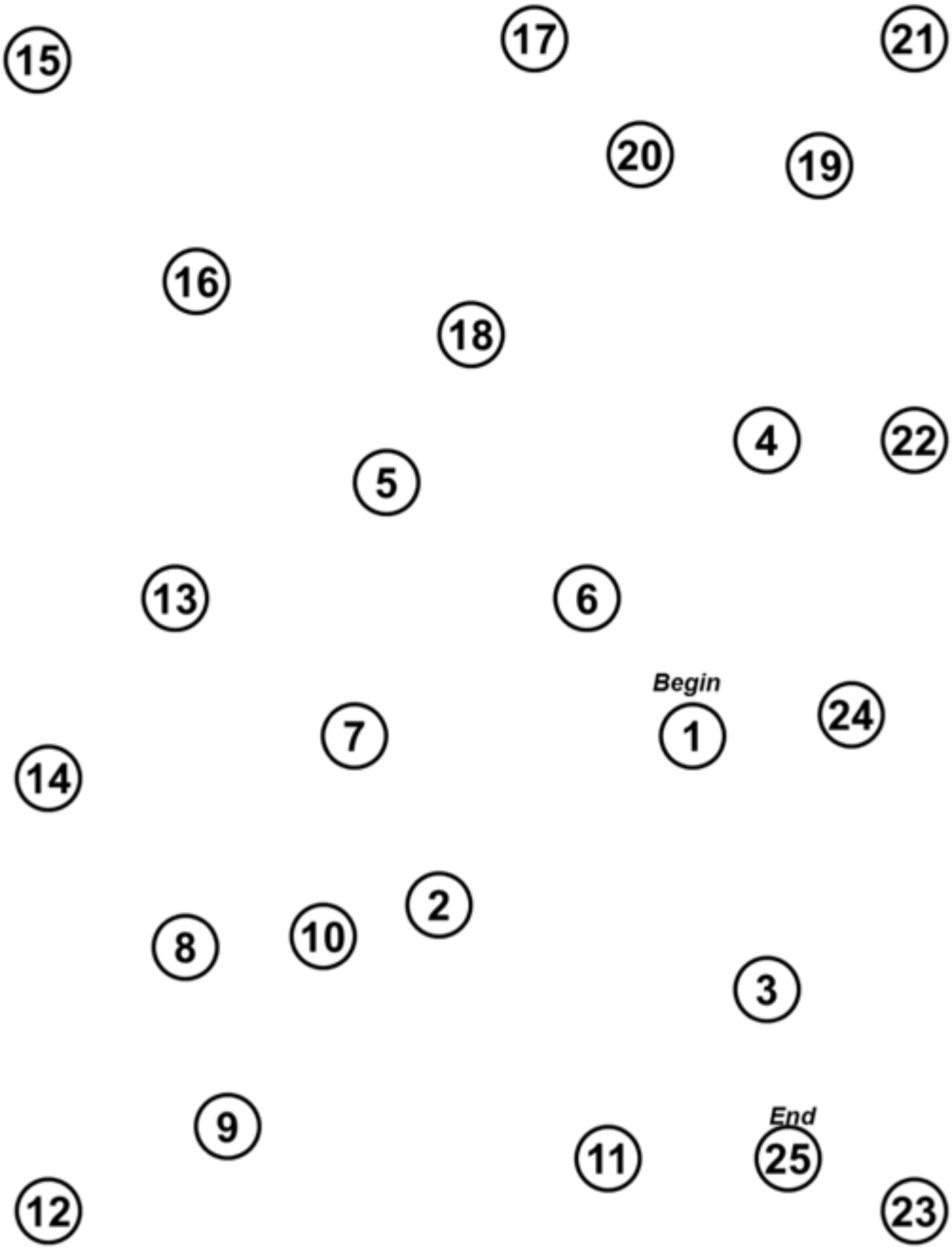
SUPERFLUOUS
SIMILE
BANAL
QUADRUPED
CELLIST
FAÇADE
ZEALOT
DRACHM
AEON
PLACEBO
ABSTEMIOUS
DÉTENTE
IDYLL
PUERPERAL
AVER
GAUCHE
TOPIARY
LEVIATHAN
BEATIFY
PRELATE
SIDEREAL
DEMESNE
SYNCOPE
LABILE
CAMPANILE

TRAIL MAKING

Part A

SAMPLE

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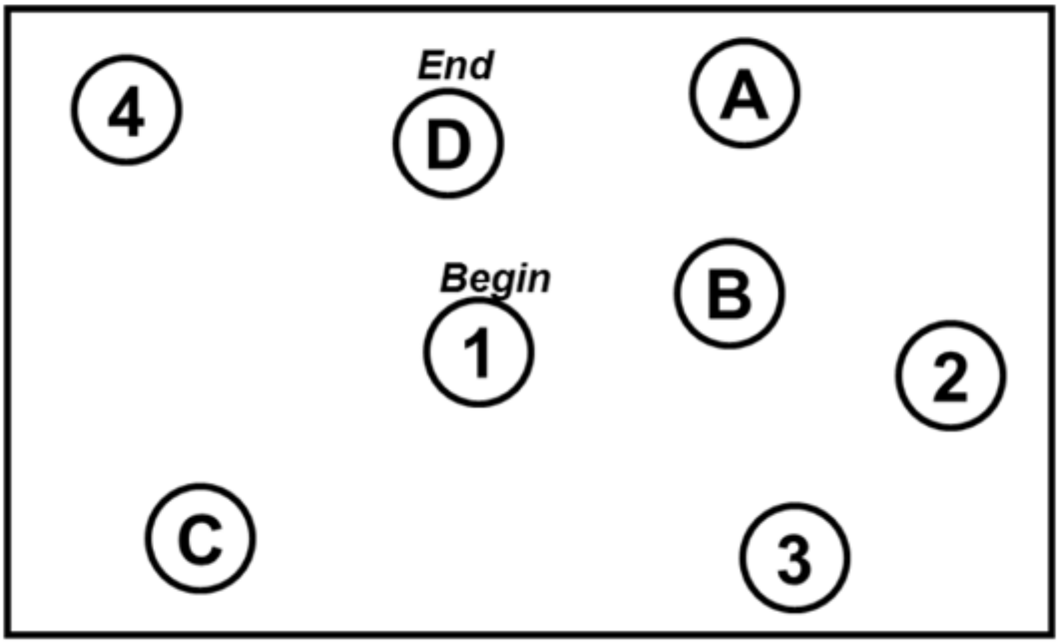
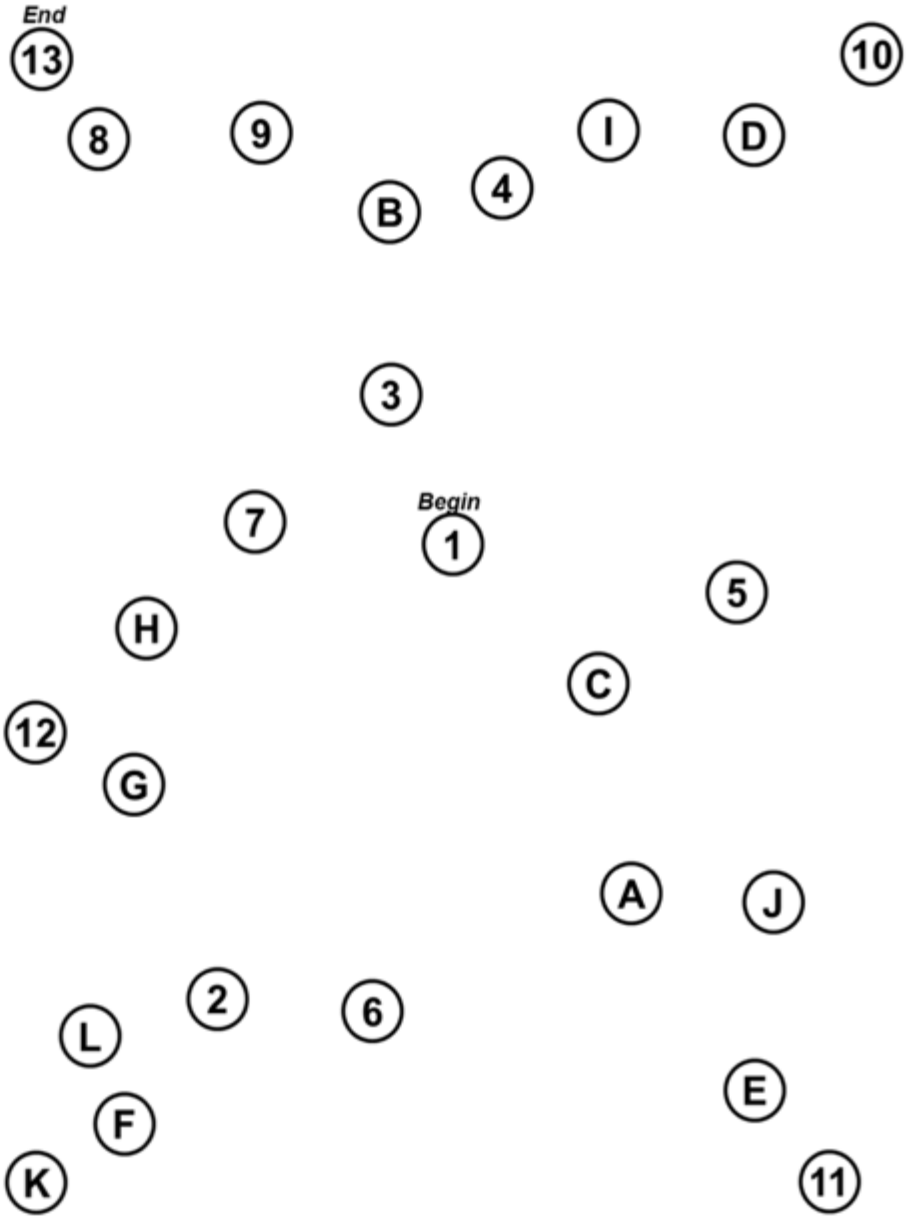
TRAIL MAKING

Part B

SAMPLE

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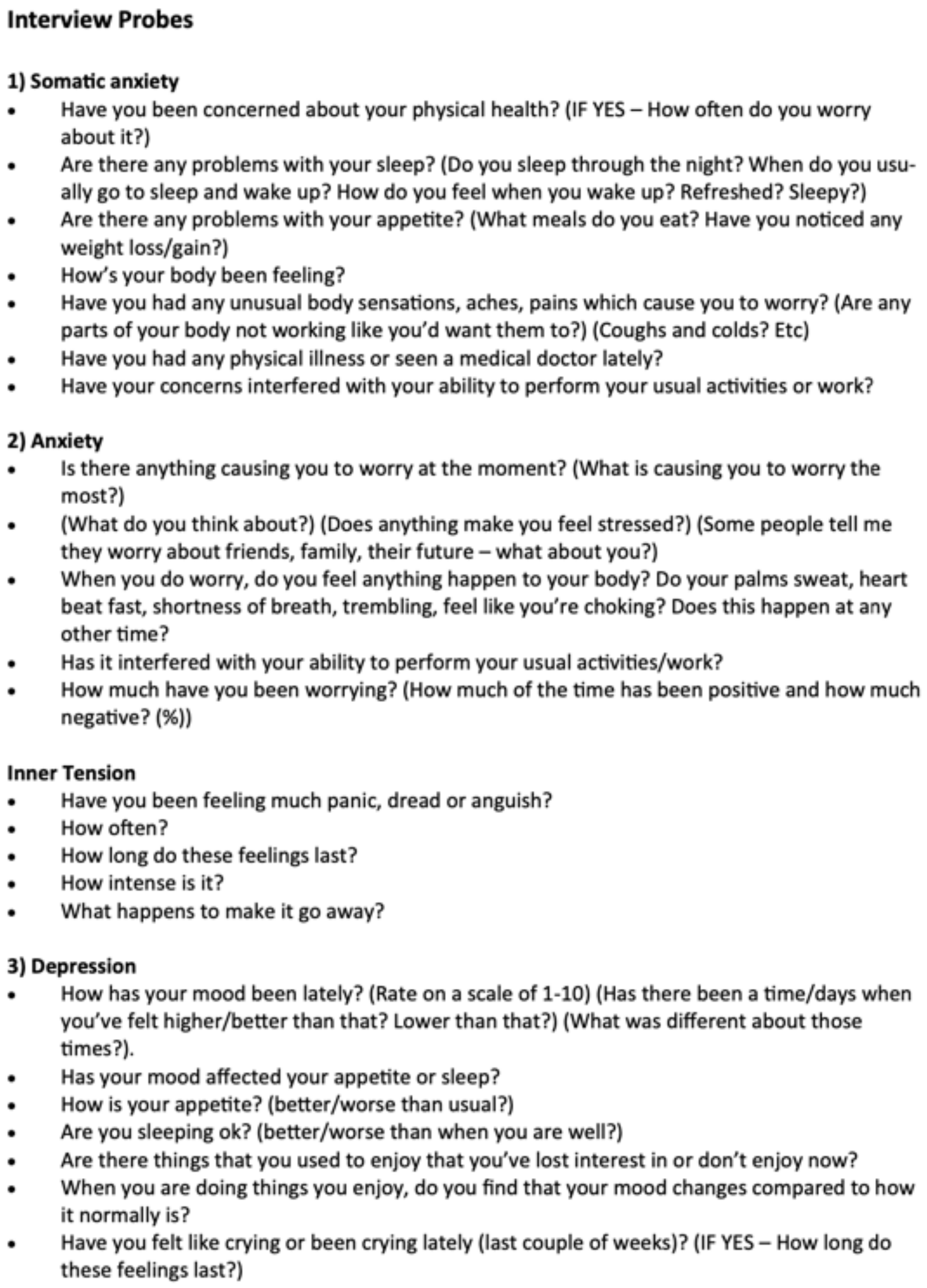
Appendix 15 – brief psychiatric rating scale (BPRS)



Interview Probes

1) Somatic anxiety

- Have you been concerned about your physical health? (IF YES – How often do you worry about it?)
- Are there any problems with your sleep? (Do you sleep through the night? When do you usually go to sleep and wake up? How do you feel when you wake up? Refreshed? Sleepy?)
- Are there any problems with your appetite? (What meals do you eat? Have you noticed any weight loss/gain?)
- How's your body been feeling?
- Have you had any unusual body sensations, aches, pains which cause you to worry? (Are any parts of your body not working like you'd want them to?) (Coughs and colds? Etc)
- Have you had any physical illness or seen a medical doctor lately?
- Have your concerns interfered with your ability to perform your usual activities or work?

2) Anxiety

- Is there anything causing you to worry at the moment? (What is causing you to worry the most?)
- (What do you think about?) (Does anything make you feel stressed?) (Some people tell me they worry about friends, family, their future – what about you?)
- When you do worry, do you feel anything happen to your body? Do your palms sweat, heart beat fast, shortness of breath, trembling, feel like you're choking? Does this happen at any other time?
- Has it interfered with your ability to perform your usual activities/work?
- How much have you been worrying? (How much of the time has been positive and how much negative? (%))

Inner Tension

- Have you been feeling much panic, dread or anguish?
- How often?
- How long do these feelings last?
- How intense is it?
- What happens to make it go away?

3) Depression

- How has your mood been lately? (Rate on a scale of 1-10) (Has there been a time/days when you've felt higher/better than that? Lower than that?) (What was different about those times?).
- Has your mood affected your appetite or sleep?
- How is your appetite? (better/worse than usual?)
- Are you sleeping ok? (better/worse than when you are well?)
- Are there things that you used to enjoy that you've lost interest in or don't enjoy now?
- When you are doing things you enjoy, do you find that your mood changes compared to how it normally is?
- Have you felt like crying or been crying lately (last couple of weeks)? (IF YES – How long do these feelings last?)

4) Suicidality/self harm

- Have you felt that life wasn't worth living?
- Have you thought about harming or killing yourself?
- Have you even felt tired of living or as though you would be better off dead? (IF YES – How often have you thought about it? Any specific plans?)

5) Guilt

- Is there anything you feel guilty about? Anything you've regretted doing or saying?
- Have you been thinking about past problems?
- (IF YES – How often do you think about it? How does it make you feel? How bad do you feel about it?)

6) Hostility/aggression

- Do you live with your family? Who do you get along with best? Do you feel you're close to them? Do you talk to them about personal things? Anything you wouldn't talk to them about?
- What happens when you fight?
- How have you been getting along with other people (other siblings, friends, etc)?
- Have you been irritable or grumpy lately? (Have you thrown things? Been sarcastic? Been argumentative?)
- Were you so irritable that you would shout at people or start fights or arguments?

7) Elevated mood

- Have you felt so good or high that other people thought that you weren't your normal self?
- Have you been feeling cheerful and "on top of the world" without any reason?
- (IF YES – Did it seem like more than just feeling good? How long did that last?)

8) Grandiosity

- Is there anything special about you compared to other people? Are you different from other people in any way?
- Do you have any special talents, abilities or powers that most people don't?
- Have you thought that you might be somebody rich or famous?
- (IF YES – How often have you been thinking about it? Have you acted on any of these ideas?

9) Suspiciousness

- Do you feel uncomfortable in public?
- Does it seem as though others are watching you? Talking about you?
- Do you feel you can trust most people?
- Are you concerned about people intentions toward you?
- Do you feel that people are making things harder for you or trying to hurt you? Do you feel in danger?
- Do you feel as though anyone may be spying on you or plotting against you?
- (IF YES – How often have you been concerned about it?)
- (How convinced are you that this is actually happening? (%))

10) Hallucinations

- Have you had any unusual experiences lately?
- Have you ever heard noises/voices in your head, any sounds or people talking about you when there was no one nearby? Did these interfere with you functioning? How did they make you feel? Did you know they weren't real?
- (IF YES to voices, what do the voices say? Are they familiar/unfamiliar? Soft/loud? Where are they coming from?)
- Was there ever a change in the way things sounded to you?
- Did your hearing seem sharper or better, or have increased sensitivity? Or was it worse?
- Did you ever misinterpret things you heard? (eg. Heard your name being called in a crowd)
- Do you ever have any unusual visual experiences or see things that others do not see? (things appearing to change in size/shape, looking distorted, colours appearing different, mistaking certain objects for others (eg. A shadow for a person)? (Is it a human form? Has it ever tried to hurt you? Good/evil? Big/small? Colour? Male/female?)
- When you saw these things, how real did they seem? Did you know they weren't real?
- Have you had any unusual bodily sensations, tastes or smells? Things you might be quite sensitive to that other people don't notice? (What does it feel like? How long does it last? How long has it been happening? What do you think causes it? How do you know it's there?)
- Strange feelings on or just beneath the skin? Smelling things others don't notice? Odd tastes in your mouth? Food tasting different? Feelings that part of your body had changed or there was something wrong with some parts? IF YES – Have these experiences interfered with things you usually do? How often do they occur?)

11) Unusual thought content

- Do you have any ideas or beliefs which others might find unusual or difficult to believe?
- Do you/have you ever believed that you were somehow in communication with others in some special way? (telepathy, psychic abilities, etc).
- Have there been any times when things around you (TV, newspaper, radio) seem to have a particular or special meaning for you?
- Have you seen any references to yourself on TV or in the newspapers? (sending special messages, talking about you?)
- Do you believe others can read your mind or that you can read others peoples minds? Ever? When?
- Do you ever feel that others have put thoughts or ideas into your head? Taken them out of your head? Broadcast?
- Have you felt under the control of another person or force, so that things you do or say are being controlled by someone/something else?
- (IF YES – How often do you think about it?)

12) Bizarre behaviour

- Have you done anything lately that may seem unusual to other people or that has attracted the attention of others? Have people commented on this?
- Have you done anything that has or could have gotten you into trouble with the police?
- Have you done anything that seemed disturbing to others?

13) Self neglect

- Have you had any trouble looking after yourself as well as usual?
- Have you lost any interest in your appearance? (failing to dress to usual standards, stopping to regularly shave, stop using cosmetics?)
- How often do you take a shower or change your clothes?
- Has anyone complained about your grooming or dress?
- Do you eat regular meals?

14) Disorientation/attention

- How old are you?
- What is the day/date/time/place? (allow +/- 2 days)
- Who is the Prime Minister?
- Can you spell the word WORLD backwards (DLROW)?
- Can you count backwards from 100 by 7s (93, 86, 79, 72, 65)?

