

Optimising SloMo, a digitally supported therapy targeting paranoia, for implementation using inclusive, human-centred design

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Abstract

Background: Despite the promise of digital therapeutics in providing scalable interventions for psychosis, translating them from clinical trials to routine care is challenging. SloMo is an evidence-based, digitally supported cognitive behavioural therapy for psychosis comprising an online therapy platform and mobile app. The therapy encourages individuals to slow down for a moment, to address fast-thinking habits fuelling paranoia. SloMo has received a NICE Early Value Assessment recommendation for National Health Service use to address evidence gaps related to its use in the real world, and an implementation study is underway.

Objective: This study optimised the SloMo software for this implementation work, with the aim of reducing technology complexity and improving user experience, to increase equitable outcomes.

Methods: An inclusive, human-centred design methodology was used to optimise SloMo. Guided by the Non-adoption, Abandonment, Scale-up, Spread, Sustainability framework, the redesign sought to reduce the technology's complexity, and improve the user experience for diverse patients and therapists. The double diamond framework structured the iterative redesign, integrating insights from PPI consultants, therapists, and a transdisciplinary codesign team. Key stages were identifying implementation barriers, redefining user needs, iteratively developing solutions, and delivering a validated minimum viable product. Methods included co-design workshops, 1:1 interaction testing, and think-aloud sessions.

Results: Users wanted a form of CBTp that was usable, trustworthy, enjoyable, personalised, normalising, and memorable. The redesign therefore included a minimalist user interface, more diverse lived experience vignette content, enhanced agency over data, greater representation of protected characteristics and their intersectionality, and intuitive navigation. Feedback from a purposively sampled patient and therapist sample validated the redesign as it was associated with strong user experience, particularly in relation to usability and usefulness.

Conclusions: The study produced a redesign of the SloMo software optimised for real-world use, whilst retaining fidelity to the therapeutic content of the previous version. Through an inclusive, human centred approach, the optimised design of SloMo addresses barriers to adoption by reducing complexity and fostering accessibility. This study underscores the value of integrating lived experience involvement into digital therapeutics to support scalable, equitable, and sustainable mental health care solutions. Clinical Trial: N/A

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Abstract

Background

Despite the promise of digital therapeutics in providing scalable interventions for psychosis, translating them from clinical trials to routine care is challenging. SloMo is an evidence-based, digitally supported cognitive behavioural therapy for psychosis comprising an online therapy platform and mobile app. The therapy encourages individuals to slow down for a moment, to address fast-thinking habits fuelling paranoia. SloMo has received a NICE Early Value Assessment recommendation for National Health Service use to address evidence gaps related to its use in the real world, and an implementation study is underway. This study optimised the SloMo software for this implementation work, with the aim of reducing technology complexity and improving user experience, to increase equitable outcomes.

Methods

An inclusive, human-centred design methodology was used to optimise SloMo. Guided by the Non-adoption, Abandonment, Scale-up, Spread, Sustainability framework, the redesign sought to reduce the technology's complexity, and improve the user experience for diverse patients and therapists. The double diamond framework structured the iterative redesign, integrating insights from PPI

consultants, therapists, and a transdisciplinary codesign team. Key stages were identifying implementation barriers, redefining user needs, iteratively developing solutions, and delivering a validated minimum viable product. Methods included co-design workshops, 1:1 interaction testing, and think-aloud sessions.

Results

Users wanted a form of CBTp that was usable, trustworthy, enjoyable, personalised, normalising, and memorable. The redesign therefore included a minimalist user interface, more diverse lived experience vignette content, enhanced agency over data, greater representation of protected characteristics and their intersectionality, and intuitive navigation. Feedback from a purposively sampled patient and therapist sample validated the redesign as it was associated with strong user experience, particularly in relation to usability and usefulness.

Discussion

The study produced a redesign of the SloMo software optimised for real-world use, whilst retaining fidelity to the therapeutic content of the previous version. Through an inclusive, human centred approach, the optimised design of SloMo addresses barriers to adoption by reducing complexity and fostering accessibility. This study underscores the value of integrating lived experience involvement into digital therapeutics to support scalable, equitable, and sustainable mental health care solutions.

Keywords

Co-design; design thinking; digital health; user-centered design; participatory design; mHealth; eHealth; schizophrenia; psychosis; user experience; engagement; therapy

Introduction

Digital therapeutics present an opportunity for providing scalable, usable, and targeted evidence-based interventions for people with psychosis. Emerging evidence suggests digital technologies are acceptable and effective at addressing a range of treatment targets in this population [1,2]. With device ownership and levels of technology confidence on the increase, investment and interest in digital therapeutics for psychosis is growing. However, despite their promise, implementing digital therapeutics within real-world clinical settings following clinical trials is difficult, and a notable

evidence-practice gap exists [3].

Successful implementation of digital technology in psychosis is multifactorial, with technology complexity being a particularly important barrier [4]. People from minoritised backgrounds are more likely to experience additional barriers to technology access and digital literacy, and if this is not given careful consideration, there is the risk that technology might inadvertently magnify health inequalities [5]. The National Health Service (NHS) Inclusive Digital Healthcare Framework [6] lists accessibility and ease of technology use as a key domain of digital inclusion. Inclusive, human-centred design (iHCD) is a method that seeks to ensure the design of a product matches the needs and capabilities of the people for whom they are intended [7]. iHCD employs ethnography to understand users and their contexts, with purposive recruitment to ensure representation across relevant user identities and characteristics (i.e., gender, age, ethnicity, cognitive abilities, use of technology, and attitudes to therapy) and the inclusion of seldom-heard groups [8,9].

