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Participatory design to create a VR therapy for psychosis

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ABSTRACT

This paper describes how participatory design was employed in the design of an automated Virtual Reality (VR) psychological therapy (gameChange), putting people with lived experience of psychosis at the heart of the process. Solutions to complex challenges invariably need to include the expertise and ideas of specialists from a broad variety of disciplines and experiences. The design of gameChange relied on the insights of clinical psychologists, programmers, animators, designers, product managers, producers, writers, researchers, 3 D artists, mental health advocates, and people with lived experience of psychosis. This involved a considerable diversity of working cultures, professional disciplines, and vocabulary. A transdisciplinary, participatory design process was established during the project. It allowed for rapid iteration, meaningful input from people with lived experience of psychosis, and delivered a VR psychological therapy with robust cognitive therapeutic principles. The structures put in place to support the different disciplines working together on the design, particularly people with lived experience of psychosis, are detailed in this paper, with examples of how decisions were made and their outcomes. The clinical effectiveness of the gameChange VR therapy is now being tested in a randomized controlled trial with several hundred patients with psychosis. https://gamechangevr.com/intro_video/

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Introduction

Many patients with conditions such as schizophrenia become isolated at home. Two-thirds of patients with schizophrenia have levels of anxious avoidance equivalent to agoraphobia (Freeman, Taylor, et al. 2019) but few get specialized forms of cognitive therapy. Game Change is an automated Virtual Reality (VR) cognitive therapy to help people with psychosis to overcome anxiety and feel confident in everyday social situations. The high degree of automation may enable many more patients to access the psychological therapy.

People with lived experience (PWLE) of psychosis were at the heart of the design process. They were involved throughout the design process, not just at set points. This was facilitated by the McPin Foundation (a co-investigator), a charity that 'exists to transform mental health research by putting the lived experience of people affected by mental health problems at the heart of the research agenda' (McPin Foundation 2020). It was an iterative process, which brought together the various expert groups, made up of PWLE of psychosis, developers, advocates, designers, and clinical psychologists. This led to a mutual awareness and understanding of the others' needs and promoted a transdisciplinary, participatory design (TPD) approach.

This paper discusses the methods used in the TPD process with PWLE of psychosis to develop an automated VR therapy and illustrates some of the results of these methods. It describes the working structures, and outlines the reasons for some of the design decisions.

Psychosis

The UK National Health Service (NHS) describes psychosis as 'when people lose some contact with reality. This might involve seeing or hearing things that other people cannot see or hear (hallucinations) and believing things that are not actually true (delusions)' (NHS 2019).

Many people with psychosis are socially isolated, negatively impacting their health (Hjorthøj et al. 2017). Often isolation arises because they feel frightened in social situations (Freeman, Taylor, et al. 2019). This fear may be due to paranoia, threatening voices, social anxiety or low confidence in their ability to cope, and can lead people to avoid social situations. When this is not possible, people use more subtle behaviours when outside (e.g. avoiding eye contact). These behaviours ('safety-seeking behaviours') are carried out in order to prevent the feared outcome. However, they may lead to the persistence of unrealistic fears because there is no opportunity for new learning; people don't find out that they are safer and better able to cope than they think.

Virtual Reality and therapy

VR is an immersive experience, where the reality of the outside world is (largely) supplanted by computer-generated environments in a headset; the user sees and hears what is presented within the headset. In this virtual world, users can find themselves feeling and reacting as they would in reality (Sanchez-Vives and Slater 2005), producing both a psychological and physiological response (Martens et al. 2019). This has been attributed to the presence VR can cause, achieved by immersion and involvement (Witmer and Singer 1998). This makes VR a way to practice techniques to overcome anxieties that people might experience in real world situations. A new generation in treatment development is the automation of VR therapy, which aims to reduce reliance on a stretched psychological workforce and enable greater scaling up of provision (Freeman et al. 2018; Freeman, Lister, et al. 2019). A VR intervention has been shown to reduce paranoia in everyday life (Geraets et al. 2020) and VR can potentially deliver accessible, less delivery intensive therapies with higher ecological validity (Gainsford et al. 2020). This project built on the PI's track record in VR interventions in mental health (Freeman et al. 2016, 2018); funding was specifically given to the team to build a VR intervention; it was the designers' role to explore how PWLE of psychosis were to participate in the design process.