Avolition & apathy

- How is your motivation at the moment?
- Is it hard to get going each day when you get up in the morning?
- What about your energy levels?
- Are you currently working or studying?
- What is your average day? (go through entire day)
- What are some of the jobs/chores you have to do at home? How often do you do these? How much time does it take up? Do you find it hard to get the motivation to do these things?
- Do you have any plans for the future? What is the time frame?

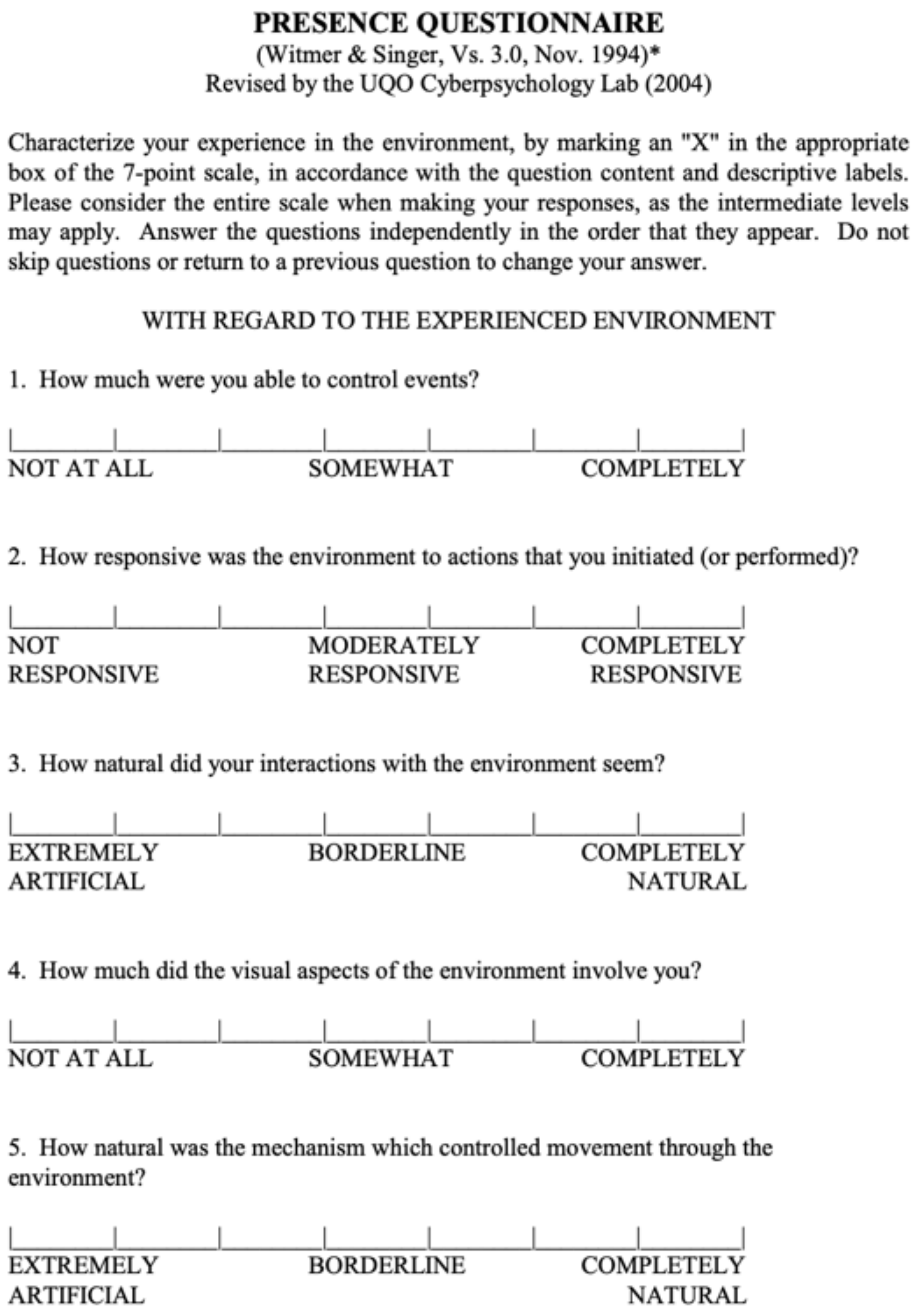
Anhedonia & asociality

- What are your interests?
- Are there people that you can rely on for help?
- Are their people that you see outside the family? How often would you see them? What sort of things do you do with them?
- Are you happy with the amount of friends that you have?
- Are you happy with the things you are doing at the moment? Would you like to do more? What? Are you doing any new things?
- Do you have a boyfriend/girlfriend? Are you dating? Are you sexually active?
- If not, are you interested in a relationship?

Concentration

- Do you have any difficulties concentrating?
- Are you able to read a book or magazine? (How much can you read before you start thinking about other things?)
- Can you watch a TV program or movie without your thoughts wandering off? (How long for?)
- Do you find it hard to get your thoughts together?

Appendix 16 – presence questionnaire



PRESENCE QUESTIONNAIRE

(Witmer & Singer, Vs. 3.0, Nov. 1994)*
Revised by the UQO Cyberpsychology Lab (2004)

Characterize your experience in the environment, by marking an "X" in the appropriate box of the 7-point scale, in accordance with the question content and descriptive labels. Please consider the entire scale when making your responses, as the intermediate levels may apply. Answer the questions independently in the order that they appear. Do not skip questions or return to a previous question to change your answer.

WITH REGARD TO THE EXPERIENCED ENVIRONMENT

1. How much were you able to control events?

|________|________|________|________|________|________|________|
NOT AT ALL SOMEWHAT COMPLETELY

2. How responsive was the environment to actions that you initiated (or performed)?

|________|________|________|________|________|________|________|
NOT RESPONSIVE MODERATELY RESPONSIVE COMPLETELY RESPONSIVE

3. How natural did your interactions with the environment seem?

|________|________|________|________|________|________|________|
EXTREMELY ARTIFICIAL BORDERLINE COMPLETELY NATURAL

4. How much did the visual aspects of the environment involve you?

|________|________|________|________|________|________|________|
NOT AT ALL SOMEWHAT COMPLETELY

5. How natural was the mechanism which controlled movement through the environment?

|________|________|________|________|________|________|________|
EXTREMELY ARTIFICIAL BORDERLINE COMPLETELY NATURAL

6. How compelling was your sense of objects moving through space?

|________|________|________|________|________|________|________|

NOT AT ALL	MODERATELY COMPELLING	VERY COMPELLING

7. How much did your experiences in the virtual environment seem consistent with your real world experiences?

|________|________|________|________|________|________|________|

NOT CONSISTENT	MODERATELY CONSISTENT	VERY CONSISTENT

8. Were you able to anticipate what would happen next in response to the actions that you performed?

|________|________|________|________|________|________|________|

NOT AT ALL	SOMEWHAT	COMPLETELY

9. How completely were you able to actively survey or search the environment using vision?

|________|________|________|________|________|________|________|

NOT AT ALL	SOMEWHAT	COMPLETELY

10. How compelling was your sense of moving around inside the virtual environment?

|________|________|________|________|________|________|________|

NOT COMPELLING	MODERATELY COMPELLING	VERY COMPELLING

11. How closely were you able to examine objects?

|________|________|________|________|________|________|________|

NOT AT ALL	PRETTY CLOSELY	VERY CLOSELY

12. How well could you examine objects from multiple viewpoints?

|________|________|________|________|________|________|________|

NOT AT ALL	SOMEWHAT	EXTENSIVELY

13. How involved were you in the virtual environment experience?

|_______|_______|_______|_______|_______|_______|_______|

NOT	MILDLY	COMPLETELY
INVOLVED	INVOLVED	ENGROSSED

14. How much delay did you experience between your actions and expected outcomes?

|_______|_______|_______|_______|_______|_______|_______|

NO DELAYS	MODERATE	LONG
	DELAYS	DELAYS

15. How quickly did you adjust to the virtual environment experience?

|_______|_______|_______|_______|_______|_______|_______|

NOT AT ALL	SLOWLY	LESS THAN
		ONE MINUTE

16. How proficient in moving and interacting with the virtual environment did you feel at the end of the experience?

|_______|_______|_______|_______|_______|_______|_______|

NOT	REASONABLY	VERY
PROFICIENT	PROFICIENT	PROFICIENT

17. How much did the visual display quality interfere or distract you from performing assigned tasks or required activities?

|_______|_______|_______|_______|_______|_______|_______|

NOT AT ALL	INTERFERED	PREVENTED
	SOMEWHAT	TASK PERFORMANCE

18. How much did the control devices interfere with the performance of assigned tasks or with other activities?

|_______|_______|_______|_______|_______|_______|_______|

NOT AT ALL	INTERFERED	INTERFERED
	SOMEWHAT	GREATLY

19. How well could you concentrate on the assigned tasks or required activities rather than on the mechanisms used to perform those tasks or activities?

|_______|_______|_______|_______|_______|_______|_______|

NOT AT ALL	SOMEWHAT	COMPLETELY

IF THE VIRTUAL ENVIRONMENT INCLUDED SOUNDS:

20. How much did the auditory aspects of the environment involve you?

|________|________|________|________|________|________|________|
NOT AT ALL SOMEWHAT COMPLETELY

21. How well could you identify sounds?

|________|________|________|________|________|________|________|
NOT AT ALL SOMEWHAT COMPLETELY

22. How well could you localize sounds?

|________|________|________|________|________|________|________|
NOT AT ALL SOMEWHAT COMPLETELY

IF THE VIRTUAL ENVIRONMENT INCLUDED HAPTIC (SENSE OF TOUCH):

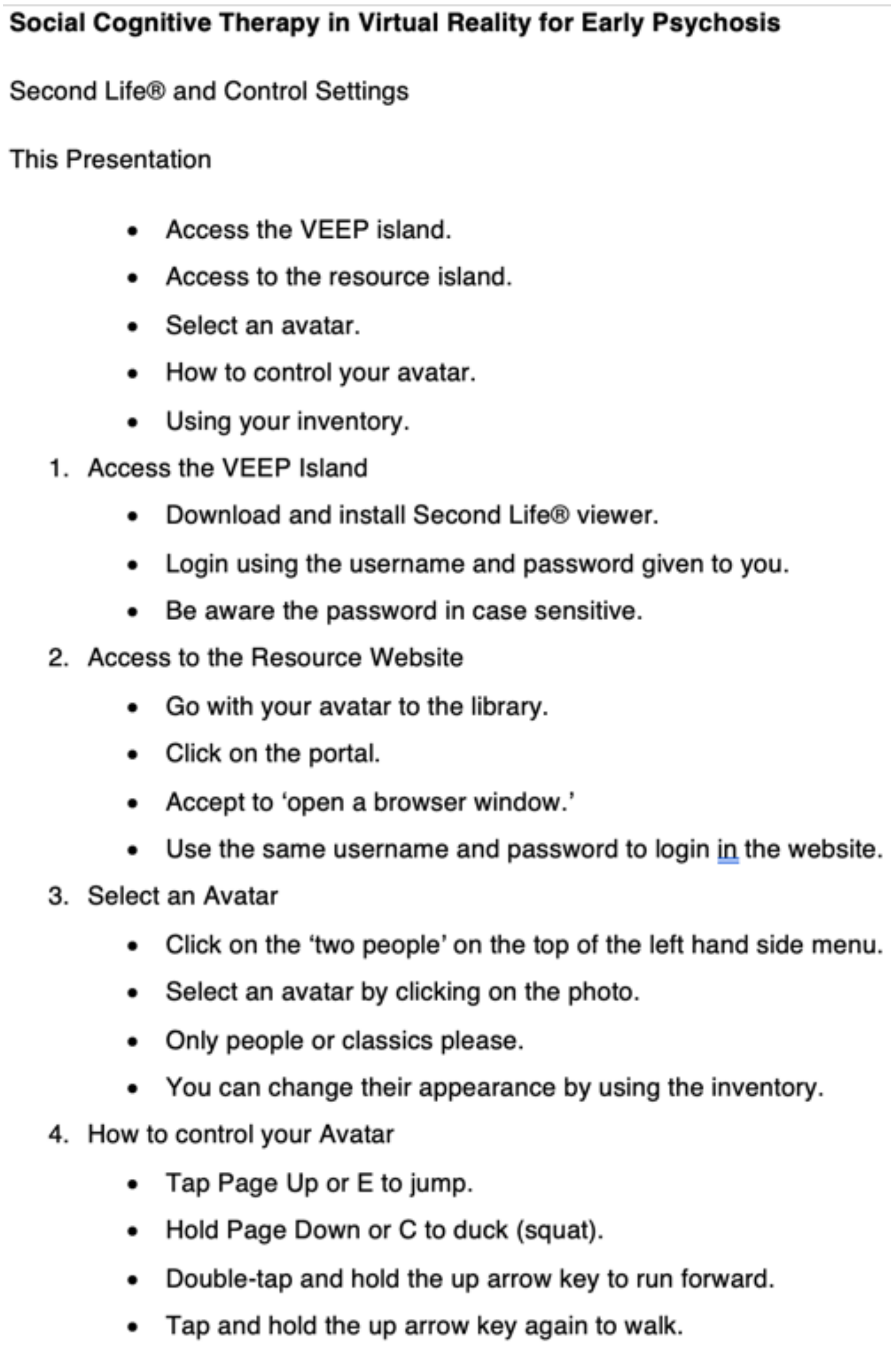
23. How well could you actively survey or search the virtual environment using touch?

|________|________|________|________|________|________|________|
NOT AT ALL SOMEWHAT COMPLETELY

24. How well could you move or manipulate objects in the virtual environment?

|________|________|________|________|________|________|________|
NOT AT ALL SOMEWHAT EXTENSIVELY

Appendix 17 – participant VEEP instructions



Social Cognitive Therapy in Virtual Reality for Early Psychosis

Second Life® and Control Settings

This Presentation

- Access the VEEP island.
- Access to the resource island.
- Select an avatar.
- How to control your avatar.
- Using your inventory.

1. Access the VEEP Island
    - Download and install Second Life® viewer.
    - Login using the username and password given to you.
    - Be aware the password in case sensitive.
2. Access to the Resource Website
    - Go with your avatar to the library.
    - Click on the portal.
    - Accept to 'open a browser window.'
    - Use the same username and password to login in the website.
3. Select an Avatar
    - Click on the 'two people' on the top of the left hand side menu.
    - Select an avatar by clicking on the photo.
    - Only people or classics please.
    - You can change their appearance by using the inventory.
4. How to control your Avatar
    - Tap Page Up or E to jump.
    - Hold Page Down or C to duck (squat).
    - Double-tap and hold the up arrow key to run forward.
    - Tap and hold the up arrow key again to walk.

- To enable double-tap run:
    a. Open **me>preferences** to open the PREFERENCES window.
    b. Click the **Move & View** tab.
    c. Check the **Tap-tap-hold** to run checkbox.
- You can view nearly any object or avatar from any angle or distance.
- Access onscreen camera controls by clicking the **View** button on the bottom bar of the Viewer.
- **Mouse look**: view the world through the avatar's eyes.
- Enter mouselook by:
    a. Pressing the M key
    b. Mouse's scroll wheel to zoom
- **Escape key** resets your view to its default location behind your avatar.
- To sit down, right click on a chair and select 'sit here.'
- To talk to other avatars, plug in your headset and select the 'speak' icon on the task bar at the bottom of your screen. You should be able to hear others and talk to them through the microphone.
- To type a message to other avatars, select the 'chat' icon on the task bar at the bottom of your screen. Click on the '+' button to select or search for the person you want to type a message to.

5. Using your Inventory – Method 1
    - Click on the suitcase symbol on the left panel of your screen.
    - Right click on the object.
    - Select 'wear' or 'add' to use the item.
    - Select 'detach' to stop using the item.
6. Using your Inventory – Method 2
    - Right-click on the object of your avatar.

- Select ‘detach’ to stop using the item.
- Go to your inventory.
- Select an object and drag it to your avatar.
- If you are using an object, the object’s name in bold and the word ‘(worn)’ will appear.

7. Moving Between Rooms
    - You should have a task bar on the right hand side of your screen which you can use to teleport to different rooms. If you do not have this bar, go to your inventory and search for the ‘VEEP teleport device’ and right-click to select ‘wear.’
    - Click on the icons on the task bar on the right hand side to teleport to different rooms e.g. Click on the ‘red’ icon to go to the red room, click on the ‘blue’ icon to go to the blue room, click on the ‘book’ icon to go to the library etc.

Appendix 18 – VEEP PPI study summary and invitation

Dear [NAME]

Thank you for agreeing to taking part in our consultation. The VEEP study aims to adapt an existing social cognition training package to a virtual world using service user experts, researchers and computer designers. More information about the study is included at the end of this letter.

You are invited to the following meeting:

Type: Group discussion

Date: 2nd May at 16:00

Location: Warwick Medical School, University of Warwick, Coventry, CV4 7AL

(Please see the below map of where to find us).

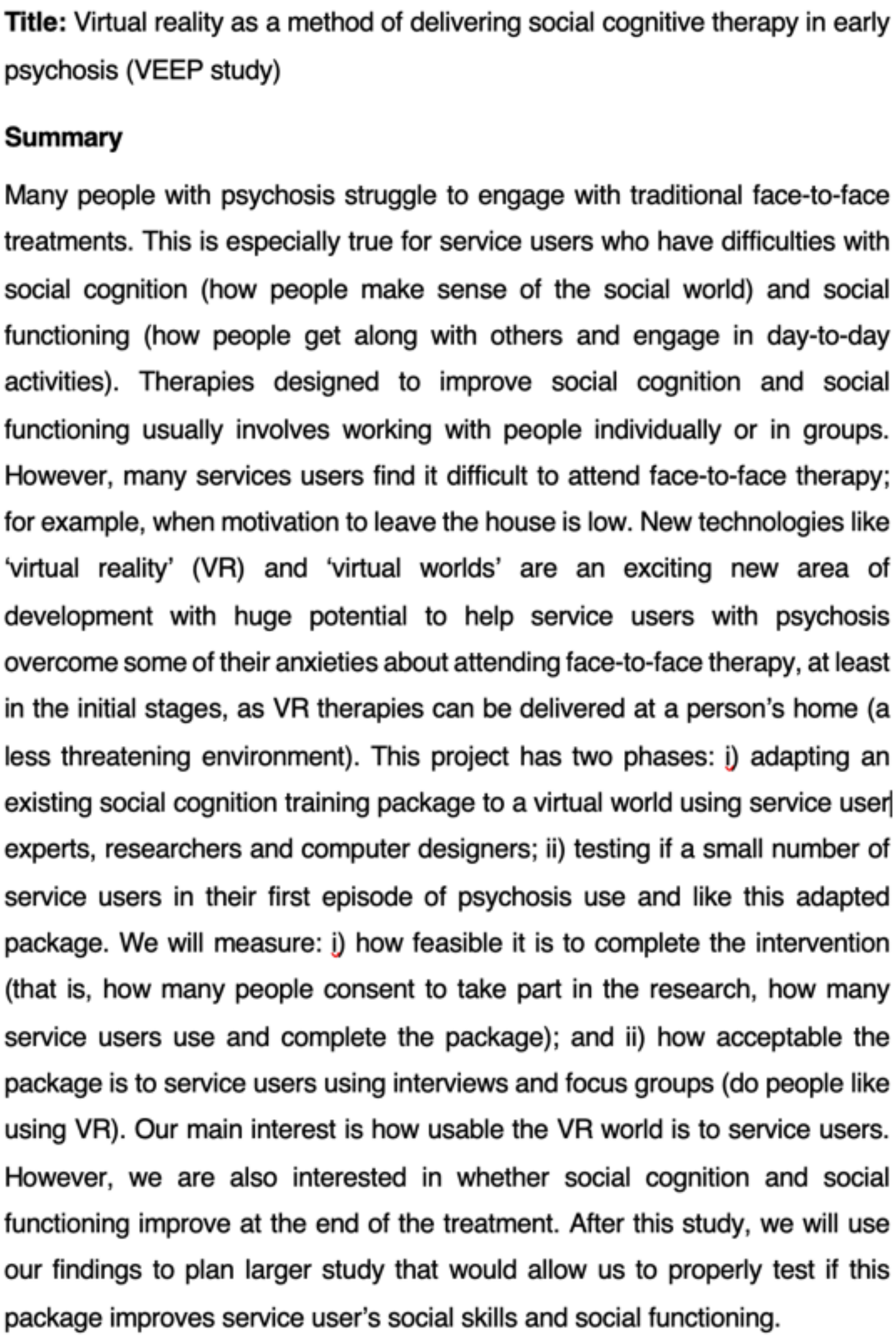
Duration: 1 hour

Incentives: £40, travel expenses and refreshments

We would like to take notes of your suggestions about our semi structured interview schedule for participants. Please do not hesitate to contact me for further information. My details are below.