SloMo is a digitally supported psychological therapy targeting paranoia in psychosis. It was developed to address the limitations of conventional psychological therapies for psychosis; namely issues in access, experience and outcomes [10–12]. SloMo works by targeting fast thinking habits that fuel worries and supports people to *slow down for a moment* to find ways of feeling safer and living well [13,14]. The technology comprises an online therapy platform that augments face-to-face individual therapy sessions, offering interactive features such as audio-visual psychoeducational vignettes, games, and personalised content. This synchronises with a mobile app that supports self-management in daily life. SloMo uses technology to support visualisation of thoughts and thinking habits. People can interact with their personalised SloMo thought bubbles, altering speed and size to reflect thinking habits and distress. SloMo tips support people to slow down and notice new information, helping to shrink fast-spinning grey, worry bubbles and grow colourful, slow-spinning helpful thoughts to promote wellbeing [15].

iHCD was employed for the design of the first version of SloMo¹ [15,16]. Ethnographic research insights indicated users needed a form of CBTp that was usable, trustworthy, enjoyable, personalised, normalising, and memorable. The therapy design and usability of SloMo was validated by a comprehensive mixed-methods approach [14,17–19]. Notably, although baseline technology use and confidence were lower in groups known to be disproportionately affected by the digital divide (Black people and older adults; [20]), these baseline characteristics were not associated with differences in outcomes or user experience. This suggests the SloMo therapy design may bridge the “digital divide” and support accessibility, as intended.

In a multi-site randomised controlled trial (RCT) (N=362), SloMo demonstrated improved paranoia, self-concept, and well-being outcomes over six months compared with treatment as usual, with small to moderate effects [17]. SloMo received a NICE Early Value Assessment recommendation [21] for use in the NHS whilst real world data is collected to address identified evidence gaps, and accordingly is now being tested in a type II hybrid implementation-effectiveness study (ClinicalTrials.gov identifier: NCT06568081). McGinty et al. [22] recommend the evidence-practice gap is approached with a complexity science lens, including adaption of the intervention to the implementation context. Consistent with this, we sought to optimise the SloMo therapy software for routine care prior to commencing our implementation-effectiveness study. The Non-adoption, Abandonment, Scale-up, Spread, Sustainability (NASSS) framework, an evidence-based implementation science framework for technologies, informed the work [23,24]. This mixed methods approach encourages the minimisation of complexity in key domains (target problem, technology,

¹ The first version of the therapy was “SlowMo”. Stakeholder feedback indicated “SloMo” was more usable and had fewer problematic connotations. The spelling was updated for version two.

adopters, organisation, and broader system) to reduce the likelihood of non-adoption and abandonment, and increase the likelihood of scale-up, spread, and sustainability. The redesign of SloMo focused on reducing technology complexity due to findings that this can be detrimental to the implementation of DMHIs in psychosis populations [4].

In summary, the study aim was to optimise the SloMo software for implementation in routine care. We anticipated that through iHCD methods, complexity in the technology domain would be reduced, thereby improving user experience and increasing the likelihood of successful implementation.

Methods

Design

Consistent with the design of the first version of SloMo [15,16] the Double Diamond [8], a human-centred design framework, was used to optimise SloMo for implementation, using inclusive design principles [9].

Sample

Service user Patient and Public Involvement (PPI) consultants were recruited from three geographically diverse NHS trusts. Service users were eligible to be involved if they had lived experience of paranoia and current or past experience of secondary mental health services. To address the risk inherent in participatory design that the most willing, able, and vocal users are more likely to be involved, neglecting the needs of minoritised groups, we purposively sampled people from a wide range of backgrounds (i.e. across diverse gender, age, ethnicity, technology confidence, and attitudes to therapy). Therapist PPI consultants currently working with people with psychosis were purposively sampled in relation to gender, age, ethnicity, and experience of delivering psychological interventions for psychosis.