Overall project structure

The gameChange project (gameChangeVR.com) is a three-year collaboration funded by the National Institute for Health Research. It is led by a Professor of Clinical Psychology at the University of Oxford and Oxford Health NHS Foundation Trust, in partnership with a number of organizations including The Royal College of Art Helen Hamlyn Centre for Design (HHCD), the McPin Foundation, Oxford VR, MindTech and a number of other universities and NHS trusts. The grant application included 14 applicants. The aim of the project is to develop an automated VR cognitive therapy for people with psychosis who feel anxious in everyday situations. The intervention needed to be designed and developed within the first year of the project in time for a clinical trial in five centres with 432 people with psychosis (Freeman, Yu, et al. 2019).

gameChange VR therapy

The gameChange application is a standalone VR cognitive therapy, allowing people to go into virtual simulations of the situations they normally avoid and test out their fears. Patients are encouraged to stay in simulations of troubling situations and drop their safety-seeking behaviours (e.g. make eye

contact with people, stand close to someone) to see what happens. The aim of the therapy is to help them adopt a new set of actions they can use when anxious, enabling them to feel more confident in everyday situations.

The VR therapy starts and ends in the coach's room, a calm space where the virtual coach explains the therapy and asks the person to choose a scenario. People can choose from six scenarios; a pub, corner shop, café, street, GP's waiting room or bus. There are five levels of challenges for each scenario, and each level has a task for the person to complete. Each scenario is designed for patients to learn that they are safe and can cope; a virtual coach guides them through the therapy, where they can interact with different characters. The scenarios are made more demanding by increasing the number of people, noise and degree of exposure felt.

The scenarios and tasks were designed to allow the user to test out 'fearful cognitions while limiting the use of safety-seeking behaviours, allowing patients to build confidence in their ability to cope' (Lambe et al. 2020). Beyond exposure, actively testing out fears with the dropping of safety seeking behaviours is key for clinical change (Freeman et al. 2016).

Transdisciplinary Participatory Design

Participatory design (PD) is the idea that genuine participation means that the users' role changes from informants 'to being legitimate and acknowledged participants in the design process' (Robertson and Simonsen 2013). People affected by the design play a part in the design process which has the 'potential to ensure that existing skills could be made a resource in the design process.' (Bjögvinsson, Ehn, and Hillgren 2012). This has been recognized as 'a critical success factor in the adoption of information systems' and 'goes beyond user-centered design and co-operative design approaches to include end users as more active participants in design ideas and decision making' (Kushniruk and Nøhr 2016).

The development of PD is associated with new technology systems and modes of production, but has broad roots in society and design from local communities as well as industry (Kensing and Greenbaum 2013). There are many approaches to PD; it is a 'proliferating family of design practices that hosts many design agendas and comes with a varied set of toolboxes.' (Brandt, Thomas, and Sanders 2013). There are challenges in using PD: involving the end user in the design process doesn't always lead to the expected adoption (Terp 2019); there are political concerns on the influence of the researcher in the process (Akama and Light 2020).

There are questions about the ethics and the level of agency participants have in PD projects. There is the idea of 'Othering', where a group is seen as separate or an other. This may not be a problem if it highlights the needs of

specific groups but is negative when seen as 's/he is not as good or capable as 'we' are, which leads to stereotypes and other forms of representation' (Spiel et al. 2019). There is a discussion on where power lies in PD between different stakeholders. There is a move towards a set of ethical principles in PD: 'free and informed participation', 'balancing participation with minimizing the risk of harm', 'maximizing the benefits of the experience and outcomes of participation' and 'supporting fair and appropriate empowerment' (Kelly 2019).

PWLE of psychosis, developers, designers and clinical psychologists worked together on the design of gameChange. In multidisciplinary collaborations, perspectives from different disciplines inform the solution, but 'stay within their boundaries' (Choi and Pak 2007). In transdisciplinary collaborations these boundaries are crossed, as an understanding between the disciplines creates new ways of thinking and solutions. 'Transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines' (Nicolescu 2010).