Kind regards,

Farah Elahi
PhD Student
VEEP Study



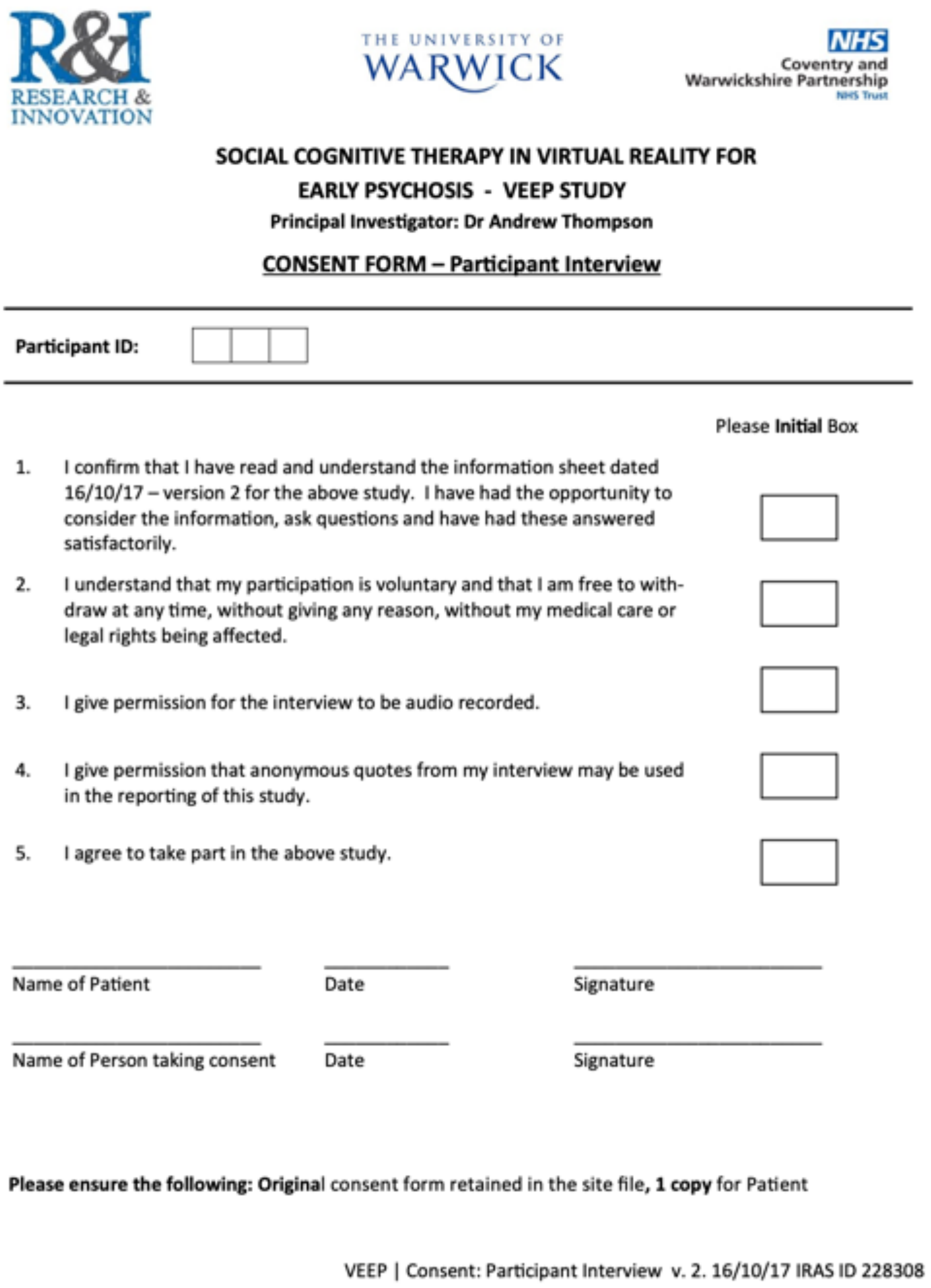
Title: Virtual reality as a method of delivering social cognitive therapy in early psychosis (VEEP study)

Summary

Many people with psychosis struggle to engage with traditional face-to-face treatments. This is especially true for service users who have difficulties with social cognition (how people make sense of the social world) and social functioning (how people get along with others and engage in day-to-day activities). Therapies designed to improve social cognition and social functioning usually involves working with people individually or in groups. However, many services users find it difficult to attend face-to-face therapy; for example, when motivation to leave the house is low. New technologies like ‘virtual reality’ (VR) and ‘virtual worlds’ are an exciting new area of development with huge potential to help service users with psychosis overcome some of their anxieties about attending face-to-face therapy, at least in the initial stages, as VR therapies can be delivered at a person’s home (a less threatening environment). This project has two phases: i) adapting an existing social cognition training package to a virtual world using service user experts, researchers and computer designers; ii) testing if a small number of service users in their first episode of psychosis use and like this adapted package. We will measure: i) how feasible it is to complete the intervention (that is, how many people consent to take part in the research, how many service users use and complete the package); and ii) how acceptable the package is to service users using interviews and focus groups (do people like using VR). Our main interest is how usable the VR world is to service users. However, we are also interested in whether social cognition and social functioning improve at the end of the treatment. After this study, we will use our findings to plan larger study that would allow us to properly test if this package improves service user’s social skills and social functioning.

Below is a map of where to find us:

Appendix 19 – VEEP semi structured interview participant consent form



R&I RESEARCH & INNOVATION

THE UNIVERSITY OF WARWICK

NHS Coventry and Warwickshire Partnership NHS Trust

SOCIAL COGNITIVE THERAPY IN VIRTUAL REALITY FOR EARLY PSYCHOSIS - VEEP STUDY

Principal Investigator: Dr Andrew Thompson

CONSENT FORM – Participant Interview

Participant ID: ☐☐☐

Please **Initial** Box

1. I confirm that I have read and understand the information sheet dated 16/10/17 – version 2 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐
3. I give permission for the interview to be audio recorded. ☐
4. I give permission that anonymous quotes from my interview may be used in the reporting of this study. ☐
5. I agree to take part in the above study. ☐

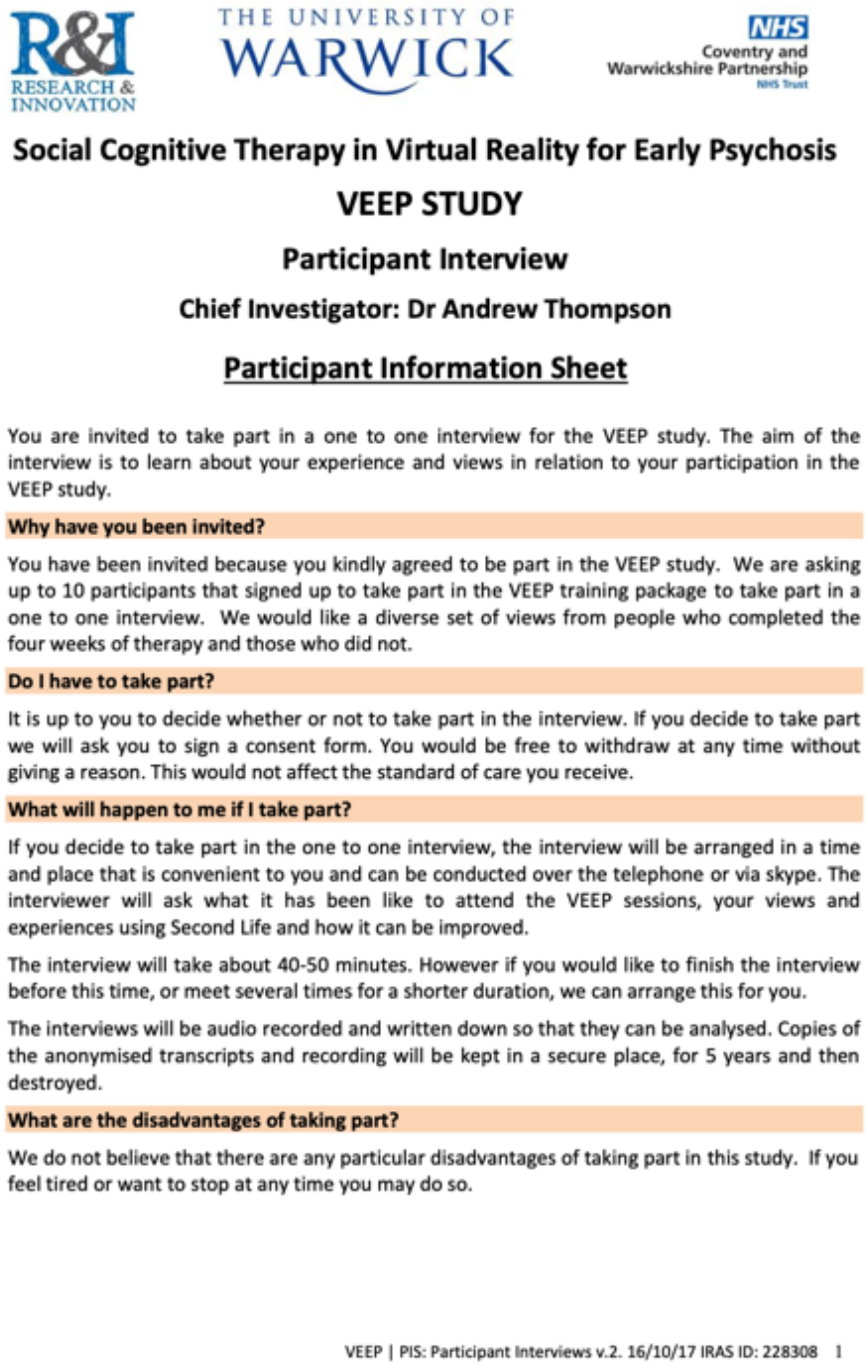
Name of Patient ______ Date ______ Signature ______

Name of Person taking consent ______ Date ______ Signature ______

Please ensure the following: Original consent form retained in the site file, **1 copy** for Patient

VEEP | Consent: Participant Interview v. 2. 16/10/17 IRAS ID 228308

Appendix 20 – VEEP semi structured interview participant information sheet



R&I RESEARCH & INNOVATION
THE UNIVERSITY OF WARWICK
NHS Coventry and Warwickshire Partnership NHS Trust

Social Cognitive Therapy in Virtual Reality for Early Psychosis

VEEP STUDY

Participant Interview

Chief Investigator: Dr Andrew Thompson

Participant Information Sheet

You are invited to take part in a one to one interview for the VEEP study. The aim of the interview is to learn about your experience and views in relation to your participation in the VEEP study.

Why have you been invited?

You have been invited because you kindly agreed to be part in the VEEP study. We are asking up to 10 participants that signed up to take part in the VEEP training package to take part in a one to one interview. We would like a diverse set of views from people who completed the four weeks of therapy and those who did not.

Do I have to take part?

It is up to you to decide whether or not to take part in the interview. If you decide to take part we will ask you to sign a consent form. You would be free to withdraw at any time without giving a reason. This would not affect the standard of care you receive.

What will happen to me if I take part?

If you decide to take part in the one to one interview, the interview will be arranged in a time and place that is convenient to you and can be conducted over the telephone or via skype. The interviewer will ask what it has been like to attend the VEEP sessions, your views and experiences using Second Life and how it can be improved.

The interview will take about 40-50 minutes. However if you would like to finish the interview before this time, or meet several times for a shorter duration, we can arrange this for you.

The interviews will be audio recorded and written down so that they can be analysed. Copies of the anonymised transcripts and recording will be kept in a secure place, for 5 years and then destroyed.

What are the disadvantages of taking part?

We do not believe that there are any particular disadvantages of taking part in this study. If you feel tired or want to stop at any time you may do so.

Appendix 21 – VEEP semi structured exit interview guide (completers)

VEEP Participant Exit Interview Guide

INTERVIEWER INSTRUCTIONS

What follows is a guide: The order and exact content of the questions will be determined by the participant and will be influenced by the ongoing analysis so the order of the questions may vary as the interview develops.

- Introduce self, welcome & thank participant for attending interview, ensure comfortable, offer drink etc.
- Re-confirm informed consent still valid.
- Outline interview procedures, time duration, audio-recording, other pauses, breaks, etc.
- Explain limitations of confidentiality (i.e. research becomes aware of potential harm to self or others).
- Explain purpose of the interview in relation to the VEEP study
- Explain that they can stop and take a break at any point in the interview (if they would like).
- Explain that they do not have to answer a question if they do not want to.

“It is important for us to learn from people’s experiences of using the VR environment in order to assess whether or not using the ‘environment’ can be useful in supporting people with mental health problems.”

PERCEPTIONS OF THE GROUP

- Have you ever taken part in group treatment before?
- If you have what were your experiences of it? (prompts: did it work for your or not? What was good about it or not? How long was this group treatment? What was the size of the group? How many people were in the group?)

DIGITAL EXPERTISE AND PRIOR THOUGHTS OF THE TREATMENT

- What were your experiences of using technology before beginning the treatment? (Prompts: apps, Internet websites, social media platforms, virtual worlds, video games)
- How does your usage of technology compare to your peers?
- What were your perceptions of VR prior to beginning the treatment? (Prompts: have you heard of it before? If you have what did you hear about it?).
- Have you ever used technology to monitor or improve your mental health? If you have, what are your experiences of it?

VIRTUAL REALITY PLATFORM AND TREATMENT

- How did you find using the virtual reality environment to receive therapy?
- "We wanted to develop a virtual environment, which was accessible, engaging, comfortable and a practice place to provide treatment. Do you think the VR environment does this? Why/why not?"
- Did you have any difficulties using the environment in the beginning? If you did, did these difficulties persist during the treatment?
- Do you think this is a good or bad way to manage their experience of psychosis? If yes, why? If no, would there be a better way?
- Do you feel you had enough information to help you to use the VR

environment? Could we have provided any other information or tools?
- How did you feel when the treatment ended?

EXPERIENCES OF USING A VIRTUAL REALITY PLATFORM

- What are your views on the Second Life® environment to deliver the treatment?
- What features (if any) of Second Life® did you like or not like? (Prompts: what did you think about the different therapy rooms, the beach relaxation area, the cinema, the café etc.)
- What were the most memorable parts of the treatment?
- What were the least memorable parts of the treatment?
- Did you feel like you were actually part of Second Life®? Can you describe how it felt? If no, then what improvements can be made?
- What are your experiences of using the avatars to receive treatment? (Prompts: what were the similarities and differences between virtual and face-to-face treatment).
- Did you feel your avatar represented you? Can you explain why it did or did not? (prompts: encourage questions about the movement of the avatar, style, visual appearance, facial expressions).

FITTING IN WITH EVERYDAY LIFE

- How well did using the VR environment fit into your everyday life? (Prompts: Timing of the sessions, duration, dosage of the treatment).
- How much time did you spend using the VR environment?
- Did you miss being part of the treatment once it finished?
- Have you discussed the VR environment with anyone else?
- What were their views?

IMPACT ON MANAGING MENTAL HEALTH

- Has attending therapy sessions in the VR environment made any changes to the way you manage your mental health?
- Are you coping better or worse since using the VR environment?
- Has attending therapy sessions in the VR environment changed the way in which you think about your difficulties? How so (explore in more detail)?
- Has it changed the level of confidence you have to manage your mental health problem? How so (explore in more detail)?
- In your opinion, what are the most important reasons for attending treatment?
- Has VEEP had an impact on the treatment(s) you are currently receiving in the NHS? If it has in what ways?

BENEFITS AND PROBLEMS

- Were there any benefits to taking part in the study?
- Were there any negative consequences for taking part in the study?
- How did you find committing to this treatment?

WHAT COULD BE IMPROVED?

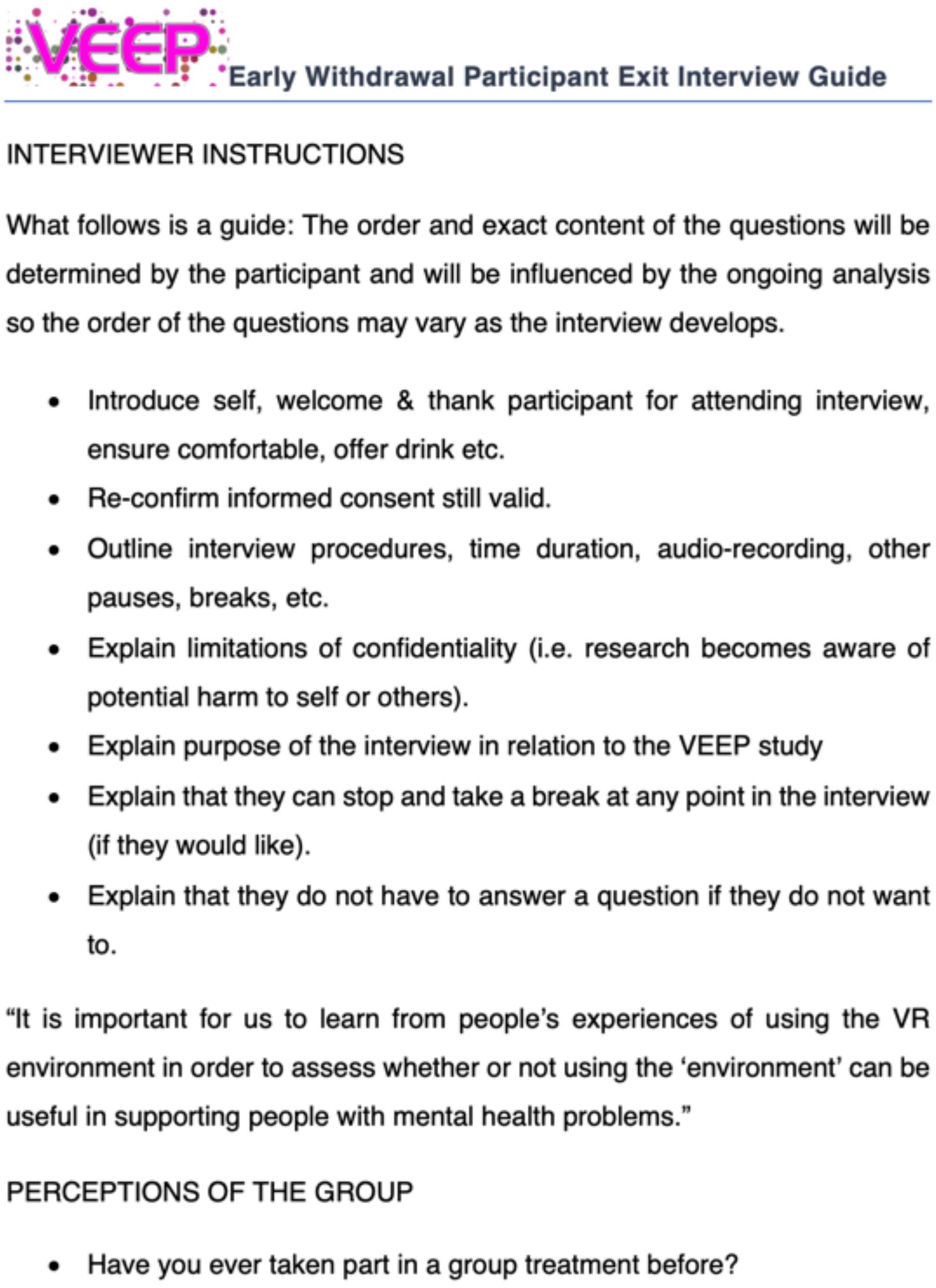
- Are there any ways in which the therapy sessions or the VR environment could be improved? If yes, can you elaborate on what your ideal VR treatment would look like?
- Privacy and Safety - did you feel that the VR environment was safe?
- Did you have any privacy or safety concerns whilst using the VR environment?
- What could we do to assure you that your information is safe?
- Is there anything else you would like to tell me that we've not talked about but might be important for me to know about how to improve the virtual world? Did you feel more or less confident in engaging with the

therapy because it was in VR?