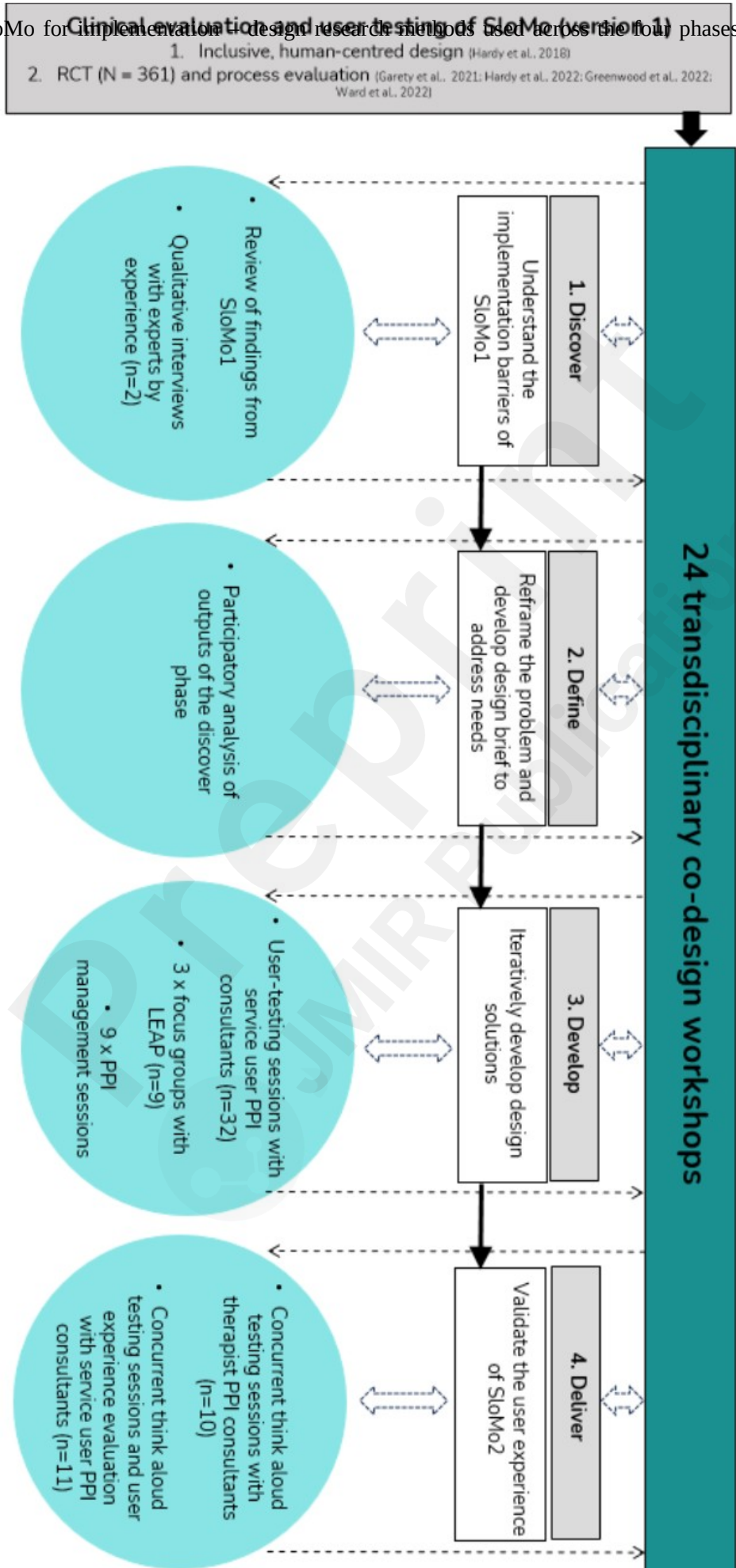
Procedure

Transdisciplinary codesign workshops (referred to as “workshops” here forward) were central to the redesign of the new version of SloMo. Our project team included experts by experience (EBEs), designers, clinicians, academics, software developers, video producers, and illustrators (see [15] for further details on the codesign team and process). Workshops were initially held in person (to support group cohesion) then switched to remote (to facilitate engagement of people from geographically diverse locations). Attendees were informed of the workshop’s focus in advance of the meeting, which was pre-specified according to the phase of development. Sessions were recorded so discussion could be reviewed and members who were unable to attend could review and offer feedback via email. A PPI management team oversaw the project, and an independent Lived Experience Advisory Panel (LEAP) provided feedback.

The Double Diamond is organised into four convergent and divergent phases: discover (understand the problem; divergent), define (reframe the problem and develop a design brief; convergent), develop (develop potential solutions; divergent), and deliver (test out solutions at small scale and iterate; convergent). It should be noted that divergent phases were necessarily constrained by the previous version of SloMo and its clinical evaluation, and so we adopted a “waterfall-agile” approach [15]. Figure 1 provides an overview of the Double Diamond phases used to optimise SloMo for implementation, which are explained in more detail below.

Figure 1. Optimising SloMo for implementation – design research methods used across the four phases of the double diamond framework. Gant et al

Figure 1. Optimising SloMo for implementation – design research methods used across the four phases of the double diamond framework.



Discover

The aim of the discover phase was to develop an understanding of possible implementation barriers for the SloMo software. This first involved reviewing the outputs of the SloMo1 RCT [14,17–19] in the transdisciplinary codesign workshops, to explore key technology problem areas that could potentially be targeted for the next iteration of SloMo. In addition, the designers conducted qualitative interviews with two EBEs who had received the first version of SloMo. Interviews focused on exploring what was required from a psychological therapy for psychosis, building on insights from Hardy et al. [16] as well as exploring how SloMo could be improved.

Define

The define phase synthesised the insights gathered in the transdisciplinary workshops. The EBEs who provided feedback during the discover phase also took part in the next round of workshops to assist in synthesis. The information from the discover phase was sent to codesign group members to review ahead of time to allow for opportunity to familiarise and reflect on the materials. Workshops involved reviewing the insights as a group, noting patterns, and sorting into themes, using a group consensus approach. Multiple workshops were run until a clear and workable design brief was developed, in line with identified user needs.

Develop

The develop phase aimed to generate potential design solutions that helped to address the redefined user needs outlined in the preceding phase. Guided by clinician and EBE recommendations, the designers initially explored content relevant to SloMo (i.e., existing apps available on the market, including for mental health, as well as apps in parallel markets, such as meditation, nutrition, habit-building). The designers fed back their design solutions in co-design workshops, and group consensus determined which ideas were taken forward for iterative development.

Low fidelity digital prototypes of initial design concepts were developed (see multimedia appendix 1). Preferred concepts, selected through workshops, were taken for one-to-one user testing with service user PPI consultants. User testing data informed iterative development through further workshops, leading to the development of higher fidelity digital prototypes of adopted concepts. Prototypes were further iteratively tested and developed through one-to-one service user testing, focus groups with LEAP members, and workshops. Once a prototype had been validated, it was added to the optimised SloMo minimum viable product (MVP) software, which was taken forward to the deliver phase.

Deliver

The convergent deliver phase aimed to validate the user experience of the optimised version of SloMo. Given the redesign of SloMo focused on two software components (an online therapy platform and native mobile app) the deliver phase aimed to validate both through consultation with the applicable user groups. For the online therapy platform, therapist PPI consultants were chosen as this would be used by therapists to augment the face-to-face therapy sessions they deliver. Service user PPI consultants were chosen for mobile app feedback, as they were the main intended users of the app.