While there are differing definitions of transdisciplinarity, the focus on real life world problems and 'transcending and integrating of disciplinary paradigms' are widely shared. Participatory research and the search for knowledge beyond disciplines are also acknowledged (Hirsch Hadorn et al. 2008).

The funding proposal for gameChange made it explicit that patient involvement was fundamental to the research. There were predefined success criteria for the design: that it was immersive, easy to use, and engaging. PD was chosen as the best method of meaningfully involving PWLE of psychosis and to achieve the success criteria. There was, however, a limit to PD in this project; the final decision on the design was taken by the chief investigator and his clinical psychology team at the University of Oxford, who had oversight of the whole project. Also, VR as a delivery method, the psychological principles underpinning the therapy and the idea of a virtual coach were all decisions made before the funding was secured and the project started. Given that there were definite constraints on the design ahead of the project, and that there were immovable factors such as psychological therapeutic principles and development requirements, the nature of the design process is better described as a blend of transdisciplinarity and participatory design: Transdisciplinary Participatory Design, or TPD.

The transdisciplinary nature of the project aided the PD activities as it allowed stakeholders to work together and discuss their needs. While the final approval for designs was made by the principal investigator and the clinical psychology team, this team took part in the TPD. Final approval decisions were often made during meetings where designs were presented and advocates for PWLE of psychosis had a strong voice. The designs created were shaped by the participation of all of the stakeholders.
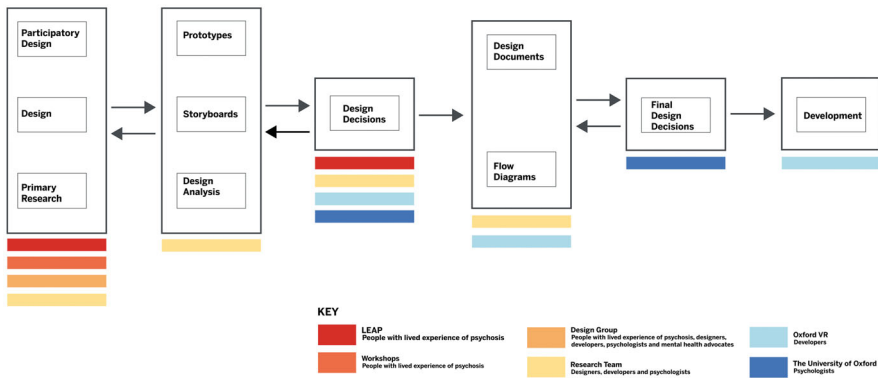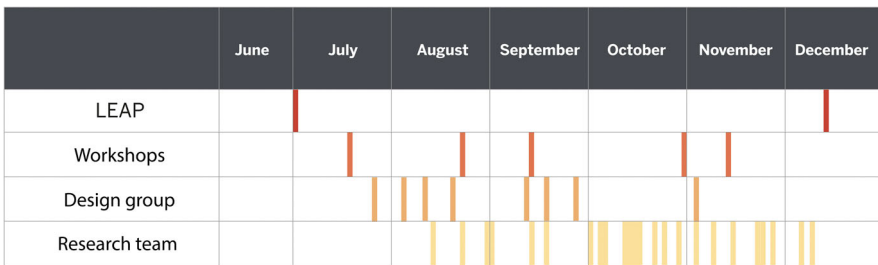
Figure 1. The working structure and activities.

Figure 2. The activity schedule for groups in the design period from June to December 2018. Excludes internal reviews.

The VR treatment development

The aim was to design and develop a VR therapy that was easy to use, highly engaging, desirable, and potentially scalable. Alongside these criteria the designs also needed to follow the psychological principles of the therapy, be feasible with the available technology and be possible to develop in VR within the time frame.

There were three main challenges to the design phase: a shortened design period (due to a shorter than expected regulatory timeframe), working with time-pressured people, and working with different expert groups with different working practices and needs.

With less design time than anticipated, a method was developed that allowed for the same amount of input from PWLE of psychosis over a shorter period, whilst keeping the design clinically robust. The initial plan was to have a lived experience advisory panel and run six workshops with PWLE of psychosis; a new working structure was formed to allow more involvement to PWLE of psychosis.