- Finally may I ask how you have found being involved in this interview?
- Prompts: How might we improve the experience for other participants?
- Is there anything else you would like to ask, which has not been covered in the above questions?

End interview, thank participant (your responses are very useful and will help other individuals diagnosed with psychosis), explain what will happen to the information discussed, offer to provide summary of study findings when available.

Appendix 22 – VEEP semi structured exit interview guide (non-completers)



VEEP Early Withdrawal Participant Exit Interview Guide

INTERVIEWER INSTRUCTIONS

What follows is a guide: The order and exact content of the questions will be determined by the participant and will be influenced by the ongoing analysis so the order of the questions may vary as the interview develops.

- Introduce self, welcome & thank participant for attending interview, ensure comfortable, offer drink etc.
- Re-confirm informed consent still valid.
- Outline interview procedures, time duration, audio-recording, other pauses, breaks, etc.
- Explain limitations of confidentiality (i.e. research becomes aware of potential harm to self or others).
- Explain purpose of the interview in relation to the VEEP study
- Explain that they can stop and take a break at any point in the interview (if they would like).
- Explain that they do not have to answer a question if they do not want to.

“It is important for us to learn from people’s experiences of using the VR environment in order to assess whether or not using the ‘environment’ can be useful in supporting people with mental health problems.”

PERCEPTIONS OF THE GROUP

- Have you ever taken part in a group treatment before?

- If you have, what were your experiences of it? (prompts: did it work for your or not? What was good about it or not? How long was this group treatment? What was the size of the group? How many people were in the group?

DIGITAL EXPERTISE AND PRIOR THOUGHTS OF THE TREATMENT

- What were your experiences of using technology before beginning the treatment? (Prompts: apps, Internet websites, social media platforms, virtual worlds, video games).

HOW DOES YOUR USAGE OF TECHNOLOGY COMPARE TO YOUR PEERS?

- What were your experiences / perceptions / thoughts of VR prior to beginning the treatment? (Prompts: have you heard of it before? If you have what did you hear about it?).
- Have you ever used technology to monitor or improve your mental health? If you have, what are your experiences of it?

VIRTUAL REALITY PLATFORM AND TREATMENT

- How did you find using the virtual reality environment to receive therapy?
- "We wanted to develop a virtual environment, which was accessible, engaging, comfortable and a practice place to provide treatment. Do you think the VR environment does this? Why/why not? "
- Did you have any difficulties using the environment in the beginning? If you did, did these difficulties persist during the treatment?
- Do you think this is a good or bad way to manage their experience of psychosis? If yes, why? If no, would there be a better way?
- Do you feel you had enough information to help you to use the VR

environment? Could we have provided any other information or tools?

EXPERIENCES OF USING A VIRTUAL REALITY PLATFORM

- What are your views on the Second Life® environment to deliver the treatment?
- What features (if any) of Second Life® did you like or not like? (Prompts: what did you think about the different therapy rooms, the beach relaxation area, the cinema, the café etc.)
- What were the most memorable parts of the treatment?
- What were the least memorable parts of the treatment?
- Did you feel like you were actually part of Second Life®? Can you describe how it felt? If no, then what improvements can be made?
- What are your experiences of using the avatars to receive therapy? (Prompts: what were the similarities and differences between virtual and face-to-face treatment).
- Did you feel your avatar represented you? Can you explain why it did or did not? (prompts: encourage questions about the movement of the avatar, style, visual appearance, facial expressions).

FITTING IN WITH EVERYDAY LIFE

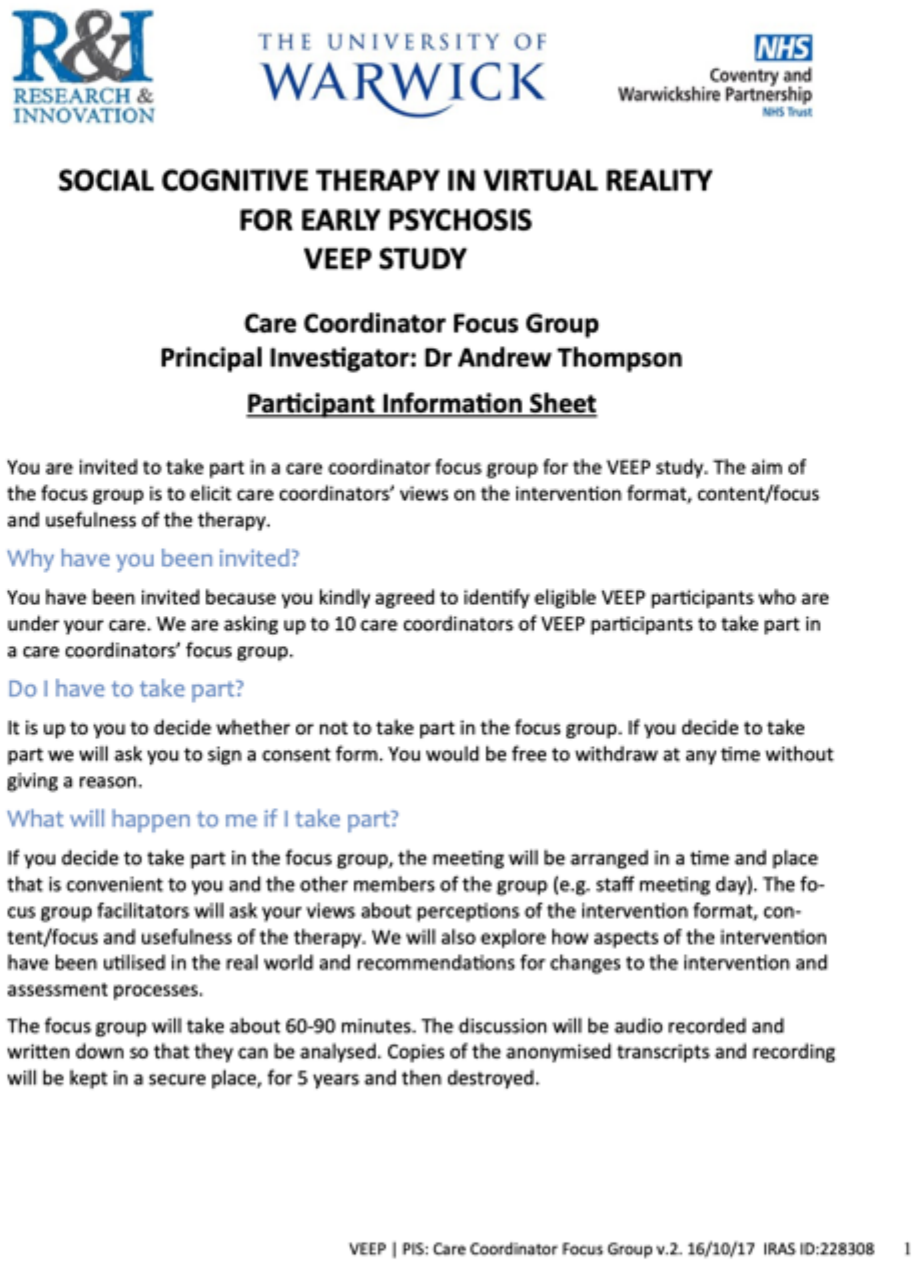
- How well did using the VR environment fit into your everyday life? (Prompts: Timing of the sessions, duration, dosage of the treatment).
- VEEP relies on online technology. How much do you use a computer or other device in your everyday life?
- How much time did you spend using the VR environment?
- Did you miss being part of the treatment once you withdrew?
- Have you discussed the VR environment with anyone else?
- What were their views?

WHAT COULD BE IMPROVED?

- What were your reasons for withdrawing from the treatment early? (Prompts: was there something about the treatment you did not like? Did it involve the treatment dosage/length of sessions?)
- Are there any ways in which the therapy sessions or the VR environment could be improved? (Prompts: what is your ideal number of sessions?) If yes, can you describe to me what your ideal VR therapy would look like?
- If you had the opportunity, would you like to begin another VR treatment?
- Did you have any privacy or safety concerns whilst using the VR environment?
- What could we do to assure you that your information is safe?
- Is there anything else you would like to tell me that we've not talked about but might be important for me to know about how to improve the 'virtual world'?
- Did you feel more or less confident in engaging with the therapy because it was in VR?
- Do you feel it was the 'right time' for to engage in this treatment? Please explain why.
- Finally may I ask how you have found being involved in this interview?
- Prompts: How might we improve the experience for other participants?
- Is there anything else you would like to ask, which has not been covered in the above questions?

End interview, thank participant (your responses are very useful and will help other individuals diagnosed with psychosis), explain what will happen to the information discussed, offer to provide summary of study findings when available.

Appendix 23 – VEEP focus group participant information sheet



RESEARCH & INNOVATION

THE UNIVERSITY OF WARWICK

NHS
Coventry and Warwickshire Partnership
NHS Trust

SOCIAL COGNITIVE THERAPY IN VIRTUAL REALITY FOR EARLY PSYCHOSIS
VEEP STUDY

Care Coordinator Focus Group
Principal Investigator: Dr Andrew Thompson

Participant Information Sheet

You are invited to take part in a care coordinator focus group for the VEEP study. The aim of the focus group is to elicit care coordinators' views on the intervention format, content/focus and usefulness of the therapy.

Why have you been invited?

You have been invited because you kindly agreed to identify eligible VEEP participants who are under your care. We are asking up to 10 care coordinators of VEEP participants to take part in a care coordinators' focus group.

Do I have to take part?

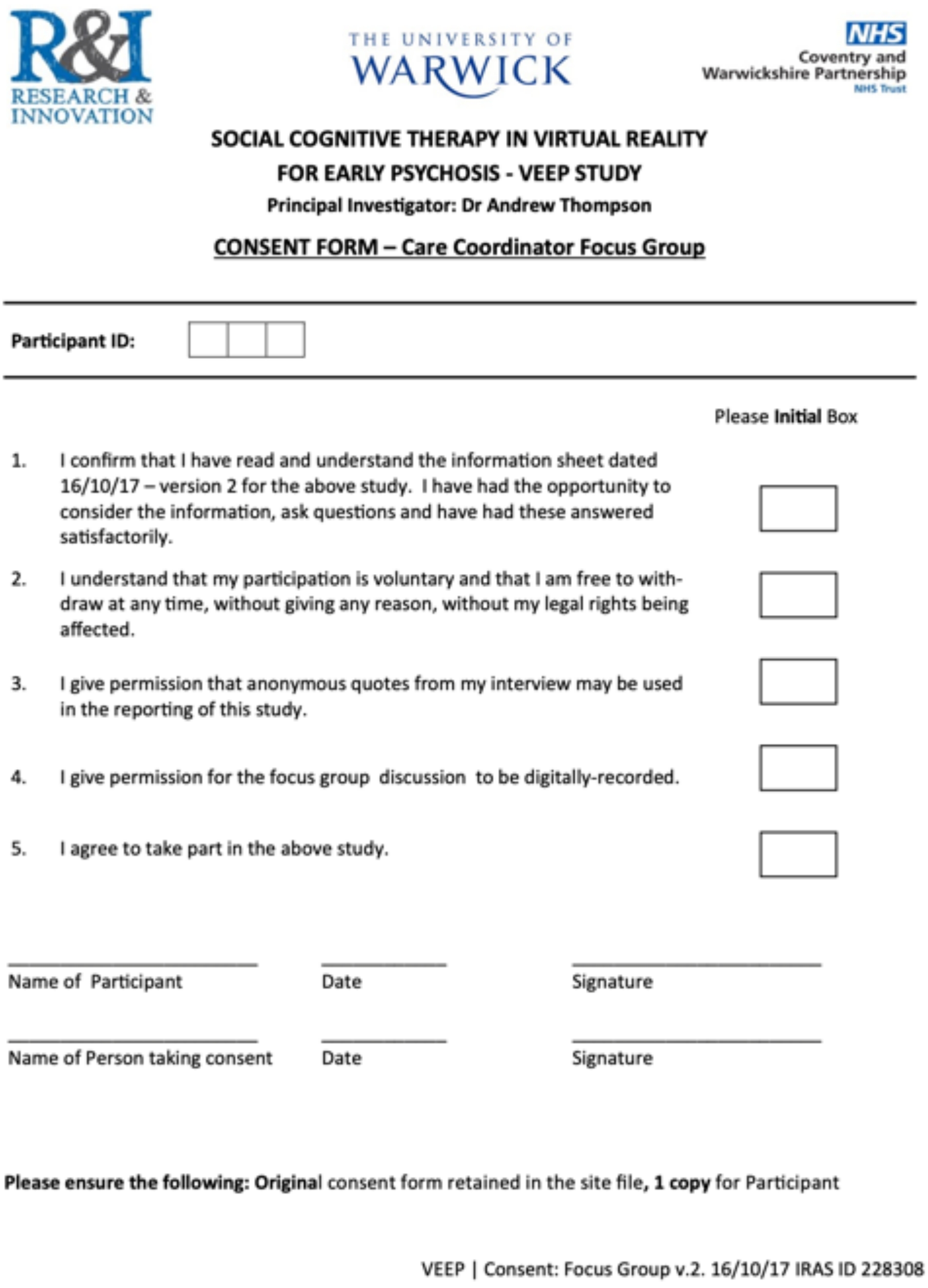
It is up to you to decide whether or not to take part in the focus group. If you decide to take part we will ask you to sign a consent form. You would be free to withdraw at any time without giving a reason.

What will happen to me if I take part?

If you decide to take part in the focus group, the meeting will be arranged in a time and place that is convenient to you and the other members of the group (e.g. staff meeting day). The focus group facilitators will ask your views about perceptions of the intervention format, content/focus and usefulness of the therapy. We will also explore how aspects of the intervention have been utilised in the real world and recommendations for changes to the intervention and assessment processes.

The focus group will take about 60-90 minutes. The discussion will be audio recorded and written down so that they can be analysed. Copies of the anonymised transcripts and recording will be kept in a secure place, for 5 years and then destroyed.

Appendix 24 – VEEP focus group participant consent form



SOCIAL COGNITIVE THERAPY IN VIRTUAL REALITY FOR EARLY PSYCHOSIS - VEEP STUDY

Principal Investigator: Dr Andrew Thompson

CONSENT FORM – Care Coordinator Focus Group

Participant ID: ☐☐☐

Please **Initial** Box

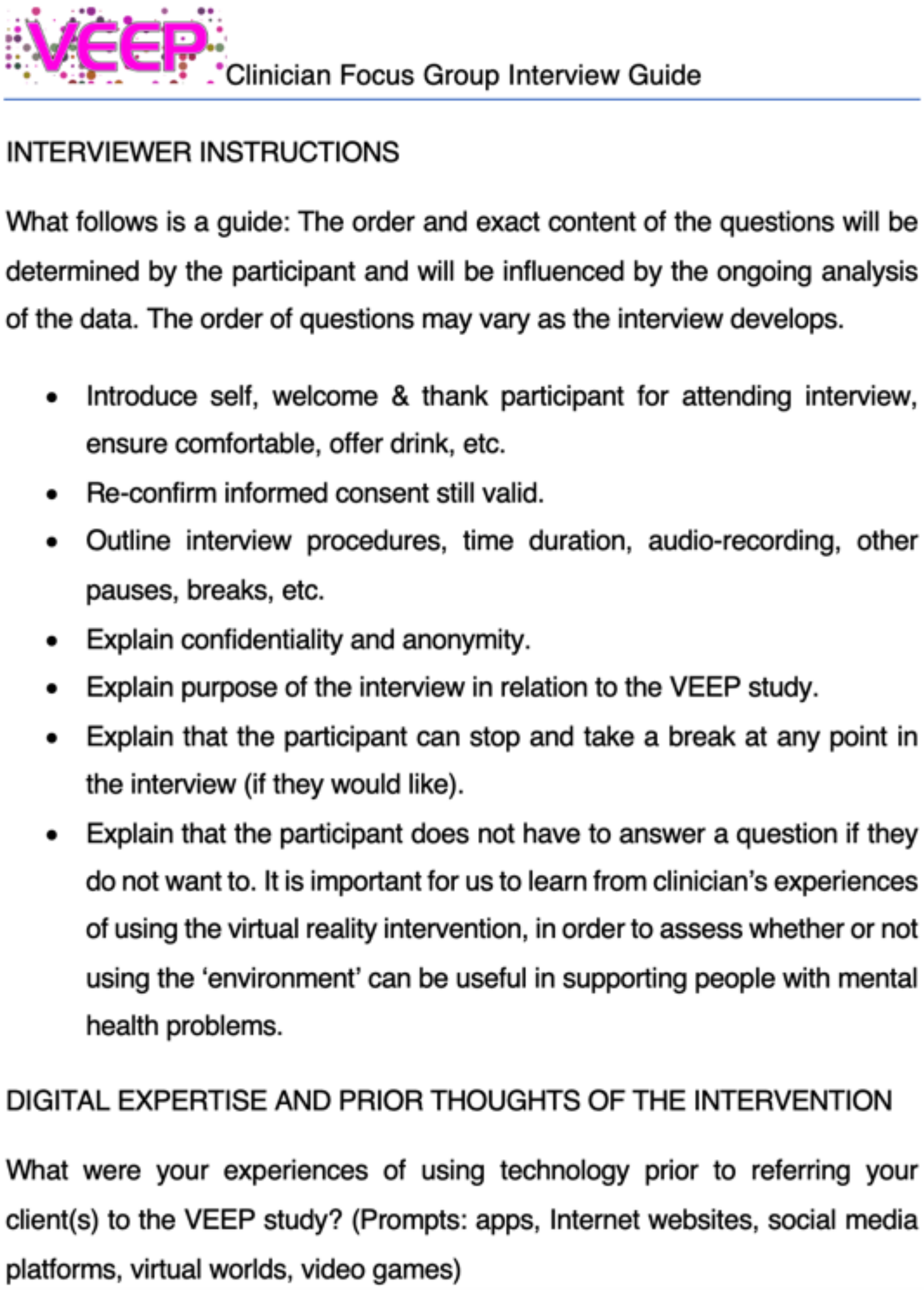
1. I confirm that I have read and understand the information sheet dated 16/10/17 – version 2 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected. ☐
3. I give permission that anonymous quotes from my interview may be used in the reporting of this study. ☐
4. I give permission for the focus group discussion to be digitally-recorded. ☐
5. I agree to take part in the above study. ☐

______________________	__________	______________________
Name of Participant	Date	Signature
______________________	__________	______________________
Name of Person taking consent	Date	Signature

Please ensure the following: Original consent form retained in the site file, **1 copy** for Participant

VEEP | Consent: Focus Group v.2. 16/10/17 IRAS ID 228308

Appendix 25 – VEEP clinician focus group interview schedule



VEEP Clinician Focus Group Interview Guide

INTERVIEWER INSTRUCTIONS

What follows is a guide: The order and exact content of the questions will be determined by the participant and will be influenced by the ongoing analysis of the data. The order of questions may vary as the interview develops.

- Introduce self, welcome & thank participant for attending interview, ensure comfortable, offer drink, etc.
- Re-confirm informed consent still valid.
- Outline interview procedures, time duration, audio-recording, other pauses, breaks, etc.
- Explain confidentiality and anonymity.
- Explain purpose of the interview in relation to the VEEP study.
- Explain that the participant can stop and take a break at any point in the interview (if they would like).
- Explain that the participant does not have to answer a question if they do not want to. It is important for us to learn from clinician's experiences of using the virtual reality intervention, in order to assess whether or not using the 'environment' can be useful in supporting people with mental health problems.

DIGITAL EXPERTISE AND PRIOR THOUGHTS OF THE INTERVENTION

What were your experiences of using technology prior to referring your client(s) to the VEEP study? (Prompts: apps, Internet websites, social media platforms, virtual worlds, video games)

- What were your perceptions of virtual reality and virtual world environments prior to referring your client(s) to the VEEP study? (Prompts: have you heard of VR or virtual worlds before? If you have, what did you hear about it?).
- What experience have your clients had of using technology to monitor or support their mental health? If they have, what were their experiences of it?
  Was their experience helpful / helpful – can you tell me a bit more about that?

VIRTUAL REALITY PLATFORM AND INTERVENTION

Introduction: We wanted to develop a virtual environment that is accessible, engaging, and comfortable and a safe place to provide treatment.