Concurrent think aloud testing sessions were carried out with therapist PPI consultants. This is a form of usability testing where participants are asked to verbalise their thoughts in real time as they interact with a user interface (i.e., modules on the SloMo online therapy platform) [25]. Following this, additional unstructured qualitative feedback was gathered. A similar approach was taken for the mobile app. Service user PPI consultants who were involved in the develop phase took part in think aloud testing sessions. Service users were asked to complete different core functionalities on the app (e.g., adding a new worry, slowing down a worry, viewing session summary cards) whilst thinking aloud. Interactions were observed and qualitative feedback elicited. Following this, a User Experience Survey (UES; [18]) was completed. This is a ten-item questionnaire (adapted from [26]) with subscales relating to enjoyment, usability, and usefulness. Each item is rated from zero to ten and summed for the subscale total scores, which were calculated as percentages, with higher percentages indicating a more positive experience. Following user experience validation, an MVP of SloMo, optimised for implementation, was finalised for release to Apple and Android app stores for piloting clinical use.

Results

Sample characteristics

Table 1 provides descriptive data on the demographics of the service user PPI consultant sample across the four phases of the Double Diamond. The sample was representative of the service users across the three NHS Trusts in which SloMo was due to be deployed with respect to ethnicity and age. A wide range of confidence in using technology was reported, skewed towards people with higher confidence levels. This is in line with recent literature indicating digital literacy is improving amongst people with psychosis [27].

Table 1. Demographic characteristics of service user PPI consultants for the develop and deliver phases.

Number of service user PPI consultants	32
Gender, N (%)	
Female	18 (56.3)
Male	13 (40.6)
Non-Binary	1 (3.1)
Age, N (%)	
18 – 25	1 (3.1)
26 – 35	12 (37.5)
36 – 45	5 (15.6)
46 – 60	11 (34.4)
60+	3 (9.4)
Ethnicity, N (%)	
Asian or Asian British	3 (9.4)
Black British, Caribbean or African	10 (31.3)
Mixed or multiple ethnic groups	3 (9.4)
White British	15 (46.9)
Any other white background	1 (3.1)
Technology Confidence (0-100), Mean (Range)	82 (10 – 100)

SloMo redesign outputs

The key insights and outputs from each phase of the double diamond are presented in Table 2 and expanded on below.



SloMo1 Original design solution	RCT design solution from SloMo1	Discover – implementation barriers to	Redefine – SloMo design solution for implementation	Develop & Deploy
Usable	Poorer usability in males compared to females ¹	UI that is sufficiently visually appealing	Minimalist Character	2. Su
	Lower adherence with less tech confidence ¹	App navigation should feel intuitive	App home Embedde	ma
•	• Participants disliked carrying two phones ²	• Convenient access to mobile app	App avail	ry
•	• Therapists struggled pacing sessions*	• Feedback available on session progress	Session p	of
•	• Difficulty generating goals and safer thoughts*	• To feel supported in generating content	Burger m	Sl
• Trustworthy	• Lack of clarity on data transfer *	• Greater agency over data sharing	Notificati	o
			Ability to	M
			“Lock the	o
Enjoyable	Worries on home screen increased distress*	To feel supported when opening the app	Home scr	red
			Active na	esi
Personalised	In session progress slow for some ^{2,3}	Therapists to tailor session to person	Burger m	gn
	Lack of diverse content in vignettes ²	Manage more paranoia related worries	Optional i	usi
Normalising	Negative connotations of “Slow” in SlowMo*	For SloMo to feel like a positive experience	Codesign	ng
•	• Lack of intersectional diversity in videos*	• To feel represented and normalised	Therapy r	Do
			Videos co	tbl
• Memorable	• User wanted memory aides for post-therapy*	• SloMo journey to continue after completion	Customis	e
			Function	Di
			Catch-up	am
			Increased	on
			Sto	d
			me	me

* Refer to barriers identified by PPI consultants in transdisciplinary co-design workshops (hence not published in SloMo1's RC

²Greenwood et al. [19]; Ward et al. [14]

Discover

Key implementation barriers in the technology domain for the first software version were identified through review of the SloMo RCT outputs and interviews with EBEs. This included reporting of poorer software usability by males and people with lower levels of technology confidence. In addition, qualitative data revealed service users disliked carrying two mobile handsets (the first version of SloMo was only available on a study handset). Therapists reported difficulties in pacing the sessions, as there were no signifiers indicating how much session content remained, which aligned with service user feedback indicating progress was at times too slow. Therapists and service users reported finding the content of psychoeducational vignettes limited and instead used SloMo for a greater range of paranoia related worries than was covered in the software. Other barriers included a lack of clarity around when data was being transferred between devices (i.e., the online therapy platform and mobile app), an overemphasis on worries instead of safety on the app home screen, difficulties in generating personalised goals and safer thoughts, a lack of diversity across psychoeducational vignettes, and forgetting content covered in therapy sessions once these had ended.

Define

The define phase reaffirmed the importance of SloMo's design brief of users needing a form of CBTp that was usable, trustworthy, enjoyable, personalised, normalising, and memorable [16]. The problems identified during the discover phase mapped on to these domains, indicating these were areas that could be targeted in this next iteration to further deliver on this design brief and enhance user experience.