This structure was set up with four groups (see Figure 1); the interrelated structure of these groups aimed to include all voices and establish a TPD

process within the given practical constraints. Figure 2 shows the meetings of these four groups in the design period between June to December 2018, it does not include project partners' internal meetings or project review meetings.

LEAP

The Lived Experience Advisory Panel (LEAP), established by the McPin Foundation, comprises of 11 people who had lived experience of psychosis. It met several times throughout the process to input and give feedback into the designs, and had an overview of the whole project. Members were also consulted remotely using questionnaires.

Workshops

PWLE of psychosis from diverse backgrounds were the main voice of the workshops. Common aims ran through several workshops: all ideas and designs were captured, each having equal weight, no idea was wrong.

Research team

Made up of design researchers from HHCD, psychologists from the University of Oxford, and members of the development team from Oxford VR, the research team met regularly. The research team produced prototypes, animated storyboards, flow diagrams and design specification documents. Throughout the project, the research team met with the investigators to present and discuss designs for acceptance, rejection or modification.

Design group

Complementing the workshops, a smaller design group was established, bringing together the research team, people from the McPin Foundation, and PWLE of psychosis. Meeting regularly, it discussed and developed designs in relation to their practical development, clinical and user needs.

Methods

53 PWLE of psychosis contributed to the design of the gameChange therapy, with over 500 hours of input (Lambe et al. 2020). Participants were at different points of recovery, with different needs and requirements. The PD methods were sensitive to this, and workshops and design group activities were designed and facilitated accordingly, to fit the participants' needs and keep them safe.

There were seven workshops in total involving PWLE of psychosis, the initial six planned workshops and an extra role-play workshop. The researchers ran workshops to design specific areas of the VR therapy e.g. the design of the virtual coach. Each workshop was designed around a set of aims, developed from previous workshops, meetings and the needs of the developers. These aims were agreed upon by the team.

Workshop materials were designed to explore those aims in an engaging and safe way, and to give participants the knowledge needed to participate.

Each workshop had new participants, with between four and eight PWLE of psychosis, aiming for an even split between men and women (though not always possible). Having different participants allowed a range of opinions and designs to emerge and to see where consensus arose. Participants were recruited via the McPin Foundation, project partners and NHS Trusts.

Pre-workshop

Workshop aims were defined in co-ordination with the psychologists, developers, designers and mental health advocates. Several factors defined the aims and expected outputs of the workshop including:

- Psychological principles.
- Outputs and designs from previous workshops, the design group and partner meetings.
- The knowledge needed by the developers in order to progress with the development of the application.

Participants tried VR, thought about and discussed psychosis, all of which could cause distress. In order to limit this, and ensure the right course of action if it did occur, the following measures were put in place:

- Access to a quiet space outside the main workshop setting that people could use if overwhelmed or distressed.
- Psychologists with experience of working with people with psychosis in attendance.
- Adequate capacity for support workers or family to attend.
- Sufficient time for people to have a break between workshop activities.

Given the ethical considerations and concerns of power imbalances in PD, every care was taken so that participants were comfortable and central to the process.

The workshop

The research team were transparent about the design and aims of each workshop with the participants. It was made clear at the start that people could leave at any time.

With the exception of the role-play workshop, each workshop had a similar structure:

1. Introductions and time for questions. Lunch was provided which everyone ate together.
2. Optional opportunity to try an earlier automated VR therapy developed for the THRIVE trial (Freeman, Lister, et al. 2019).
3. Workshop activities.

While all participants tried VR, it was made clear that they didn't need to.

There were a high number of facilitators at each workshop, mainly provided by HHCD, Oxford VR, the University of Oxford and the McPin Foundation; their roles in the workshop were explained at the start of the workshop. Each participant introduced themselves, but all workshop materials were anonymized.

The THRIVE trial VR therapy tried in the workshop had environments such as a lift, and a coffee shop. It used similar psychological principles to the VR therapy being developed, so workshop participants were able to get a good idea of the therapy. Although it was optional, all workshop participants did try the VR. While people were wearing the VR headset there was always a facilitator in attendance.