- Do you think this is a good or bad way to manage patients' experiences of psychosis? If yes, why? If no, would there be a better way?
- What are the benefits of using virtual reality treatment to manage psychosis?
- What are the negative consequences of using virtual reality to manage psychosis?
- What are your views on the Second Life® environment to deliver the treatment?
- What features (if any) of Second Life® did you like or not like? (Prompts: what did you think about the different therapy rooms, the beach relaxation area, the cinema, the café etc.)
- What were the most memorable features of Second Life®?
- What were the least memorable features of Second Life®?

IMPACT ON MANAGING MENTAL HEALTH

- How well did using the VR environment fit into your client's everyday life? (Prompts: Timing of the sessions, duration, dosage of the treatment).
- Has attending therapy sessions in the VR environment made any changes to the way your client manages their mental health or experiences their mental health problem?
- Has it had any effect on the way you work with the client (e.g. has it helped your work / hindered your work?)
- How do you think the client is coping since taking part in the VEEP study?
- How has attending therapy sessions in the VR environment changed the way in which they your client might think about their difficulties? (explore in more detail)?
- Has it changed their level of confidence to manage their mental health problems? How so (explore in more detail)?

WHAT WAS THE IMPACT ON YOUR THERAPEUTIC PRACTICE?

- In what way did recruiting for VEEP impact your normal workflow?
- Do you feel you had enough information to help you to recruit participants to the VEEP study? What other information could we have provided to facilitate the process?
- In what way did VEEP help you in the way you provide care to the client?
- Were there any specific features within VEEP that played a role in this?
- Was there any instance where VEEP was unhelpful or got in the way? Can you tell me more about this?

WHAT COULD BE IMPROVED?

- In what ways could the therapy sessions or the virtual reality environment be improved? Can you elaborate on what your ideal VR treatment would look like?

- Did you have any privacy or safety concerns about the virtual reality environment? Explore in detail.
- (If you did) what could we do to assure you that your client's information is safe?
- Is there anything else you would like to tell me that we've not talked about but might be important for me to know about how to improve the study?
- Finally, may I ask how you have found being involved in this interview?

End interview, thank participant (your responses are very useful and will help other clinicians working with those who have experienced psychosis), explain what will happen to the information discussed, offer to provide summary of study findings when available.

Appendix 26 – VR-360° storyboard video 1

Date and Time: Friday 6th January 2017 10am – 1pm

Location: Café Social, Social Sciences Building, University of Warwick

Crew size: Infinite Pixel (4 people)

Number of actors/volunteers required: 6-8 people

Additional Equipment/materials: coffee cups (no branding).

N.B. We have a choice of either filming the entire video in one take or filming the scenes separately. I've chosen to split the scenes in accordance to outcome/task we want to assess. However it doesn't have to stay this way.

Facial Emotion Recognition

The service user is sitting down in the middle of the café with their drink, where there are a couple of individuals at a nearby table engaged in a conversation (Person A is talking about their experiences of sitting in an examination hall, when a student's phone started ringing. The invigilator comes towards the student concerned and asks him to turn his paper in as this qualifies as cheating. Instead of accepting this, this student decides to argue with the invigilator and thereby delay the exam in the process. Person B looks surprised at this).

Person A: "So then he got up and started talking to the invigilator about why he shouldn't be removed from the hall…" *(Looks disgusted).*

Person B: "He should have just admitted to his mistakes." (*Looks surprised*).

Person C who's just paid for his/her drink at the counter walks over to the service user with a *neutral* look on his/her face. He/she then asks if he could borrow a chair ("Hi I was wondering if I could borrow this chair please?").

Service user nods his/her head in response (no speech allowed?). Person C then takes this chair to a nearby table and Person D, joins him/her where they engage in a conversation (its' important to make sure that there is a table nearby which only has one chair).

In the background, there should be other individuals who are sitting and displaying different emotions on their face. For example:

- A couple sitting very closely together and looking very *happy*. They may be smiling at each other and laughing (Person E and Person F).
- Another individual (Person G) may be looking at their phone with a neutral look on their face in the distance.

Jumping to Conclusion Bias/Perspective taking

Person A has just bought their drink and is walking towards a table. He/she accidentally knocks over Person B's drink (his/her bag could have knocked over the drink because there is not enough space between the tables for example). Person B is clearly frustrated and upset because it has spilt all over his/her papers. Person A apologies ("I'm so sorry!"). Person B says "it's fine," but is clearly still upset. After trying to clear up the spillage, he/she walks up to the barista and asks for another drink ("hi can I have another coffee please?") He/she is still clearly frustrated and angry – so therefore he/she acts abrupt and angry to the barista (Person C). The barista is visibly sad that he/she is being spoken to in this way. The barista then continues to make a new drink for person B. As the barista hands over the drink to person B, he/she asks "have I done something to offend you?" Person B then pays for his/her drink and says, "look I'm sorry I spoke to you in this way; I was just frustrated that my drink spilt on my papers." The barista looks a bit more positive and says "okay I understand." Person B walks back to his/her table.

This is from the viewpoint of the service user, who could be either sitting down at the table with their drink or waiting in line to get a drink themselves.

Jumping to Conclusion Bias/Perspective taking

Person C and D are sitting at a nearby table working on a school project together. They have their papers/books on the table, and person C has his/her wallet/purse on the table. Person C says that before they start, they want to buy a coffee (“okay before I start I just want to buy a coffee”). Instinctively he/she puts his/her wallet/purse in their back pocket. As he/she is doing this, person D says “okay I’m going to get to work on this first chapter.” Person C then walks up to the barista and asks to buy a coffee (“can I buy a large coffee please?”). The barista makes the cup of coffee. As Person C goes to pay for the coffee, he/she realises that his/her wallet is not in his/her coat pocket. She looks fearful, hastily walks up to person D and accuses him/her of taking her purse

Person C: “you’ve stolen my wallet/purse haven’t you?”

Person D: denies that he/she has; “no I haven’t!”

Person C: “well I can’t find my wallet, and I remember leaving it here on the table.”

Person D: “Have you checked your pockets?”

Person C: “Yes! I checked my coat pockets (checks them again).”

Person D: “What about your other pockets?”

Person C: checks the back pockets and finds the wallet. “oh…..here it is.” *(looks embarrassed).*

**There’s approximately a 5 second pause….”*

Person C: “Sorry about accusing you. I shouldn’t have done that.”

Person D: “That’s ok”

Person C: walks back to the barista to pay for the coffee.

This is from the viewpoint of the service user, who is sitting down at a nearby table with their own drink.

Jumping to Conclusion Bias/Perspective taking

At a nearby table to the service user a couple sit down with their cups of coffee.

Person E: “So what are you doing for the rest of the day?”

Person F: “Not much really……should do some work though.”

Person E: “Well shall we go for lunch a little later on?”

Person F: “(*long pause)* Hmm…well I should be getting on with doing some work.”

Person E: “Oh I see…..you don’t want to hang out with me *(looks sad)*.”

Person F: “no its not that at all! I’m really behind with my work, so I should use this time to catch up.”

Person E: “okay….yeah sure fine *(looks upset).*

This is from the viewpoint of the service user, who is sitting down at a nearby table with their own drink.

Appendix 27 – VR-360° storyboard video 2

Details

When: Thursday 17th October 2019 13:00-17:00

Where: Orygen, The National Centre of Excellence in Youth Mental Health. Filming will take place in a meeting room and in the café/kitchen area.

Number of actors: 4 people

Actor 1: Interviewer 1

Actor 2: Interviewer 2

Actor 3: Candidate 1

Actor 4: Candidate 2

Additional equipment/materials: Pens, folders, booklets and coffee cups (no branding).

Rationale: These scenes will be filmed on a 360 degree camera. The purpose of these videos is to be part of a VR treatment programme for people with Psychosis. The aim of these videos is to help patients improve their social cognition skills (which is related to social skills and functioning).

We've decided to tailor these videos around job interview scenarios. This is because our patients (who are typically young people) will be looking for jobs and may struggle with undertaking interviews. The videos will be viewed by patients using a VR headset, which will give them a more immersive and realistic experience of the scene. These scenes all follow a chronological order.

Scene 1: Facial Emotion Recognition

Premise: This scene will be a good introduction into facial emotion recognition. This is an opportunity for patients to develop their understanding of reading and interpreting emotions. The premise is that actors (Actor 1 and 2) will be standing against a white wall, where only their face will be filmed. These actors will be required to show certain emotions every 2 seconds (6 facial expressions in total).

The purpose of this scene is to show our patients how facial expressions can change very quickly. We can interpret someone's face as looking 'sad' and then in another second the facial expression has changed to looking 'happy.' (Please see Appendix A for more information).

Scene 2: Waiting Room

Premise: candidate 1 and 2 are in the waiting area (maybe they both meet by the water cooler, where they are getting a drink) ready to be interviewed for an administration job. Candidate 1 is quite nervous about the interview in comparison to Candidate 2. They have a conversation about this. The purpose of this interview is to provide a background and introduction to the next scenes. This is also a point in which the therapist might stop and introduce people to recognizing the link between thoughts – emotions – actions by contrasting the two actors

Candidate 2: "Hi how are you, I'm (insert name here)." (Smiling).

Candidate 1: "Hi nice to meet you, I'm (insert name here)." (does not make eye contact and speaks quietly).

Candidate 2: "Erm so you're here for the administration job interview right?"

Candidate 1: "Yes I am." (looks up momentarily and looks down again at their drink).

Candidate 2: (Looks around the room) “So how are you feeling about the interview?”

Candidate 1: “Hmm…quite nervous if I’m being honest.”

Candidate 2: “Oh really? (Looks surprised). Why?”

Candidate 1: “Well there’s a lot of pressure to do well in the interview, and I feel that makes me uncomfortable and anxious.”

Candidate 2: “Yeah I understand. I find that if you relax and try not to worry too much about how it will go, it should be ok.”

Candidate 1: “Hmm…yeah.”

Candidate 2: “Well that always works for me anyway (smiles)?”

Candidate 1: (Nods in agreement).

Candidate 2: “Okay well good luck!”

Candidate 1: “Thank you good luck to you too.”

End of Scene.

Scene 3: Candidate 1 Interview

Premise: Candidate 1 now has their one to one interview. Candidate 1, who has already said they are quite nervous, finds the interview challenging. Candidate 1 struggles to make eye contact with the interviewer, speaks quietly, looks fearful and anxious, misunderstands some questions and does not answer them properly. The purpose of this interview is to continue developing emotion recognition and perspective taking, linking thoughts-emotions-actions.

Interviewer 1: “Hi. My name is (insert name here). I’m the administration manager here. Thank you for coming to the interview” (makes eye contact with candidate 1 and smiles).”

Candidate 1: “Hmm…thanks” (does not make eye contact and looks down).

Interviewer 1: “Okay so I want to start by firstly asking some questions about your previous experience. So tell me a little bit about yourself.”

Candidate 1: “Well….I work as an administration assistant nearby….”

Interviewer 1: “Where exactly?”

Candidate 1: “Oh! Erm the school on Wimpole Street. You know…”

Interviewer 1: “Okay great! If you could, please tell me a little bit more about this?”

Candidate 1: “Erm what do you mean?”

Interviewer 1: “Err (looks surprised) what are your responsibilities in this job.”

Candidate 1: “Yeah..err..so…I send emails and look over the databases and stuff. So..yeah.”

Interviewer 1: “Oh okay so what types of databases, and if you could expand on this more?”

Candidate 1: “Hmm…student databases…(long pause). Not sure what else you want me to add?”

Interviewer 1: “Okay that’s fine. So why do you want this job?”

Candidate 1: “Erm…I’m not sure. I thought I would apply and see what happens.”

Interviewer 1: “Okay well I’ve asked all the questions I have. That’s the end of the interview. Thank you for your time.”

Candidate 1: (Nods their head).

End of Scene.

Scene 4: Candidate 2 Interview

Premise: Candidate 2 now has their interview. In comparison to Candidate 1, Candidate 2 has a positive interview experience at the beginning by maintain eye contact, smile, appear happy and answer questions directly and thoroughly This changes after the interviewer gets a phone call and then behaves less warmly to the candidate. This causes the candidate to perform more poorly by acting suspicious.

The purpose of this scene and the previous scene is to compare and contrast these interview performances.

Interviewer 2: “Hi. My name is (insert name here). I’m the administration manager here. Thank you for coming to the interview” (makes eye contact with candidate 2 and smiles).

Candidate 2: “Thank you for having me. I’m (insert name here). (Gets up to shake the interviewer’s hand).

Interviewer 2: “Okay great. So I want to start by firstly asking some questions about your previous experience. So tell me a little bit about yourself.”

Candidate 2: “Great. Well I have a lot of experience in administration, having worked in multiple roles. My first admin post was in a local recruitment company (insert name here) which is in the city centre. After a year there, I wanted to broaden my experience and so worked in the local hospital in the Outpatients department. Now I would like to continue building on my experience” (Smiles and maintains eye contact with the interviewer).

Interviewer 2: “Great sounds fantastic. So what types of responsibilities did you have in these posts?”

Scene 5: Job Interview Interruption

Premise: This is a continuation from the previous scene. This scene takes place in the interview room. The interviewer is getting ready for the third interview, they seem ok when they receive a phone call and get some bad news. Therefore their mood changes quite quickly.

Phone rings

Interviewer 2: “Sorry I need to take this call” (leaves room).

Interviewer 1: (Answers their phone) “Hello? (pause). What do you mean it’s cancelled? I thought we booked that in months ago? (pause) OK, well I guess we can’t do much about it now. Goodbye.”

End of Scene.

Scene 6: Candidate 2 Interview (continued)

Premise: This scene immediately follows the previous scene. Due to receiving some bad news, the interviewer’s mood has changed and they are distracted, irritated and upset. The purpose of this scene is to show that there may be multiple reasons why someone appears the way they are. We cannot know for certain why someone is displaying particular emotions and so it’s important to avoid jumping to conclusions:

Interviewer 2: “Sorry about that erm…(pause). Now where were we? (looks at papers). Yes I can see from your resume that you have some administrative experience, although not as much as we would like. You will have to understand that this is a very busy fast paced organisation, so I’m wondering what skills you think will transfer over from recruitment to this environment?”

Candidate 2: “Well….I have teamwork experience, where I have worked in busy teams. I also managed the customer and client databases.”

Interviewer 2: “So one thing we don’t tolerate here is lateness. We start promptly at 9am and finish at 5pm. You will be able to get here on time right?”

Candidate 2: “Err yes of course. I have a car and also there is err public transport (looks surprised and confused). ”

Interviewer 2: “So I see from your resume that there was a gap in your employment for 12 months. Is there a reason why?”

Candidate 2: “Err yes I was studying for my Masters degree during that time in English Literature.”

Interviewer 2: “English Literature. So what made you decide to study for a Masters in English Literature and then move to working in administration?”

Candidate 2: “Erm I’m not sure…I dealt with a high volume of work in my masters and so I guess I can deal with a high volume of work in this job (voice becomes more quieter).”

Interviewer 2: “Well I think we’ve asked all the questions we have. Thanks.”

Candidate 2: “Okay well thanks.”

End of Scene.

Scene 7: Interview from the First Person Perspective

Premise: In the previous scenes, the patient will be viewing these videos using a third person perspective. However in order to make the experience more immersive, we will film a scene where 2 interviewers are asking the camera questions. This will allow the patient to feel like they are taking part in the interview. After each question is asked there will be a pause (this will allow for the therapist to pause the video and discuss the answers with the patient).

There will be 2 pathways to allow for the patient to give different answers.

Pathway A is an example of a ‘good’ interview. The interviewers are relaxed and are content with the ‘answers’ the patient provides. Pathway B is an example of an interview which doesn’t go as well by comparison. The interviewers continuously have to ask the patient to expand more.

Interviewer 1: Hi thank you for coming to this interview. My name is (insert name here).

Interviewer 2: And my name is (insert name here). So we want to start by asking about your previous experience?

Pathway A

Interviewer 1: So, can you tell us about your past work experience?

5 second pause.

Interviewer 2: Okay that sounds great. Thank you (smiles and maintains eye contact).

Interviewer 1 makes notes.

Interviewer 1: So tell us why you would like this job?

5 second pause.

Interviewer 2: Thank you that’s very helpful.

Interviewer 1: So what skills do you have which you think are relevant to this job?

5 second pause.

Interviewer 2: Great fantastic. That’s all the questions we have. Thank you for coming.

Interviewer 1: Thank you. We will be in touch with you to let you know

Both interviewers smile directly at the camera.

Pathway B

(Interviewer 1: So tell us about your prior employment?)

5 second pause.

Interviewer 2: Hmm…okay thanks. Can you elaborate on this more please? *(Looks confused).*

At this moment, Interviewer 1 and 2 look at each other, with slightly disinterested look. Interviewer 1 then looks down to make some notes.

5 second pause.

Interviewer 1: Okay thank you. So tell us why you would like this job?

5 second pause.

Interviewer 2: Okay thanks, but why this job specifically?

5 second pause.

Interviewer 2: Thank you.

Interviewer 1: So what skills do you have which you think are relevant to this job?

5 second pause.

Interviewer 1: Hmm…okay anything else?

5 second pause.

Interviewer 2: Well that's all the questions we have. Thank you for coming.

Interviewer 1: Thank you.

Both interviewers have neutral facial expressions and look directly at the camera.

Appendix 28 – VR-360° PPI participant recruitment advert

VR-360

virtual reality 360 degree intervention to improve social cognition deficits in those with first episode psychosis - OPINIONS SOUGHT

RECRUITMENT

WHO

- Young individuals with lived experience of mental health difficulties (18-35 years)

WHAT DOES IT INVOLVE?

- 1-2 workshops online
- 1 hour each
- August - September

ORGANISATION

UNIVERSITY OF WARWICK

REIMBURSEMENT

- A free Google Cardboard Headset posted to an address of your choice
- A £10 Amazon voucher

INTERESTED?

Please contact Doctoral Researcher Farah Elahi
F.Elahi@warwick.ac.uk

Appendix 29 – VR-360° PPI information sheet

Patient and Public Involvement (People with Lived Experience) Information sheet

Title: VR-360° intervention to improve social cognition deficits in those with first episode psychosis

Introduction

You are being invited to participate in a research project. Before you decide whether to take part, it is important for you to understand why the research is being conducted and what it will involve.

Please take time to read the following information carefully. If anything is not clear, feel free to ask any questions.

What is the purpose of the study?

Many people with psychosis struggle to engage with traditional face-to-face treatments. This is especially true for service users who have difficulties with social cognition (how people make sense of the social world) and social functioning (how people get along with others and engage in day-to-day activities). Therapies designed to improve social cognition and social functioning usually involve working with people individually or in groups. However, many service users find it difficult to attend face-to-face therapy.

New technologies like 'virtual reality' (VR) are an exciting new area of development with huge potential to help service users with psychosis overcome some of their anxieties about attending face-to-face therapy, at least in the initial stages, as VR therapies can be delivered at a person's home. During the COVID-19 pandemic, it is particularly vital that online treatments are developed when face-to-face therapy is no longer safe to undertake.

Prior to this research, a small feasibility study using a virtual world to provide social cognition and interaction training (SCIT) to those with first episode psychosis, in order to improve their social cognitive deficits was undertaken (2016-2018). The findings for this research can be found here and here. Findings showed that providing SCIT treatment in a virtual world was feasible and acceptable to those patients with first episode psychosis. Therefore these findings are being used to develop this VR immersive intervention using the SCIT.

This VR-360° intervention has two phases: i) adapting the SCIT using 360° videos with the guidance and support of service users' experts and researchers ii) testing if a small number of service users in their first episode of psychosis use and like this adapted package.

Our main interest is how usable these videos are for service users. These videos have been scripted and filmed using a 360° camera. The aim is to have

viewers feel immersed in 'everyday' scenarios that may otherwise trigger social anxiety. Therefore during a stepped care approach with a therapist, service users can view these videos and improve their social functioning. The findings from this research will be used to plan a study that would allow us to properly test if this package improves service user's social skills and social functioning.

Why have I been invited?

You have been invited because you have lived experience of mental health difficulties and are aged between 18-45 years. As someone with lived experience of mental health difficulties, we are interested in hearing your views on the development of this intervention. 3 individuals are being recruited into the group.

Do I have to take part?