The issues outlined in the discover phase were reframed as user needs through codesign workshops. Service users needed a user interface (UI) that was visually appealing, intuitive mobile app navigation and convenient access to support usability. To foster a sense of trust, service users required greater agency over data sharing to and from the online therapy platform and mobile app. Service users needed to feel psychologically supported when opening the mobile app, for SloMo to feel like a positive experience, and to feel represented throughout. There was a need for learning ways of managing a wider range of paranoia-related worries, and for the SloMo journey to continue once face to face sessions had ceased. For therapists, it was important that they were provided feedback on session progress so they could pace sessions efficiently. There was a need for therapists to be able to use the online therapy platform flexibly, allowing them to tailor sessions to the client.

Develop

Thirty-two 1:1 service user testing sessions and three LEAP focus groups (n=9) were carried out. Initial user testing focused on design concepts and later stages focused on interactive digital prototypes.

Concept development

Initial design concepts taken to 1:1 user testing sessions included 1) aesthetics of bubbles used to convey worry and safer thoughts, 2) design of the avatar representing the SloMo user on their journey, 3) SloMo character illustrations, and 4) aesthetics of physical tip cards used

as a memory aide. Other concepts (e.g., lived experience vignettes, user interface changes, data transfer updates) were iteratively developed in co-design workshops. Multimedia appendix 2 displays the updated concepts for the new version of SloMo compared with the previous one used in the RCT.

Prototype development

High fidelity interactive digital prototypes developed and taken out for individual user testing included: 1) user interactions with thought bubbles, 2) user interactions for building a customisable avatar, 3) character illustrations featured in audio-visual psychoeducational vignettes, and 4) the content of newly developed psychoeducational vignettes. User testing feedback in both the concept and prototype development phases was discussed in co-design workshops and iteratively developed until there was a group consensus that the prototype should be adopted.

Boxes 1 to 3 provide an overview of the development of specific SloMo features from the discover to deliver phase. Multimedia appendix 3 & 4 provide additional data collected during the develop phase.

Discover

- o Lack of intersectional diversity in characters featuring in psychoeducational vignettes.

Define

- o Service users need to feel represented across a range of protected characteristics.

Develop

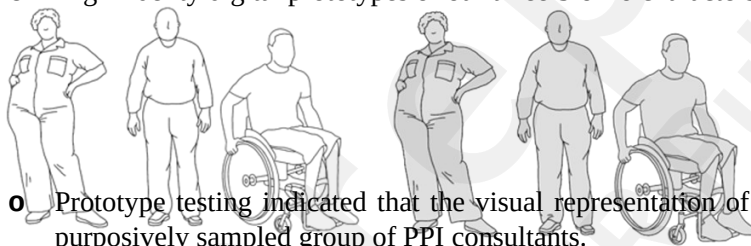
- o Low fidelity prototypes using different illustration styles developed semi-abstract (A), & semi-realistic (B), reflecting different sociodemographic realities.

- o User testing indicated preference was divided. Qualitative feedback indicated a majority would have opted for B if diversity of skin tones was shown.
- o Co-design workshops determined subsequent user testing should focus on different shading styles:

A

B

- o There was a majority preference for C, with qualitative feedback indicating that this style promoted a normalising message, that these types of difficulties can impact anyone.
- o High fidelity digital prototypes of our three SloMo characters were taken for user testing:



- o Prototype testing indicated that the visual representation of the three characters worked well for a purposively sampled group of PPI consultants.
- o Characters were added and taken forward to deliver phase.

C

A

B

C

Box 1. Development of SloMo characters featuring in psychoeducational vignettes.

Box 2. Codesigning psychoeducational vignettes on anomalous experiences and paranoia.

Discover

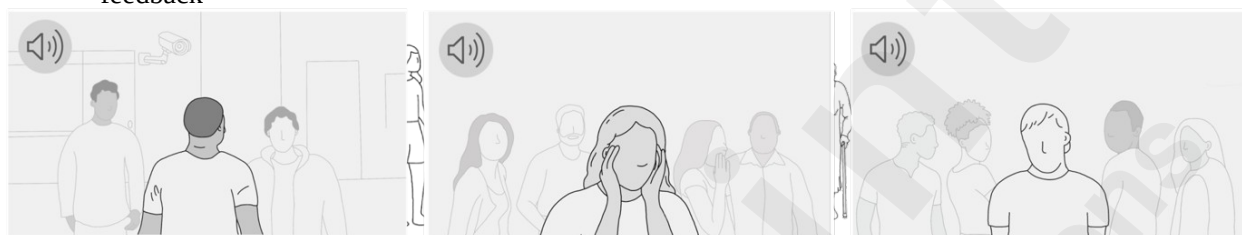
- o Participants wanted more psychoeducational vignettes

Define

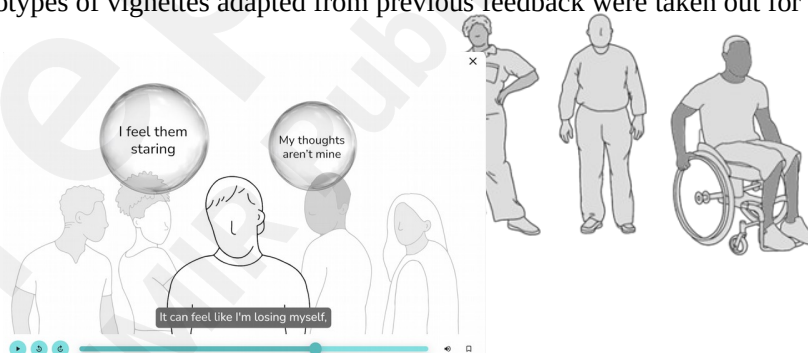
- o Learn ways of managing a wider range of paranoia-related worries

Develop

- o Audio recordings of initial vignettes developed in codesign workshops were taken for user testing feedback



- o Feedback indicated vignettes were interesting, understandable, and relatable.
- o Some feedback suggested wording changes should be made to increase authenticity.
- o During testing of audio recordings, several users commented that the module title (which was initially “unusual experiences”) felt stigmatising. This was fed back in codesign workshops, where an EBE suggested “when the world doesn’t feel right”.
- o This was taken for further user testing. 9/9 PPI consultants preferred this name.
- o High fidelity audio-visual prototypes of vignettes adapted from previous feedback were taken out for further rounds of user testing.