Solo creative thinking was an important workshop activity, giving people time to think and enabling people who felt uncomfortable speaking to have ideas recognized. If people weren't comfortable speaking, a facilitator could speak for them if they wished. Group discussions were an important element of the workshop, they brought new ideas as well as finding consensus.

The pace and activities were flexible to reflect the needs of the participants. Occasionally activities had to be tailored, or new activities devised during the workshop.

Looking in more detail at one workshop shows the requirement for flexibility. The aims of the fourth workshop were to:

- Define the tone of the language used in the script.
- See how people responded to characters in the scene.
- Discover what could make the coach's room engaging and ready people for the therapy.
- Obtain general feedback on VR and the developed VR environments.

Figure 3 shows the initial plan for this workshop.

activity	resources	time span mins	time	action
Introduce gameChange, the RCA, the workshop and each other. Settling in and Q&A.	Slides.	20	13:30 - 13:50	
Reaction to environments and characters in VR.	2 Oculus Rifts. VRCB VR application. Scene worksheets.	40	13:50 - 14:30	Split the group in two with one half experiencing a lift level and the other experiencing a cafe level in the VRCB. Participants fill in a worksheet to see what stood out in the levels, then try the other level and fill out another worksheet.
What makes a good learning environment.	Worksheet.	15	14:30 - 14:45	Solo working on worksheets.
Break.		15	14:45 - 15:00	
Script ideation.	2 Oculus Rifts to view gameChange grey box environments. Worksheets for storyboarding. Cut outs of environments and characters. Sheets for Post-it notes. Question sheets.	65	15:00 - 16:05	Everyone experiences the grey box environments of the pub, GP's waiting room, and the street in VR. Individual brainstorming on Post-it notes around the words and phrases used at different points in a level. In pairs people storyboard an idea for one of the environments.
Wrap up.		15	16:05 - 16:20	

Figure 3. The agenda and activities for the 4th workshop.

For the script ideation and the learning environment activities, participants were in two groups, with two psychologists facilitating one group and a designer facilitating the other. This allowed for an appropriate pace for participants, help was given to some participants to talk about ideas and fill in the worksheets.

The script ideation section of the workshop differed from the planned activity shown in Figure 3. Working with the cut outs felt too complicated. Instead participants worked in two groups, with time to think about a series of questions such as 'What would you say to encourage a friend to do something they found challenging?' first on their own, then in a group discussion.

```
Ready? Shall we go for it?
USER SELECTS NO:
                        COACH

Coach gives encouragement:




USER SELECTS YES:
                      COACH

Coach gives encouragement:



```

Figure 4. Extract from the script worksheet.

Post workshop

Workshop outputs were analysed and summarized. Findings became inputs for future workshops, design group sessions and partner meetings.

Some ideas were explored multiple times. This allowed for lessons learned from Workshop 4 to be applied when developing materials for Workshop 5. In place of the storyboards and character cut-outs, a worksheet was developed so people could write short scripts (sample in Figure 4).

The design group

The design group brought together PWLE of psychosis and the research team. Some of the activities were similar to the workshop, with time for solo creative thinking, and discussions about the designs between all stakeholders. There was, as much as possible, consistency in the group's attendees with between three and six PWLE of psychosis. This fostered an understanding of needs between the stakeholders. Design ideas were discussed openly with reference to the user's needs, the psychological principles and the feasibility of development in VR.

Results

As the design process was iterative and collaborative, pinpointing the origin of a given design is difficult; features evolved with input from all groups. To

LEAP defined environments and activities	Therapy Scenario
1. Social gatherings and parties	The Pub
2. Public transport	The Bus
3. Walking down the street	The Street
4. Using technology (radio, phone, computer, TV)	No scenario
5. Waiting room	The GP's waiting room
6. School/University/Work	No scenario
7. Shopping	The Shop
8. At home	The Street
9. In queues	The Cafe, the GP's waiting room, the Bus, the Shop
10. Eating out	The Cafe

Figure 5. The LEAP defined environments and activities in order of preference, and the implemented scenarios.

unpick this, and see how PWLE of psychosis influenced the process, some of the decisions are explained below.