No, it is up to you whether you would like to take part and there will be no penalty for choosing not to take part. If you decide to participate, you will be required to sign a consent form. You can withdraw your consent at any time without having to give a reason.

What will happen to me if I take part?

If you agree to take part, you will be invited to attend a workshop. It is possible 1 other workshop may also be scheduled at a later date, if we run out of time in the first workshop. The workshop will last about 60 minutes and will be conducted via videoconferencing. Therefore you will be audio-recorded.

Before the workshop

A Google Cardboard will be mailed over to an address you have provided, which is a VR headset. Your smartphone can be inserted into the Google Cardboard and you can watch the 360° videos on Youtube. You can watch the videos in 360° mode by clicking on the ‘VR headset logo’ on the screen, which is only available on the Youtube Smartphone app (see below):

Therefore you will need a Youtube App on your smartphone. You can view the videos here and here. You are welcome to view the videos before the workshop.

During the workshop

You are allowed to keep your camera either on or off – whatever you feel most comfortable with. As we are using videoconferencing methods, you will have a username on your screen. You are required to **only write a first name** as your username and to **not put a surname down**. This is for confidentiality purposes.

You are also allowed to use a pseudonym for your first name if you would like. Please email Farah Elahi in advance to inform her that you would like to be referred to by a pseudonym.

The workshop will be facilitated by Farah Elahi. She will ask questions about:

1. Your thoughts on the outline and framework of the intervention.
2. The 360° videos that have been designed, filmed and will be used as part of a novel intervention to improve social cognitive deficits in first episode psychosis.

What are the possible disadvantages and risks of taking part?

We do not anticipate that there will be any risks to taking part in the study. However if for any reason you would like to stop taking part, you are free to leave and resume when you are ready or stop altogether.

What are the potential advantages of taking part?

There are no direct advantages of taking part in the study. However, we hope that the information you provide will help us to make improvements to the intervention and inform the design of a future trial to test the package.

Will there be any payment or reimbursement of expenses?

As a thank you for taking part in the workshop, you have already been provided with a Google Cardboard headset, which you can keep. Furthermore you will be provided with a £10 Amazon gift voucher after completing all of the workshop(s).

Will my participation be kept confidential?

Yes. All information about you will be kept confidential. A code number, instead of your name will be used to identify data about you, and the list that links the codes to your identity will be kept separately from the data. The workshop(s) audio recording and transcriptions will be saved in a password protected file in a secure encrypted server. This will be kept for 5 years and then destroyed.

How will we use information about you?

We will need to use some demographic information from you for this research project. This information will be used in the analysis and write up of the study. Your data will have a code number. We will keep all information about you safe and secure. Once we have finished the study, we will keep some of the data so we can check the results. We will write our reports in a way that no-one can work out that you took part in the study.

What will happen if I don't want to carry on with this study?

You are free to withdraw from the study at any time without giving a reason and will not be penalised in any way. If you have taken part in the workshop, we will use the data unless you tell us specifically not to.

Who is organising and funding this research?

The study is being designed and developed by Farah Elahi and will be part of her doctoral thesis. Farah Elahi is a PhD student in Health Sciences at the University of Warwick. She is being funded by the Economics and Social Research Council (ESRC) to complete her thesis. She has a joint funding studentship between WMS and NIHR Mental Health MedTech Co-operative at the University of Nottingham.

Has the research been reviewed by an appropriate research ethics committee?

According to the University of Warwick's Biomedical & Scientific Research Ethics Committee (BSREC), this study does **not** require University of Warwick nor NHS Research Ethics Committee approval. However this study protocol has been and will continue to be reviewed by Farah Elahi's PhD Supervisors based at the University of Warwick and the University of Nottingham.

What will happen to the results of the research?

The workshop is part of a study on producing and testing a treatment for young people with first episode psychosis, to improve their social cognitive deficits. Study findings will be written up as part of Farah Elahi's PhD thesis and will be presented at conferences. The findings will also be published in a scientific journal. Your name will not be used in any report or publication. A summary of the findings can be provided and sent to you if you wish.

What happens if there is a problem?

If you have a complaint about this study or are unhappy or dissatisfied about any aspect of your participation, we would ask you to tell us about this in the first instance, so that we can try to resolve any concerns and find a solution. If you remain unhappy and wish to complain formally about any aspect of the way you have been approached or treated during the course of this study, then please contact Farah Elahi's Warwick Supervisors

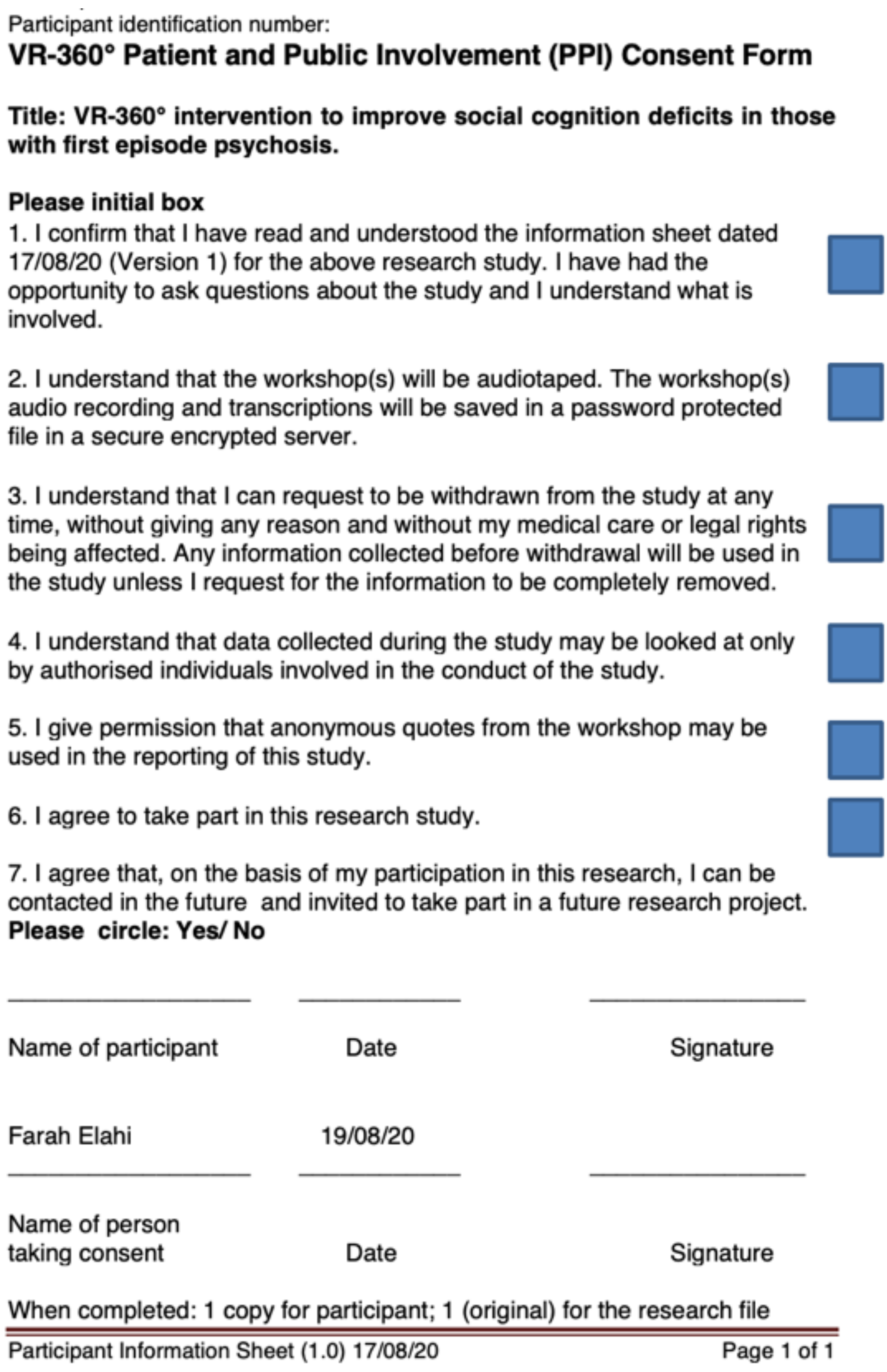
Dr. Deborah Biggerstaff: D.L.Biggerstaff@warwick.ac.uk &

Dr. Andrew Thompson: andrew.d.thompson@warwick.ac.uk

What happens if you would like more information about the study?

Name: Farah Elahi
Occupation: PhD student in Health Sciences
Location: Warwick Medical School, University of Warwick, Coventry, CV4 7AL
Email: F.Elahi@warwick.ac.uk

Appendix 30 – VR-360° PPI consent form



Participant identification number:

VR-360° Patient and Public Involvement (PPI) Consent Form

Title: VR-360° intervention to improve social cognition deficits in those with first episode psychosis.

Please initial box

1. I confirm that I have read and understood the information sheet dated 17/08/20 (Version 1) for the above research study. I have had the opportunity to ask questions about the study and I understand what is involved. ☐

2. I understand that the workshop(s) will be audiotaped. The workshop(s) audio recording and transcriptions will be saved in a password protected file in a secure encrypted server. ☐

3. I understand that I can request to be withdrawn from the study at any time, without giving any reason and without my medical care or legal rights being affected. Any information collected before withdrawal will be used in the study unless I request for the information to be completely removed. ☐

4. I understand that data collected during the study may be looked at only by authorised individuals involved in the conduct of the study. ☐

5. I give permission that anonymous quotes from the workshop may be used in the reporting of this study. ☐

6. I agree to take part in this research study. ☐

7. I agree that, on the basis of my participation in this research, I can be contacted in the future and invited to take part in a future research project.
Please circle: Yes/ No

Name of participant	Date	Signature
Farah Elahi	19/08/20	
Name of person taking consent	Date	Signature

When completed: 1 copy for participant; 1 (original) for the research file

Participant Information Sheet (1.0) 17/08/20 Page 1 of 1

Appendix 31 – VR-360° PPI workshop presentation

WARWICK

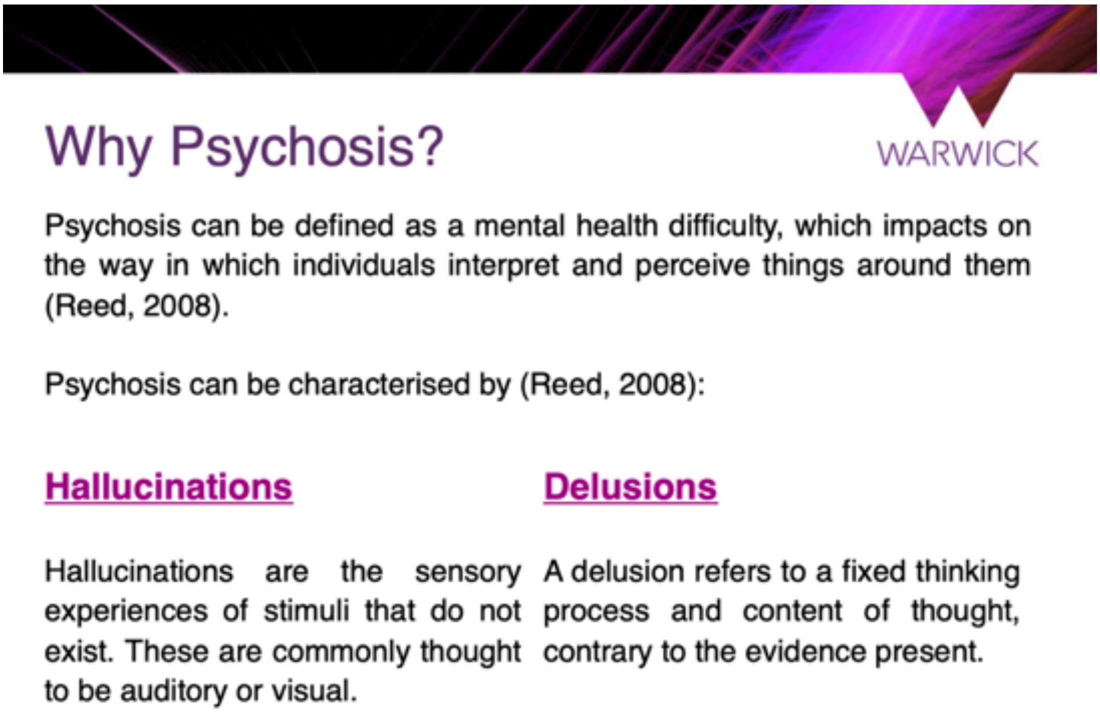
VR-360° INTERVENTION TO IMPROVE SOCIAL COGNITION DEFICITS IN THOSE WITH FIRST EPISODE PSYCHOSIS

By Farah Elahi

WARWICK

Objectives

- Background and Rationale
- Research Questions
- Study



Why Psychosis?

WARWICK

Psychosis can be defined as a mental health difficulty, which impacts on the way in which individuals interpret and perceive things around them (Reed, 2008).

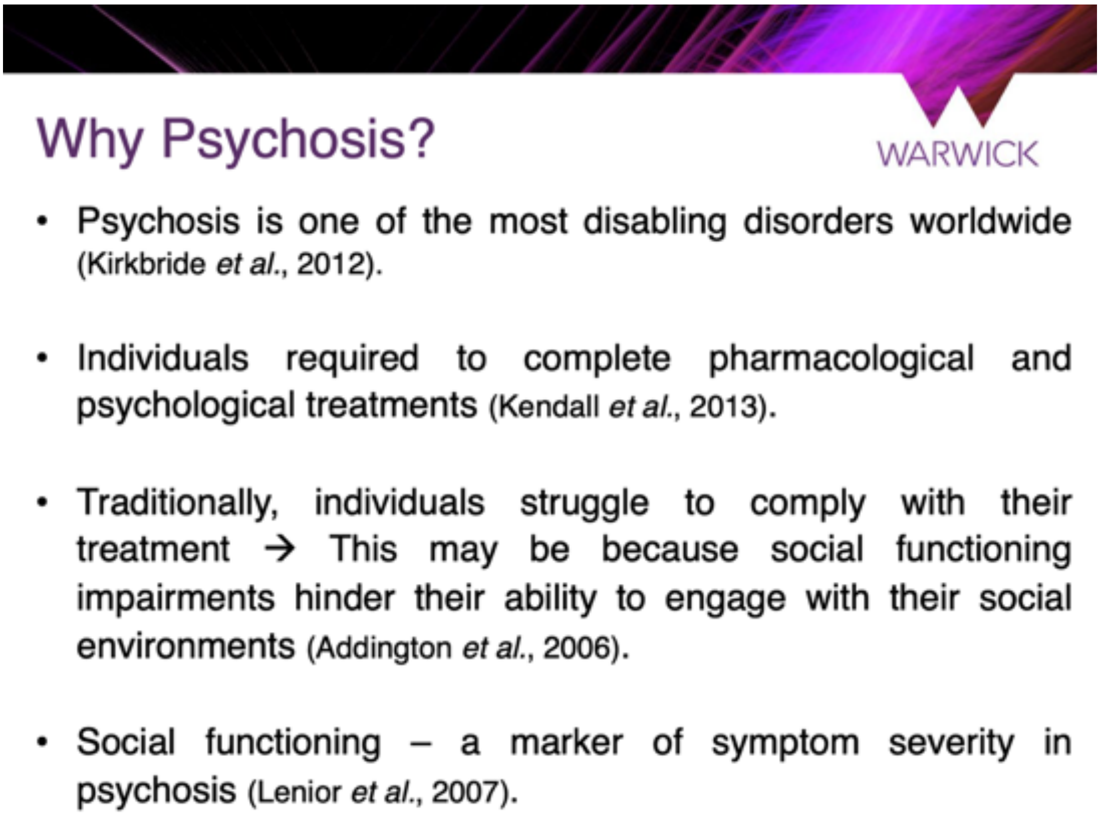
Psychosis can be characterised by (Reed, 2008):

Hallucinations

Hallucinations are the sensory experiences of stimuli that do not exist. These are commonly thought to be auditory or visual.

Delusions

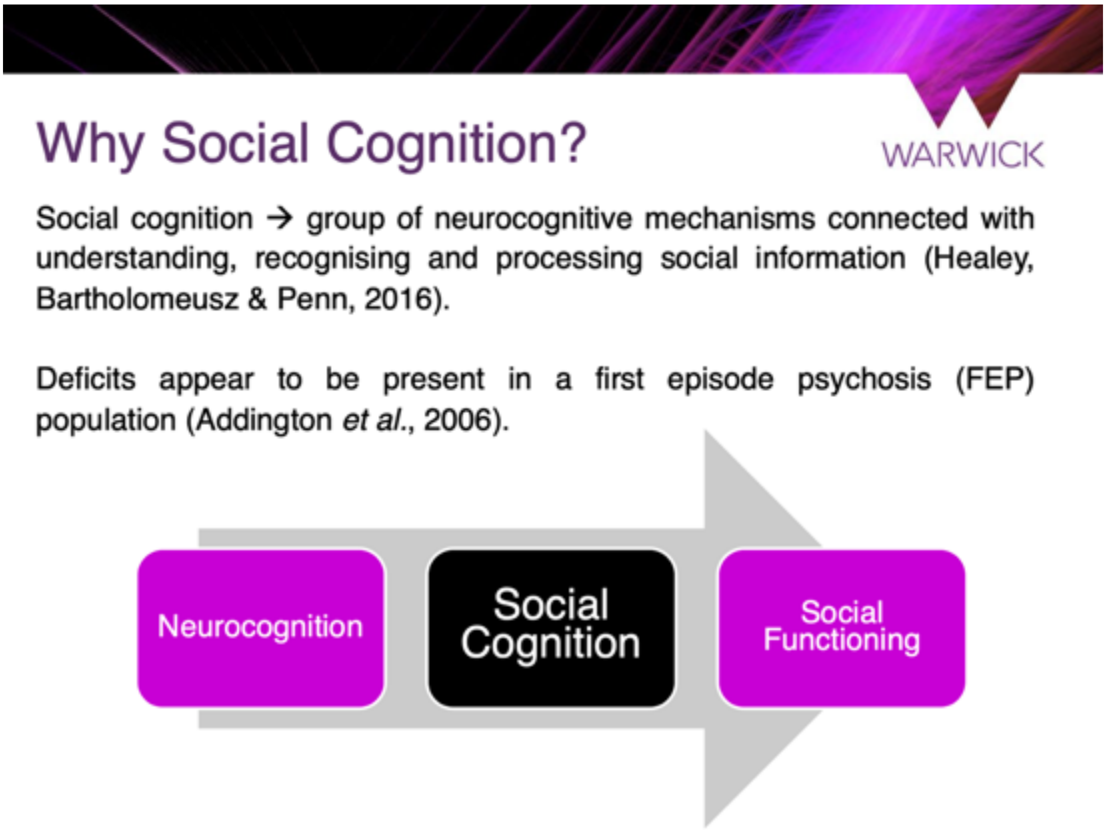
A delusion refers to a fixed thinking process and content of thought, contrary to the evidence present.



Why Psychosis?

WARWICK

- Psychosis is one of the most disabling disorders worldwide (Kirkbride *et al.*, 2012).
- Individuals required to complete pharmacological and psychological treatments (Kendall *et al.*, 2013).
- Traditionally, individuals struggle to comply with their treatment → This may be because social functioning impairments hinder their ability to engage with their social environments (Addington *et al.*, 2006).
- Social functioning – a marker of symptom severity in psychosis (Lenior *et al.*, 2007).



Why Social Cognition?