- o Feedback was sought on story content, as well as the illustrations used and narrators.
- o The vignettes were well received and added to the optimised SloMo MVP.



Box 3. Bubble interactions on the mobile app to indicate levels of distress.

Discover

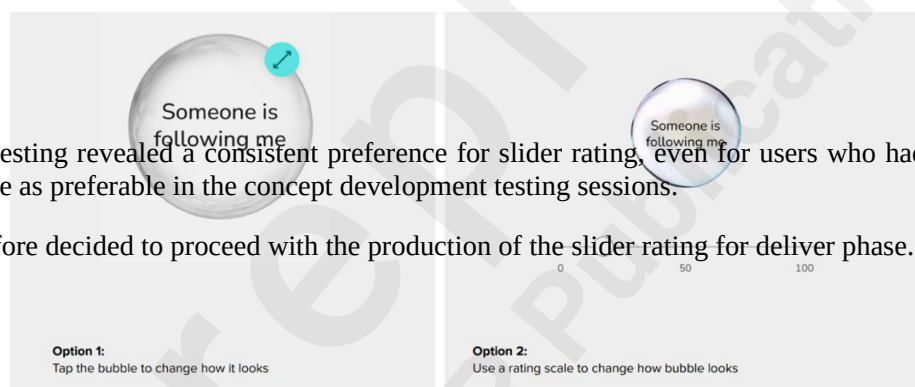
- Adherence lower in people with less technology confidence

Define

- Navigation on mobile app should feel intuitive

Develop

- Worries are resized via touch screen interactions to indicate how big of a problem a worry is. Codesign workshops determined the mobile app UI could be improved by simplifying touch screen interactions.
- Concept development testing sessions indicated preferences were divided for resizing worries using a sliding scale or pinching gesture.
- Both digital prototypes were coded by the software development team, and user interaction was tested:



- Interaction testing revealed a consistent preference for slider rating, even for users who had selected the pinch gesture as preferable in the concept development testing sessions.
- It was therefore decided to proceed with the production of the slider rating for deliver phase.

Deliver

Ten therapist PPI consultants participated in the concurrent think aloud testing sessions. The mean age was 34.9 years (range 26 to 54) and comprised of seven females and three males. One therapist identified as Bengali, two as Black British - African, two as Black British – Caribbean, four as white British, and one as white (other). Seven therapists were clinical psychologists or counselling psychologists, one was a high intensity CBT therapist, two were trainee clinical psychologists, and one was an assistant psychologist. The mean technology confidence score was 86.2 out of 100 (range 70 to 100).

Table 3 presents quotes from the therapist PPI consultants during the think-aloud testing sessions. Overall, the online therapy platform received positive feedback. Therapists appreciated the platform's simplicity and visual appeal, believing it would enhance the enjoyment and engagement of sessions. They noted therapeutic benefits, such as providing

more structure to sessions and making therapy feel more personalised. Additionally, therapists found the platform engaging and flexible, allowing for adaptation based on various therapeutic needs. The addition of progress bars was positively commented on as a helpful feature for therapists to manage the session time more effectively.

Table 3. Quotes from therapist PPI consultants (n=10) during think aloud testing

Theme	Quote
Enjoyment	<i>"I like the visuals... It is attractive to use"</i> <i>"The gamified elements make it more enjoyable"</i> <i>"This is definitely more enjoyable and accessible than conventional CBT for psychosis."</i>
Usability	<i>"I like how simple it is... It's a nice scaffolding tool"</i> <i>"I like the bar along the bottom to help with time management"</i> <i>"I feel more confident to be flexible given my experience level... I worry that low intensity therapists would struggle to deliver in a flexible manner"</i>
Usefulness	<i>"The structure scaffolds good CBT... you can be more focussed on the person in the room"</i> <i>"It gives such a clear focus for both therapists and client"</i> <i>"I think it makes [the therapy process] less intense for people who struggle with conversations for an hour"</i> <i>"The formulation feels personalised"</i>

During the think-aloud sessions, several areas for improvement were identified. Some therapists expressed hesitation about navigating back and forth due to concerns that personalized content entered into the platform might be lost. Others suggested that enjoyment could be further enhanced by incorporating more gamification elements, such as badges or achievements, to boost engagement. Additionally, there were recommendations to increase inclusivity by adding different languages, enabling access for users whose first language is not English.

Eleven service user PPI consultants who had previously taken part in user testing feedback sessions in the develop phase took part in the concurrent think aloud testing sessions for the deliver phase. Think-aloud consultants were purposively sampled to be representative of the psychosis population across the respective areas of the three trusts. The sample included seven females and 4 males, ages ranged from 25 to 60, and four consultants identified as Black British, one as South American, and the remaining six as white British.

The UES findings for each subscale are presented in Table 4. The ratings suggest a good user experience of the SloMo demonstration, with a total UES mean of 83.4%. Notably, the mean score for enjoyment was around ten percent lower than domains of usability and usefulness, as well as showing a greater range of scores. This suggested that improved enjoyment may be an area requiring further development.