The six scenarios

Initially a LEAP workshop defined ten environments and activities that were felt to be the most important to include in the therapy. From this, six scenarios were selected based on the feasibility of designing a suitable VR environment and the opportunity to employ the proposed psychological treatment techniques. For example, it would not be possible to create a school/university/work environment that would be broadly applicable due to the wide range of settings people work in. Figure 5 shows the initial 10 environments and activities in order of importance as defined by the LEAP, and their related scenarios.

A document that included treatment development considerations was produced by the psychologists at the University of Oxford. The matrix of scenarios and clinical needs (Figure 6) defined a primary action or

	cafe	pub	bus	waiting room	food shop	street
request or order	✓	✓	✓	✓	?	
stay in the situation	✓	✓	✓	✓		✓
give personal information	✓		✓	✓		
unexpected event/erratic behaviour		✓	✓			✓
trapped/shut in			✓			
people looking			✓	✓		✓
queueing	✓		✓	✓		
find an item					✓	
safe place to unknown						✓

Key ▨ primary action for scenario

Figure 6. A matrix of scenarios and their psychological principles, or actions.

psychological principle for each scenario, though each scenario covers many actions/principles.

Example scenario task—repeating an order in the cafe

In this task, the person orders a drink, the server asks them to repeat the order as they didn't hear. This idea was developed from the LEAP, a workshop, a questionnaire, and partner meetings (Figure 7) in a few stages:

1. The LEAP listed being in a queue and eating out in the top ten environments or situations for inclusion in the therapy.
2. The psychologists decided that queueing and eating out could be set in a café.
3. At a workshop, PWLE of psychosis highlighted the challenges of interactions in cafes These included the server making a mistake with the order, or being rude to the customer, as well as the customer having to ask someone twice whether a seat is taken.
4. The LEAP questionnaire highlighted that it can be challenging if people are standing too close (e.g. in a queue) or it is crowded.
5. Through discussions with the developers and psychologists, the task became the server not hearing the person's order and the individual having to repeat it. The main reasons for this were:

LEAP
2nd July
Principal group:
People with lived
experience of psychosis

Aims: Find the most important environments to include in the therapy

Inputs: Funding application

Outputs: List of ten environments or activities

Implemented: Being in a queue and eating out

**Treatment development
document**
4th July
Principal group:
Psychologists

Aims: Setting out the general structure of the therapy
Setting out the responsibilities of the partner organisations

Inputs: LEAP on 2nd July 2018
Psychological principles

Outputs: Choice of six scenarios
General cafe design
Details of specific scenarios

Workshop - London
17th July
Principal group:
People with lived
experience of psychosis

Aims: Develop tasks in the cafe

Inputs: LEAP on 2nd July 2018
Treatment development document

Outputs: Task ideas for the cafe: It's noisy so need to repeat a request if a seat is free
The server gets the order wrong

Implemented: Being asked to repeat the order as it was too noisy for the server to hear
This brings together the two ideas of the wrong order and asking for a seat

Design group
24th July
Principal groups:
People with lived
experience of psychosis
Designers
Psychologists

Aims: Cafe designs

Inputs: Workshop London

Outputs: Cafe layout

Implemented: Some aspects of the layout for the cafe came from this session

Partner meeting
31st July
Principal groups:
Designers
Developers
Psychologists

Aims: Design decisions

Inputs: Workshop London

Outputs: Level 3, ordering something and the server asks you to repeat the order

Implemented: Repeating an order

**LEAP
(questionnaires)**
13th August
Principal group:
People with lived
experience of psychosis

Aims: Find possible interactions with the environments
Find out what people might worry about in the environments
Find out what people might want to do in the environments

Inputs: Question design with psychologists from the University of Oxford
Questions from project partners
LEAP environment workshop

Outputs: Bus Scenario: random acts of kindness
Pub Scenario: People close to you
Groups of friends/groups of people

Implemented: Elements suggested for other scenarios were implemented in the cafe

Partner meeting
21st August
Principal groups:
Advocates
Designers
Developers
Psychologists

Aims: Design decisions

Inputs: LEAP, 2nd July
Workshop, London
Design group, 24th July
Partner meeting, 31st July
LEAP questionnaire, 13th August

Outputs: Key components for each scenario agreed. In the cafe, this
was being blocked in with people behind you, and placing
an order in front of others