WARWICK

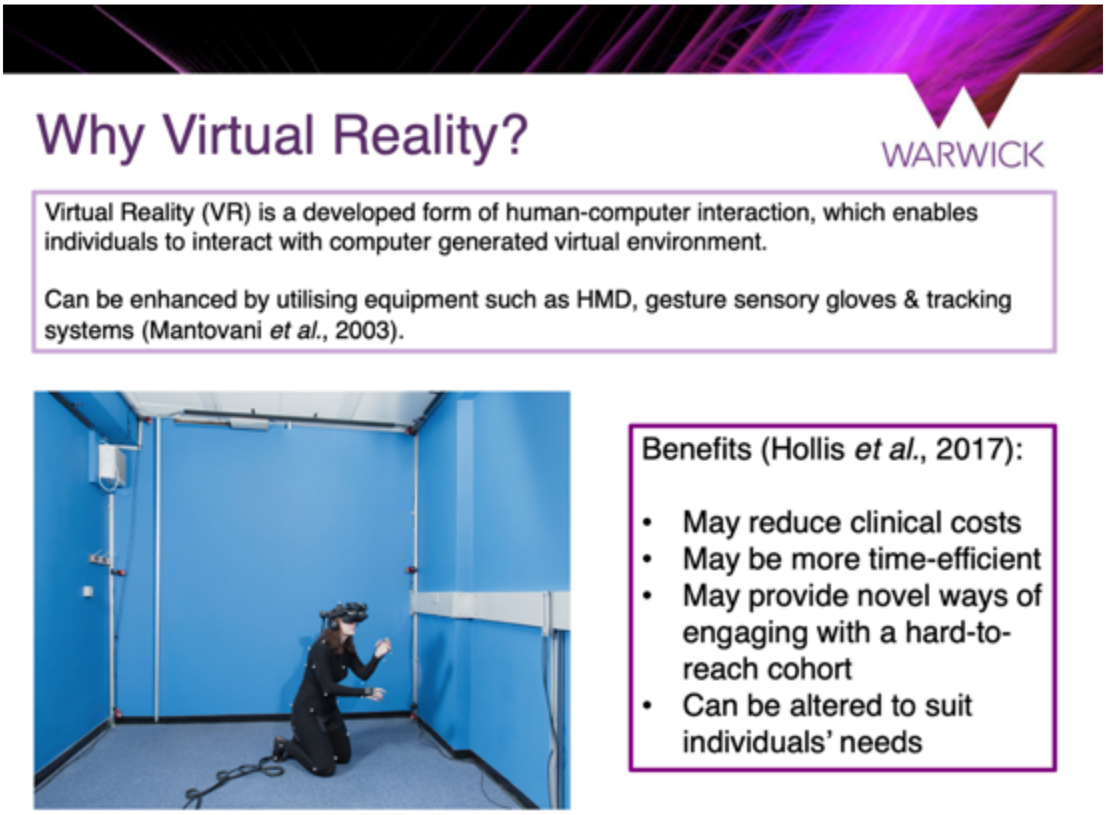
Social cognition → group of neurocognitive mechanisms connected with understanding, recognising and processing social information (Healey, Bartholomeusz & Penn, 2016).

Deficits appear to be present in a first episode psychosis (FEP) population (Addington *et al.*, 2006).

Neurocognition

Social Cognition

Social Functioning



Why Virtual Reality?

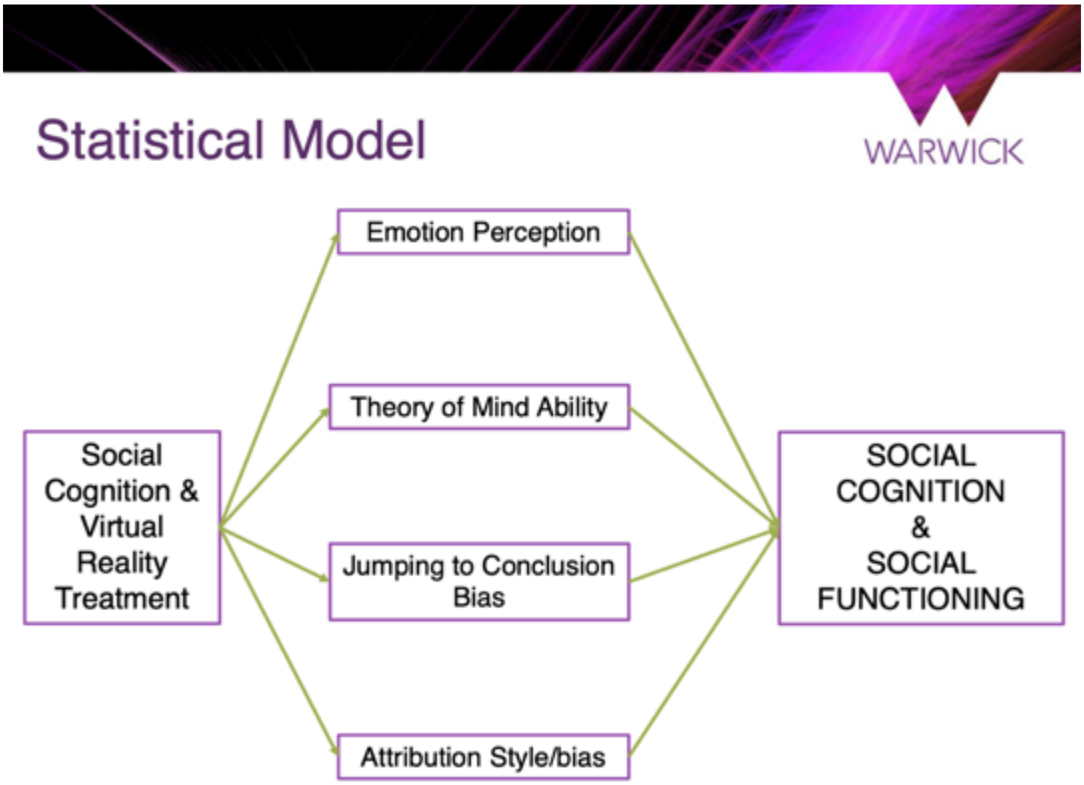
WARWICK

Virtual Reality (VR) is a developed form of human-computer interaction, which enables individuals to interact with computer generated virtual environment.

Can be enhanced by utilising equipment such as HMD, gesture sensory gloves & tracking systems (Mantovani *et al.*, 2003).

Benefits (Hollis *et al.*, 2017):

- May reduce clinical costs
- May be more time-efficient
- May provide novel ways of engaging with a hard-to-reach cohort
- Can be altered to suit individuals' needs



Statistical Model

Social Cognition & Virtual Reality Treatment

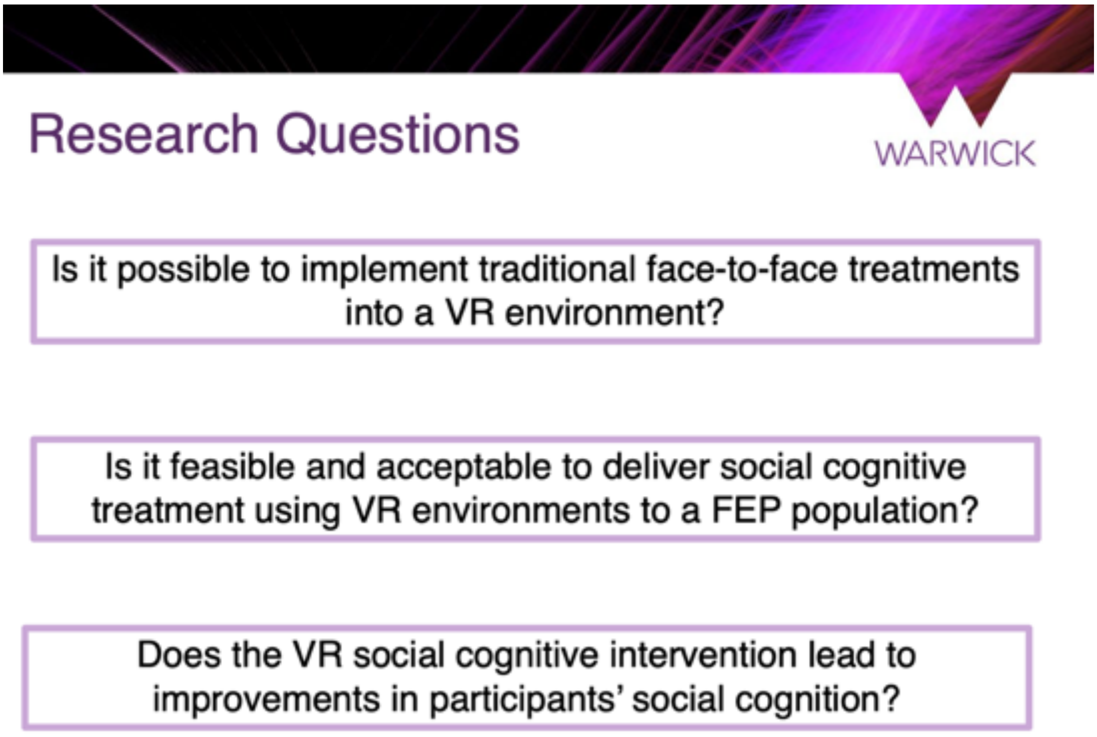
Emotion Perception

Theory of Mind Ability

Jumping to Conclusion Bias

Attribution Style/bias

SOCIAL COGNITION & SOCIAL FUNCTIONING

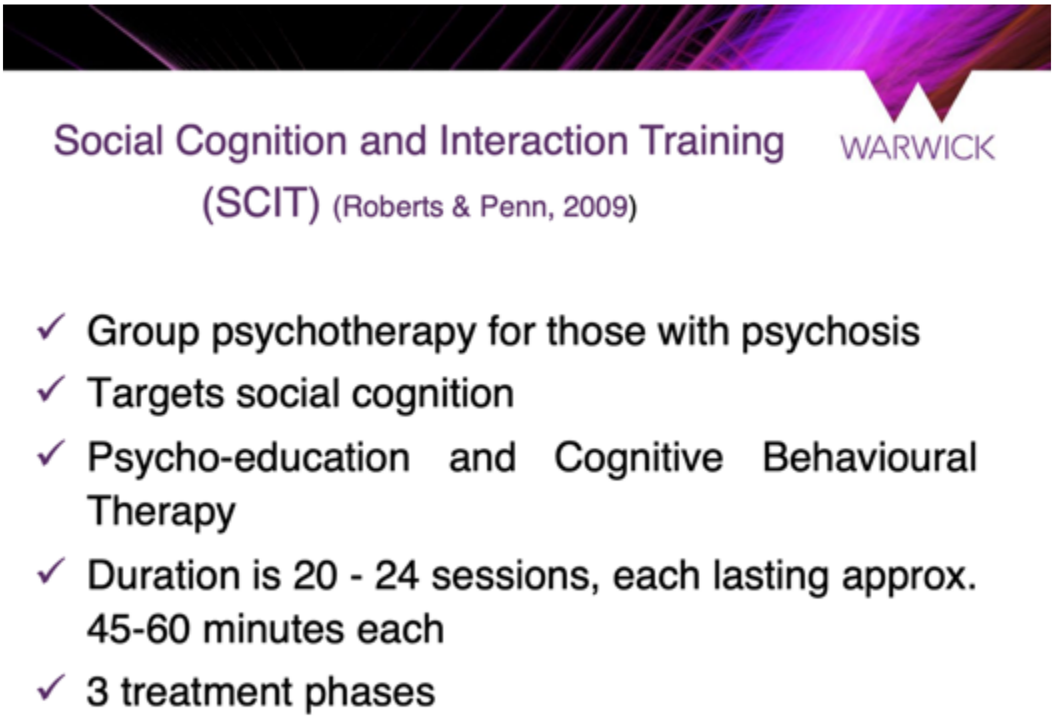


Research Questions

Is it possible to implement traditional face-to-face treatments into a VR environment?

Is it feasible and acceptable to deliver social cognitive treatment using VR environments to a FEP population?

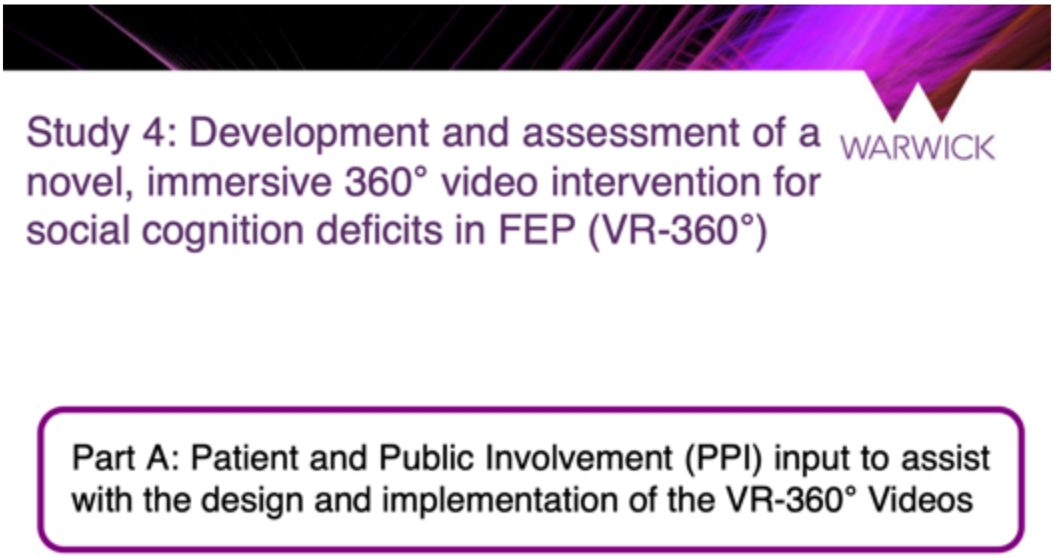
Does the VR social cognitive intervention lead to improvements in participants' social cognition?



Social Cognition and Interaction Training (SCIT) (Roberts & Penn, 2009)

WARWICK

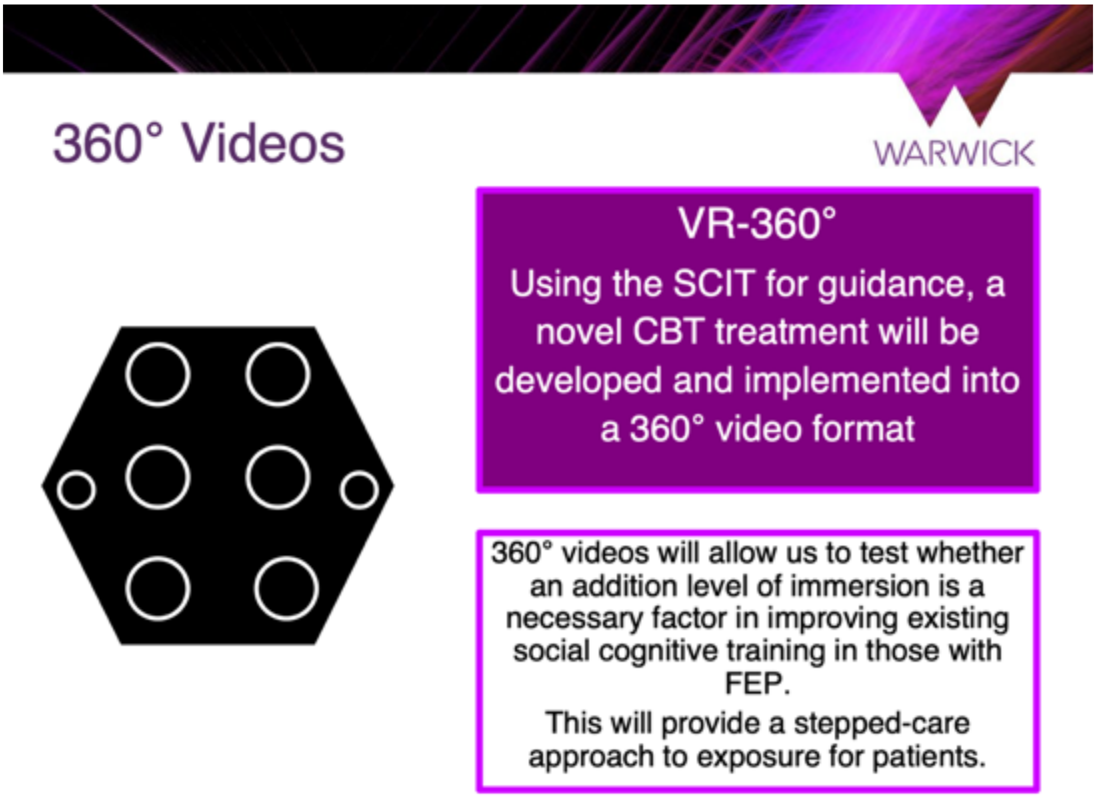
- ✓ Group psychotherapy for those with psychosis
- ✓ Targets social cognition
- ✓ Psycho-education and Cognitive Behavioural Therapy
- ✓ Duration is 20 - 24 sessions, each lasting approx. 45-60 minutes each
- ✓ 3 treatment phases



Study 4: Development and assessment of a novel, immersive 360° video intervention for social cognition deficits in FEP (VR-360°)

WARWICK

Part A: Patient and Public Involvement (PPI) input to assist with the design and implementation of the VR-360° Videos



360° Videos

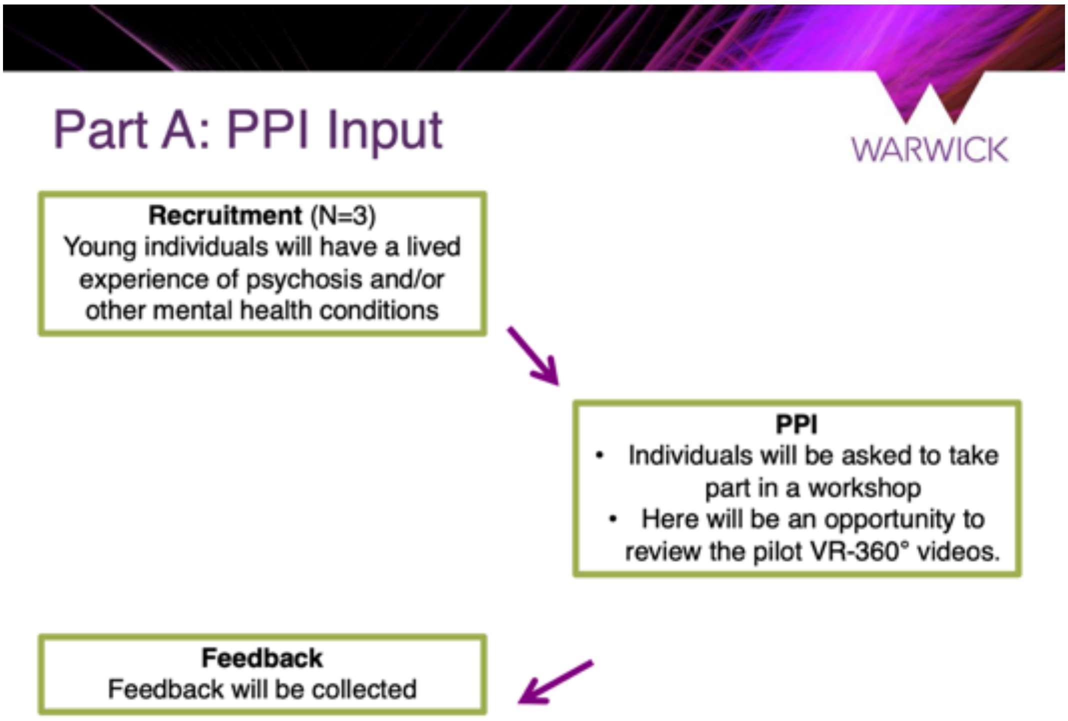
WARWICK

VR-360°

Using the SCIT for guidance, a novel CBT treatment will be developed and implemented into a 360° video format

360° videos will allow us to test whether an addition level of immersion is a necessary factor in improving existing social cognitive training in those with FEP.

This will provide a stepped-care approach to exposure for patients.