Table 4. User Experience Survey ratings of SloMo from service user PPI consultants (n=11)

UES variable

Enjoyment	Mean % (SD)	76.1 (17.3)
	Range	47.5 – 100.0
Usability	Mean % (SD)	85.8 (8.5)
	Range	72.5 – 100.0
Usefulness	Mean % (SD)	87.0 (8.5)
	Range	67.5 – 100.0
Total UES	Mean % (SD)	83.4 (9.7)
	Range	69.2 – 95.8

Table 5 displays qualitative feedback captured during think aloud user testing sessions with service user PPI consultants. The feedback aligned with the UES ratings, indicating areas across the three domains of user experience that were well received. Interestingly, there were suggestions around how enjoyment could be enhanced, possibly providing insight into lower UES scores for this domain. For instance, haptic feedback was seen as a feature that could boost enjoyment, and improving touch screen interactions could further enhance usability. Figure 2 illustrates the digital outputs from the develop phase (figure reproduced from [15]).

Table 5. Quotes from service user PPI consultants (n=11) during think aloud testing sessions.

Theme	Quote
Enjoyment	<i>"I really liked the safer thoughts and the colours on the positive safer thoughts"</i>
	<i>"Using haptics would be good... adds another layer"</i>
	<i>"The swiping [screen interaction] is difficult in places. I would find this frustrating".</i>
Usability	<i>"Ease of access is the biggest positive"</i>
	<i>"It's not difficult to add worries and sometimes people are afraid of technology, but I think it's not difficult to use this app"</i>
	<i>"I feel like I can navigate around it and haven't spent much time on in... It's pretty intuitive"</i>
Usefulness/Acceptability	<i>"I like you don't need to share all of your thoughts with the therapist ...sometimes you don't want to show your thoughts to other people"</i>
	<i>"I like that it's really personalised, I can't count the amount of times that I have been given something that has not been in my own words in therapy"</i>

Figure 2. SloMo sessions with a therapist (in person or online) are supported by an (A.)

online therapy platform which promotes (B.) understanding and managing worries through lived experience stories and interactive tasks. Personalised thought bubbles are visualised and synchronised with the (C.) SloMo mobile app (D.) then “slowed down” to find ways of feeling safer. Additional mobile app features can be accessed via a toolkit which includes (E.) personalised learning summaries of therapy sessions.



Discussion

Principal Results

This study optimised the SloMo therapy software for implementation in routine NHS care, through reducing technology complexity and boosting user experience [23,24]. An inclusive, human-centred design approach (iHCD) was used, involving transdisciplinary co-design workshops, focus groups, one-to-one user testing, and think-aloud testing sessions. From this research, we have produced an optimised MVP of SloMo, which is now being tested in the SloMo2 hybrid implementation-effectiveness study (ClinicalTrials.gov identifier: NCT06568081). User testing indicated that users need a form of CBTp that is usable, trustworthy, enjoyable, personalised, normalising, and memorable, in line with earlier work from our team [16]. Design targets for improving the SloMo software were identified to deliver this design brief, and address user needs. For reducing complexity, key targets included simplified app interfaces to highlight core functionalities, and improved navigation, and for boosting user experience this included providing users with greater agency over data, and improving the representation of protected characteristics, including their intersectionality. The user experience of this optimised version of SloMo may be improved relative to the first version that was tested in the SloMo RCT, indicated by higher UES scores compared to those

reported by Hardy et al. [18].

A distinctive aspect of our product development approach is the integration of lived experience involvement in all stages of the design work. Traditional approaches to intervention development in clinical research often follow a convergent design process using existing theory and evidence to determine intervention content and structure. This approach can miss novel opportunities to improve the user experience of therapies. In contrast, we adopted a "waterfall-agile" approach to facilitate the co-design of SloMo as an evidence-based digital therapeutic [15]. This allowed for agility in iterating specific features (e.g., user interface, psychoeducational vignettes) while maintaining fidelity to the previous user interface and therapy protocol [17]. To support this, we embraced divergence, revisiting and challenging earlier design assumptions in line with iHCD principles. An example of this was the service user feedback that "unusual experiences" could be perceived as stigmatising, despite this wording being widely used in CBTp [28] and the identification of a term describing these types of experiences which felt more relevant and acceptable – "when the world doesn't feel right". Despite this divergent approach, we were necessarily constrained in certain respects. The need to build on a pre-existing evidence base meant that some design decisions were necessarily limited by prior research findings and the parameters of the therapeutic model. For instance, some users suggested moving away from visualising thoughts and thinking habits as bubbles, which was not possible as this is a core component of SloMo and its previous clinical evaluation.

Limitations

Resource constraints restricted our ability to optimally develop this new version of SloMo. This included time pressure, as there was a need to produce an MVP in line with our implementation-effectiveness study milestones. Another constraint was workforce access, such as access to PPI consultants (therapists and service users), designers, and software developers. These limitations meant that pragmatic decisions had to be made for the redesign, for instance, regarding the types of software changes that could be made and what features were selected for user testing. Whilst decisions were made collaboratively within the transdisciplinary codesign workshops, it is possible different design decisions may have been made with additional resources. These constraints may be viewed as a barrier to reducing complexity in the technology domain of the NASSS framework [23,24]. Ideally future projects could be based in 'living labs', whereby lived experience, clinical, technological, industry, regulatory and research expertise is brought together in an organisational structure, with co-production underpinning the co-design of digital health [29].

A limitation of the PPI consultant validation is that the service user and therapist experience of the optimised version of SloMo was based on a relatively brief exposure to the software, and so may not be directly comparable to the user experience findings from the SloMo RCT. Further, the PPI consultants involved in the deliver phase had been involved in the SloMo design work for an extended period and may have been less independent than the RCT sample. This may limit the conclusions we can draw from this early-stage validation. However, more rigorous data will be provided in our ongoing implementation study, examining SloMo when delivered by frontline therapists.