Implemented: A number of designs and tasks for the cafe including repeating an order

July 2018

August 2018

Cafe - Repeating an order

Key ▢ Implemented features

Figure 7. An example of the process of deciding a scenario task.

a. *Safety:* The person would be standing, so asking for a seat might cause people to sit on a virtual (i.e. non-existent) seat.

b. *Psychological learning*: The person should stay in the queue as it keeps them close to the virtual characters, an important element of the therapy.

   c. *Psychological learning*: The task shouldn't reinforce negative thoughts about situations, so instead of blaming the person for a mistake, the server says they can't hear the order and asks them to repeat it.

   d. *Ease of use:* The tasks should be cognitively similar, and should avoid complexity.

   e. *Feasibility for development:* Situating all the action in the queue would reduce development time.

The coach's room

Alongside the tasks, the coach's room was also simulated in VR. It needed to feel safe, as the person is introduced to the therapy, and returns there at the end of each session. The design decision stages were:

- Workshop 2—participants completed a worksheet to define a relaxing environment. Images of environments, (e.g. a seascape and a forest) were mounted on a wall and people commented on how these made them feel.
- Workshop 3—the same materials as Workshop 2 were used.
- Workshop 4—participants completed a worksheet on the ideal space for taking in new information or learning new skills.
- Design Group—in multiple sessions relaxing spaces where explored in relation to their contents and layout.

The design changed considerably due to the input from PWLE of psychosis. It was originally quite clinical and more like a reception room. From the workshops, ideas emerged that a natural environment would be more relaxing, as would soft furnishings. The later design incorporated these elements, Figure 8 shows the updated room.

The delivery of the therapy

The idea of having a break within the VR application was explored and visualized in a number of workshops and design group sessions. While there was insufficient time to include these ideas in the VR, there was potential to use them in non-VR materials alongside the therapy, as well as influencing the manner in which the therapy was delivered.

The idea for non-VR materials, that would support the VR experience were explored during the final regional workshop. The aims of the workshop were to consider how to increase the likelihood of people practising what they had learnt in VR, how people could reflect on the session, and the nature of 'homework' in-between sessions.

Figure 8. The coach in the coach's room.

A series of paper and electronic prototypes were made for people to record and reflect on the session, and write their plans for in-between sessions. A questionnaire showing these designs was sent to the LEAP for feedback and refinement.

An extra workshop was held to test how people felt about the materials, and to explore what the people delivering the intervention should say. The format was a role-play workshop in which four PWLE of psychosis experienced the end-to-end delivery of a VR therapy, using the THRIVE VR therapy. A number of changes to the delivery of the therapy were suggested:

- While flexibility is needed in the clinical delivery, the health professional should not talk too much when the person is immersed in VR.
- If the person feels anxious, removing the headset and talking through some of the ideas was found to be helpful.
- Giving people a few minutes to rest after they took off the headset.
- The layout of the accompanying booklet was changed to include:
  - Improved accessibility of the language.
  - Improved use and size of the images in the booklet.
  - Area for writing notes for oneself (this request emerged from the workshops).

User testing

The funding application stated that the therapy should be highly engaging, usable and desirable. Before the clinical trial began, user testing was undertaken with a cohort that included five PWLE of psychosis to make sure the application satisfied the success criteria: immersive, easy to use, and engaging. For the threshold to be met, 90% of people taking part in the user

research would need to rate the application positively against these criteria. This was followed by a second round of user testing, with six PWLE of psychosis. At the second round of user testing, the design met the success criteria (Lambe et al. 2020).

Next steps

A complete design document was given to Oxford VR who finalized the VR. The randomized controlled trial of the VR application started in 2019 in five centres in the UK (Freeman, Yu, et al. 2019). The trial aims to recruit 432 patients with psychosis who are anxious going into everyday situations. Patients will receive either VR therapy plus usual care or usual care only. Based on the results of the trial, a business case will be made for the use of the gameChange VR therapy in NHS mental health services for patients with psychosis.