Part A: PPI Input

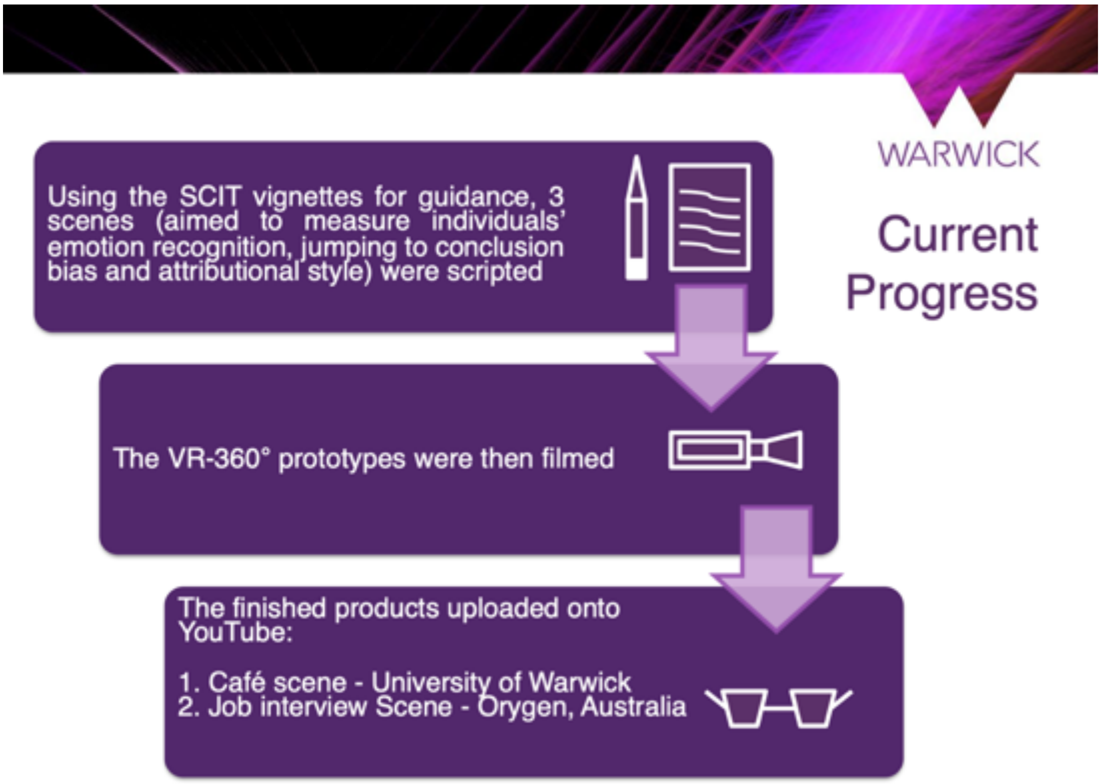
WARWICK

Recruitment (N=3)
Young individuals will have a lived experience of psychosis and/or other mental health conditions

PPI

- Individuals will be asked to take part in a workshop
- Here will be an opportunity to review the pilot VR-360° videos.

Feedback
Feedback will be collected



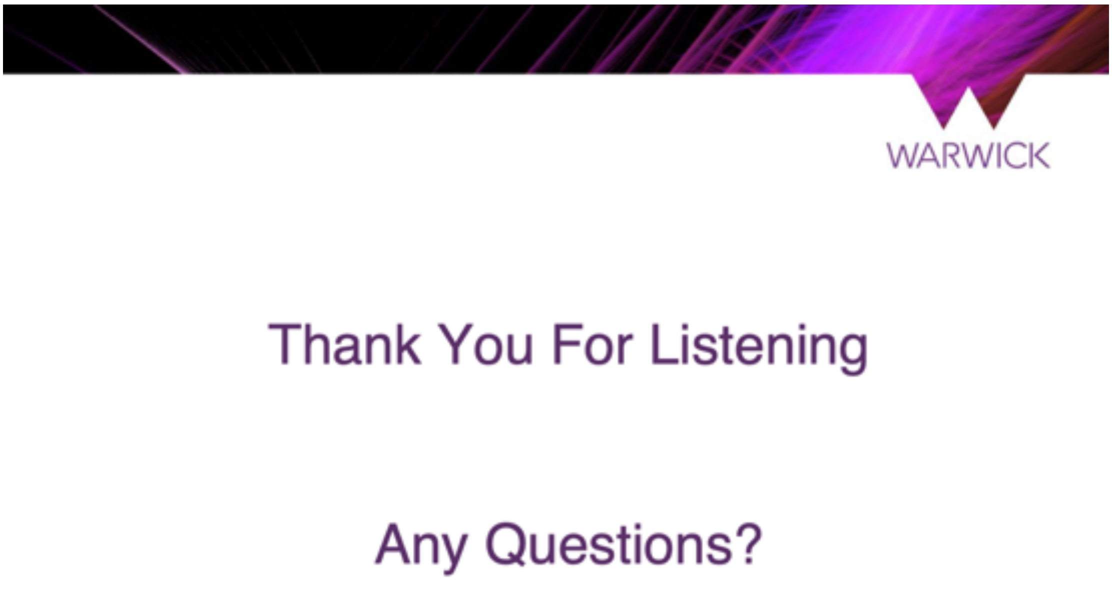
Current Progress

Using the SCIT vignettes for guidance, 3 scenes (aimed to measure individuals' emotion recognition, jumping to conclusion bias and attributional style) were scripted

The VR-360° prototypes were then filmed

The finished products uploaded onto YouTube:

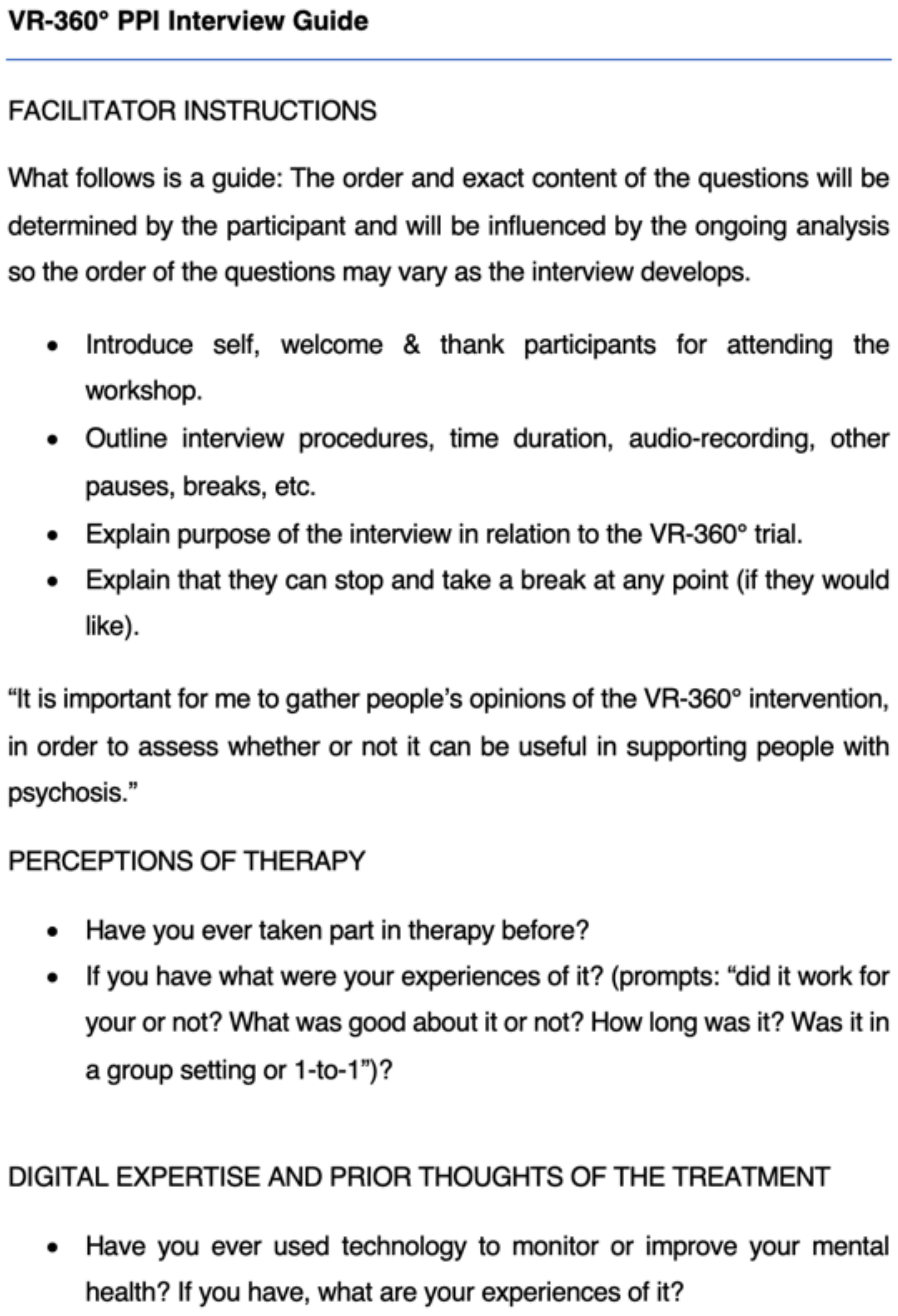
1. Café scene - University of Warwick
2. Job interview Scene - Orygen, Australia



Thank You For Listening

Any Questions?

Appendix 32 – VR-360° PPI interview guide



VR-360° PPI Interview Guide

FACILITATOR INSTRUCTIONS

What follows is a guide: The order and exact content of the questions will be determined by the participant and will be influenced by the ongoing analysis so the order of the questions may vary as the interview develops.

- Introduce self, welcome & thank participants for attending the workshop.
- Outline interview procedures, time duration, audio-recording, other pauses, breaks, etc.
- Explain purpose of the interview in relation to the VR-360° trial.
- Explain that they can stop and take a break at any point (if they would like).

“It is important for me to gather people’s opinions of the VR-360° intervention, in order to assess whether or not it can be useful in supporting people with psychosis.”

PERCEPTIONS OF THERAPY

- Have you ever taken part in therapy before?
- If you have what were your experiences of it? (prompts: “did it work for your or not? What was good about it or not? How long was it? Was it in a group setting or 1-to-1”)?

DIGITAL EXPERTISE AND PRIOR THOUGHTS OF THE TREATMENT

- Have you ever used technology to monitor or improve your mental health? If you have, what are your experiences of it?

- What are your perceptions of virtual reality as a form of treatment?

VR-360° VIDEOS AND TREATMENT

- "I have developed a series of VR-360° videos to accompany an existing type of CBT treatment, which is accessible and engaging."
- Do you think the VR-360° videos help to achieve this? Can you elaborate?
- Do you have any difficulties in accessing YouTube? If yes, what are they and how can this be improved?
- Do you have any difficulties in using the Google Cardboard headset? If yes, what are they and how can they be improved?
- What are your thoughts on using 360° videos as a way of learning and developing social skills? If yes, why? If no, would there be a better way?
- Do you feel you have enough information to help you to access the videos? Could I provide any other information or tools?
- "I would like to hear your thoughts on the 360° videos in more detail. Each video was scripted and filmed using actors. The aim was to film 'everyday scenarios' which people may find themselves in. Video 1 is filmed in a café and Video 2 is filmed in an office space." (start with each video).

    1. Could you explain to me what is happening in each scene?
    2. What are your thoughts on the dialogue?
    3. Are there any issues with the audio?
    4. Do you feel like you are a bystander in a scene or part of the scene? Why? Can you elaborate on this please?
    5. Can you describe how you felt whilst watching the videos?
    6. What are the positives of the video?
    7. What are the improvements that can be made?
    8. How does viewing this 360° video compare to watching a 2D video of the exact same scene?

FITTING IN WITH EVERYDAY LIFE

"the aim is for this treatment to take part in a face-to-face setting. A patient will be with a therapist and will view the videos as part of a face-to-face 1-to-1 treatment. However due to COVID-19, it is possible that this will take place in an online setting."

- What are your thoughts in having this treatment take place online? Do you think it is feasible?
- What are your thoughts in having this treatment take place face-to-face? Do you think it is feasible?
- What do you think of the dosage of the treatment (8 sessions) and length of the sessions (45 minutes – 1 hour)?

IMPACT ON MANAGING MENTAL HEALTH

- What impact (if any) do you think viewing the 360° videos would have on someone's psychosis and mental health?

WHAT COULD BE IMPROVED?

- Are there any ways in which the therapy sessions or the VR-360° videos could be improved? If yes, can you elaborate on what your ideal VR-360° treatment would look like?
- What are your thoughts on privacy and safety in conducting therapy online?
- What can therapists do to assure a patient that their information is safe?
- Is there anything else you would like to tell me that we've not talked about but might be important for me to know about how to improve the treatment?

End workshop, thank participants (your responses are very useful and will help other individuals diagnosed with psychosis), explain what will happen to the information discussed, offer to provide summary of findings when available.

Appendix 33: VEEP intervention structure

Phase I Emotion Recognition (four sessions)

These sessions were an opportunity to introduce participants to the treatment and the definition of social cognition. This involved discussing what the seven basic emotions are, what paranoia means to them, differentiating between facial expressions and applying this to a social context.

Session 1: Group Setting

This session provided participants with an introduction to the intervention. This involved informing them of the structure (number of sessions, times and dates of these sessions and the duration of the sessions). Participants had the opportunity to introduce themselves to other participants and develop group rules that everyone would have to abide by. Participants were then taught some psychoeducation. They then learned about what social cognition meant and had the opportunity to apply this to a video exercise.

Session 2: Defining Emotions

This session encouraged participants to learn about emotions, moods and to apply this to situational cases and effects. Participants were asked to complete a series of activities as a group, which helped them to develop their skills and knowledge in emotions. Participants were then asked to define eight emotions as group (the seven basic emotions and paranoia). Here they were then asked to describe what it meant to them and provide examples. These definitions were then recorded on a poster in the virtual world, so participants could refer back to it throughout the intervention.

Session 3: Guessing People's Emotions

This session expanded on the previous session, where participants were taught to recognise facial cues when forming conclusions about emotions.

This is achieved by using a series of pictures of individuals' faces. Participants were then asked to complete an activity to 'Guess People's Emotions' where the pictures of the same individual are morphing into more extreme impressions. This aimed to improve their flexibility in their responses and reduce the chances of rigid responses.

Session 4: Suspicious Feelings

The aim of this session was to prioritise participants' experiences of paranoia and encourage further discussions about personal experiences and triggers. It was important for participants to learn that there are justified and unjustified forms of paranoia and suspicion. This was taught using a series of video activities.

Phase II Figuring Out Situations (two sessions)

These sessions enabled participants to learn about the concept called 'jumping to conclusions,' which involves thinking about the challenges of interpreting ambiguous scenarios, distinguishing between facts and guesses and gathering evidence about social scenarios.

Session 5: Jumping to Conclusions

This session introduced the concept of jumping to conclusions, a type of thought process, which could lead to social functioning difficulties. Participants were then asked to complete a series of video exercises and formulate discussions about where and how the characters jumped to the conclusions, and the consequences of such behaviour. Jumping to conclusions is a thinking process that many individuals with psychosis, experience. Therefore participants were taught the following methods to avoid jumping to conclusions; think up several possible guesses, separate facts from guesses, and gather more evidence.

The first method is to think up several possible guesses. Here participants were asked to develop three possible guesses using three stereotypical perspectives that are identified in literature; external-personal, internal-personal and external-situation. These were introduced to participants using characters, which are caricatures of each perspective; external-personal (Blaming Bill), internal-personal (My-fault Mary) and external-situational (Easy Eddie). This helped to maximise the efficiency in developing alternative guesses. Participants then completed an activity where they are asked to find possible guesses to scenarios and record how confident they are with their answers.

Session 6: Separating Facts From Guesses and Gathering More Information

This session extended from the previous session, where participants were taught about the other two methods of avoiding jumping to conclusions. The first method is called separating facts from guesses. Here, participants were asked to reevaluate their conclusion drawing process by identifying the facts and guesses in a situation. A series of photographs and video scenarios were used to assist participants with this process.

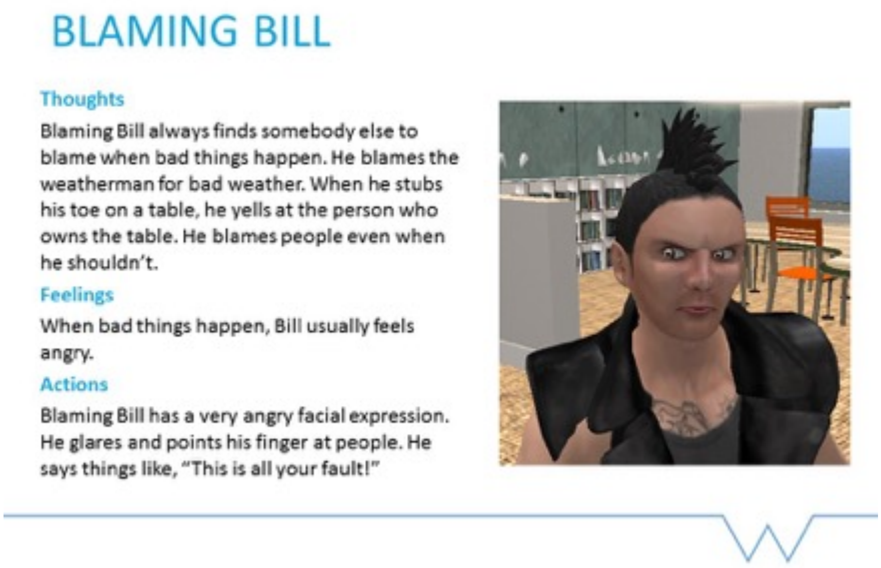
Phase III Checking It Out (two sessions)

These sessions were opportunities for participants to consolidate what they had learned from previous sessions through various activities and scenarios. It also allowed them to think about developing the appropriate questions to investigate social situations more thoroughly.

Session 7 and 8: Checking It Out

These sessions were designed to encourage participants to integrate their skills and knowledge learned in both Phase I and Phase II using a series of highly realistic social situations. Participants were asked to take part in a set of pre-designed social situations, where they were asked to take certain actions and justify why. Once these sessions have finished, participants were provided with a summary of what they have learned in these sessions.

Appendix 34 – Blaming Bill, My Fault Mary and Easy Eddie avatars



BLAMING BILL

Thoughts

Blaming Bill always finds somebody else to blame when bad things happen. He blames the weatherman for bad weather. When he stubs his toe on a table, he yells at the person who owns the table. He blames people even when he shouldn't.

Feelings

When bad things happen, Bill usually feels angry.

Actions

Blaming Bill has a very angry facial expression. He glares and points his finger at people. He says things like, "This is all your fault!"

MY FAULT-MARY

Thoughts

My-fault Mary always blames herself when bad things happen. If somebody cheats her out of money, she gets upset at herself for trusting them. If somebody acts mean towards her, she thinks she deserves it.

Feelings

When bad things happen, Mary usually feels sad and upset with herself.

Actions

Mary has a sad expression on her face, looks down, shakes her head, and holds her hand to her head. She says things like, "I'm so stupid" and "I always mess-up everything."

EASY EDDIE

Thoughts

Easy Eddie assumes that bad things happen because of bad luck and accidents. He thinks bad things are nobody's fault, and so he never acts upset. When people are mean to him, he assumes that they are only acting that way because they've had a bad day. Easy Eddie never blames other people... even when he should.

Feelings

When bad things happen, Eddie tries to push away bad feelings. He tries to feel relaxed and easy.

Actions

Easy Eddie shrugs his shoulders, raises his palms, cocks his head to one side, and raises his eyebrows. He says thinks like, "Oh well. I guess it's just bad luck."

Appendix 35 – VEEP intervention session 7 'checking it out' scenario: an incident in the bus stop scenario

SECOND LIFE® EXPERIENCE

At the Bus Stop...

Facilitator's Introduction: "Now we are going to have a go at using the checking out process with an experience here in the VEEP world. We will go in pairs to different locations here and interact with some characters. We will then come back together and check out the situation and decide what we can do. We need two volunteers to go first. The other two people can go to the chilling out room, there are some funny videos you can watch that shows what could happen if people don't take their time checking out situations. We will call you in a few minutes to meet in the red room."

Script 'An Incident in the Bus Stop'

Two participants and the facilitator approach the bus stop. As they approach, an avatar sitting at the bus stop appears to be looking at the floor. The avatar looks up and sees the group approaching, then starts displaying distress signs: shakes her head, starts crying, loses eye contact, etc. She stands up, walks to the group still displaying distress and asks:

“Do you know how long till the next bus comes?”

The facilitator says: “It will be 20 minutes.”

The avatar starts crying loudly.

The facilitator asks the participants to teleport to the red room. The other two participants in the chilling out room are asked to return to the red room. The facilitator goes through the ‘checking it out’ process and together the group decides what to do.

Example of partially completed checking out process:

FACTS: Walked to the bus stop. Woman sitting there at the bus stop. She shows distress. She asks for bus times. She cries loudly after she receives an answer.

GUESSES:

1) Woman is sad for something that has just happened
2) Woman is scared by our presence
3) Woman received bad news
4) Woman needs some help

FEELINGS:

1) Fearful
2) Angry
3) A little sad
4) Worried

ACTIONS:

Ask her what happened.
Walk away/greet her.
Do nothing.
Ask her if she needs help

If the group decides that they want to find out more about what happened, they can go back as a group to the bus stop. The avatar explains what happened.