Conclusions & future directions

This study demonstrates the value of using iHCD to optimise DMHIs for implementation in routine mental health care. By adopting an iterative, transdisciplinary approach that

prioritised collaboration with service users, therapists, and technical experts, the SloMo redesign addressed critical usability barriers, fostered inclusivity, and enhanced the therapy's ability to meet the diverse needs of its target population. This methodology offers a valuable model for future mental health innovation, where the needs of diverse user groups are addressed, and therapeutic technologies are designed to be impactful and sustainable in routine care settings. We are now evaluating the implementation and effectiveness of the optimised version of SloMo when delivered by routine care therapists. We envisage SloMo will continue to be iterated based on learning from this work, in line with the principles of implementation science [30].

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Conflicts of Interest

None declared

Abbreviations

CBTp: Cognitive Behavioural Therapy for psychosis

EBEs: Experts by Experience

iHCD: inclusive, Human-Centred Design

MVP: Minimum Viable Product

NASSS: Non-Adoption, Scale-up, Spread, Sustainability model

PPI: Patient and Public Involvement

RCT: Randomised Controlled Trial

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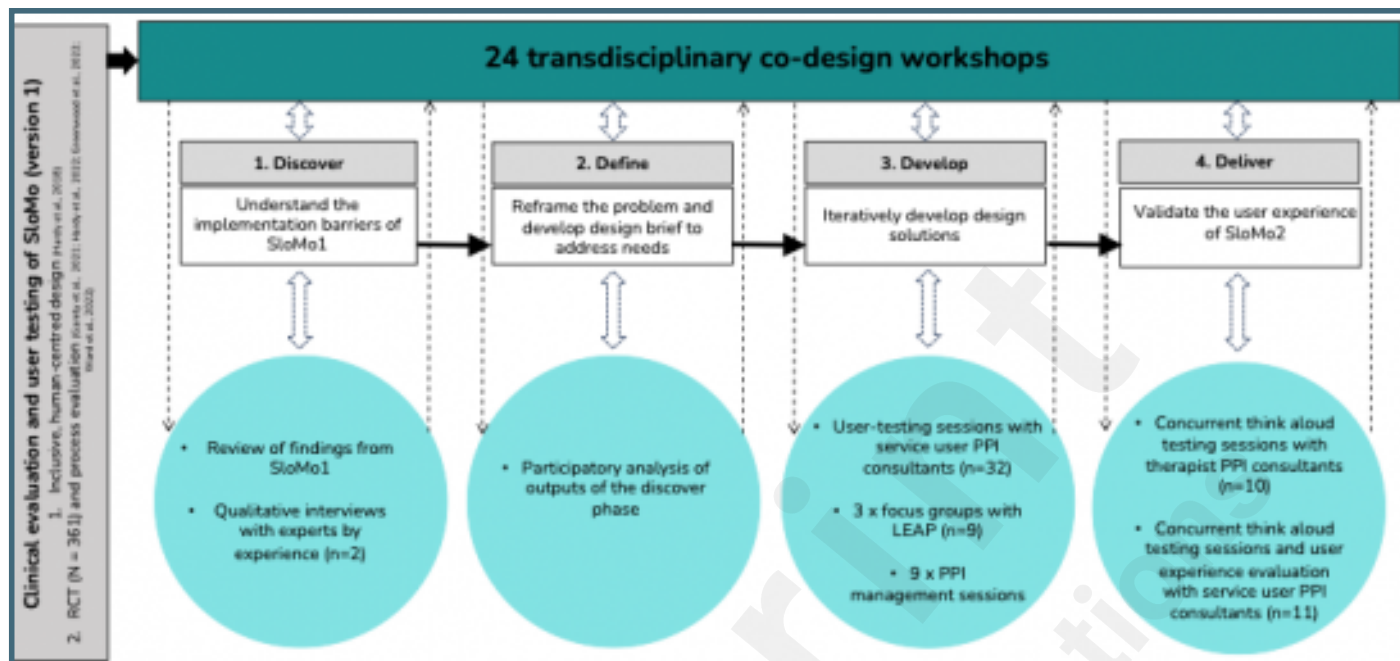
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Supplementary Files

Figures

Optimising SloMo for implementation – design research methods used across the four phases of the double diamond framework.



SloMo sessions with a therapist (in person or online) are supported by an (A.) online therapy platform which promotes (B.) understanding and managing worries through lived experience stories and interactive tasks. Personalised thought bubbles are visualised and synchronised with the (C.) SloMo mobile app (D.) then “slowed down” to find ways of feeling safer. Additional mobile app features can be accessed via a toolkit which includes (E.) personalised learning summaries of therapy sessions.



Multimedia Appendixes

Digital prototypes used in user testing sessions during develop phase.

URL: <http://asset.jmir.pub/assets/fd1831e72e394401bdbaf26294a63db4.docx>

Comparison of design outputs from the develop phase, compared to compared to the previous version.

URL: <http://asset.jmir.pub/assets/6302fd14b3cc593ed37ed0c305e04ab3.docx>

Service user PPI consultant ratings (n=19) of psychoeducational vignettes from develop phase.

URL: <http://asset.jmir.pub/assets/9dfdc72d93d0d9458096a8ce79f053d.docx>

Examples of qualitative feedback from service user PPI consultants during the develop phase.

URL: <http://asset.jmir.pub/assets/3dab1a5020f2786a16869fa6cc219bf2.docx>