Discussion

VR has the potential to revolutionize mental healthcare, both in terms of treatment efficacy and accessibility. Employing TPD could make these therapies more engaging and usable for the people they're being created for, allowing for PWLE to design within the boundaries of the clinical needs and the development time. The gameChange therapy being developed had a clear clinical target: to help patients with psychosis increase their confidence and re-engage in everyday social situations. The core psychological principles and feasibility of VR programming provided the design brief. Other design decisions were produced as an outcome of the TPD process. The key elements for this process were: involving PWLE of psychosis throughout the entire design process; forming subgroups within and between disciplines; and engaging in an iterative approach.

PWLE of psychosis were not merely included at certain points in the design process, but throughout; the LEAP provided continuity, understanding and peer knowledge.

Forming subgroups within and between disciplines allowed ideas to evolve and draw on specific inputs from each expert group. Ideas were carried into the regional workshops and the design group and reciprocally, in an iterative process.

In order to deliver the project within this timescale it was important that the design phase was open to change. The design structure needed to be cognizant of the VR developers' needs and the imperative of delivering a fully working application in time for a full clinical evaluation, while allowing as much input to the design as possible from PWLE of psychosis. This approach allowed a large number of people from different disciplines to be involved in the design process.

The blend of transdisciplinarity and participatory design used in this project aimed to address a number of concerns. These included ethical considerations, 'othering', lack of agency and the power balance within the design process for PWLE of psychosis.

The process aimed to implement a set of ethical principles: to minimize the risk of harm, allow for free and informed participation and support appropriate empowerment.

The workshops were designed to minimize the risk of harm and allow informed participation for PWLE of psychosis. A quiet area and room for support workers or family was provided, as well as having psychologist workshop facilitators.

There were constraints on the design decisions due to the clinical needs and the development time; the TPD approach aimed to work optimally within these constraints. The fostering of understanding between each expert group meant that the designs had met these constraints before they were presented for formal testing. The approval process itself allowed for discussion and debate. PWLE of psychosis were heard at all stages of the design decision process.

The working structures in the project ensured that PWLE of psychosis were part of the team at all levels of the project from data gathering and design to the strategic management of the project. The TPD approach allowed for an informed and active role in the decision making by PWLE of psychosis, addressing the considerations of 'othering', power balance and agency within the design process.

Including people affected by the design as active participants in the design and decision making is recognized as a factor for adoption of information systems (Kushniruk and Nøhr 2016), though there are concerns that this doesn't necessarily lead to the expected adoption (Terp 2019). TPD could be a way to balance this: the close collaboration between expert groups led to design and innovation within a shared understanding of constraints. This led to a final design which meets the constraining criteria (technically feasible, desirable to use, clinically useful). Though the trial is ongoing, meeting these criteria may increase the likelihood of adoption.

The TPD process and the methods used were new to a number of the partners, and were not always well understood. Likewise, it was not always clear where responsibility lay for different parts of the design. An initial clearer briefing of PD, and the process, roles and responsibilities would benefit team functioning from the outset.

Not all the ideas from the TPD were included in the VR application. Some were used in other areas of the therapy, as described in the delivery of the therapy section, while others became the basis of further research.

Conclusions

The design methods facilitated the rapid development of a VR therapy to address a complex and nuanced mental health condition. The TPD and iterative

approach allowed for a wide range of expertise to contribute to the design. Collaborating with PWLE of psychosis set an authentic tone and encapsulated a core value of the project. Features and tasks were rooted in PD activities, working collaboratively to create evidence-based designs. The process aimed to include ethical considerations by minimizing the risk of harm, allowing for free and informed participation, and aiming to support appropriate empowerment.

The outcomes of the clinical trial, if successful, and any subsequent adoption will give a better understanding of the success of the design process.

A TPD approach meant that there was not always a linear link between specific input from PWLE of psychosis and features of the technology. This paper has taken four examples to show the transdisciplinary nature of the process and the impact PWLE of psychosis had on the development of the VR therapy.

There were some constraints on the participation of PWLE of psychosis in the design process. Some elements were in place before the start of the process, and final decisions were made by the clinical psychology team, for clinical reasons or because of time constraints. The TPD approach meant that PWLE of psychosis could question decisions and had power within the design process to instigate and veto some design decisions. They were part of the team of experts working on the design of the VR therapy and had influence throughout the design process.

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