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Acceptability of a Plasticity Focused Serious Game Intervention for PTSD: A User Requirements Analysis

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Abstract

Background: Trauma-focussed CBT (TF-CBT) is a first line treatment for post-traumatic stress disorder PTSD. Despite a solid evidence base, TF-CBT response and attrition rates vary considerably. Plasticity focused interventions, including the use of serious games, have the potential to improve TF-CBT response and treatment retention.

Objective: The aim of this study was assess the acceptability of a smartphone delivered plasticity focused serious game to improve response to TF-CBT for PTSD; and to carry out a user requirements analysis should development of a prototype be warranted.

Methods: We conducted two one-to-one interviews (n = 2);one focus group involving service users who had received a diagnosis of PTSD (n = 3); and one focus group involving psychological trauma service clinicians (n = 4).

Results: We found that the concept of a plasticity focused smartphone intervention for PTSD is acceptable to patients and clinicians. Service users and clinicians both believed that usage should be guided by a therapist, and both contributed useful input regarding the audiovisual aspects of the proposed serious game. It was accepted that the game would not be suitable for all patients, and that clinicians would need to appropriately prescribe usage of the game.

Conclusions: Our findings highlight the acceptability of the proposed serious game and clarify the user requirements for such an intervention. It is the intention of the authors to carry out a user experience evaluation using a prototype serious game in a clinical population.

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Acceptability of a Plasticity Focused Serious Game Intervention for PTSD: A User Requirements Analysis

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ABSTRACT

Background: Trauma-focussed CBT (TF-CBT) is a first line treatment for post-traumatic stress

disorder PTSD. Despite a solid evidence base, TF-CBT response and attrition rates vary considerably. Plasticity focused interventions, including the use of serious games, have the potential to improve TF-CBT response and treatment retention.

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Conclusions: Our findings highlight the acceptability of the proposed serious game and clarify the user requirements for such an intervention. It is the intention of the authors to carry out a user experience evaluation using a prototype serious game in a clinical population.

Introduction

In the absence of UK estimates, lifetime prevalence of post-traumatic stress disorder (PTSD) in the United States has been estimated to be between 6.8 and 7.8% [1]. The disorder is characterised by intrusive memories of traumatic events, nightmares and avoidance of event related stimuli [2]. In the UK, trauma-focused cognitive-behavioural psychotherapy (TF-CBT) is a first-line treatment for PTSD[3]. TF-CBT refers to a range of evidence based psychotherapeutic techniques for the treatment of psychological trauma. Despite a strong evidence base and wide implementation of TF-CBT, response and attrition rates vary widely; in some circumstances exceeding 50% [4,5]. Contributory factors to less than optimal response to therapy in PTSD are varied, including mutliple possible social and behavioural factors [4]. One possible contributory variable is neural deficit associated with PTSD. Functional imaging studies suggest that reduced fronto-medial neural network connectivity (e.g. reduced prefrontal modulation of the amygdala) and volumetric abnormality of medial limbic structures are associated with PTSD psychopathology [6-8].

Neural correlates of PTSD

Fronto-medial neural connectivity is thought to play a critical role in regulating computational processes which are integral to processing trauma memories; according to the theoretical frameworks underpinning TF-CBT. These processes include pattern identification, separation and completion [9]; which allow for complete retrieval and successful discrimination between contextually similar episodic or event memory formations based on familiar stimuli. Difficulty in completing these processes is characteristic of PTSD. For example, someone who experiences post-traumatic symptoms in relation to the trauma of surviving a house fire, might experience involuntary recall of traumatic memory in response to the sight and smell of a bonfire.

There is also evidence of intrinsic medial temporal lobe (MTL) connectivity contributing to the

successful processing of fear related memory [10], and to the formation of egocentric episodic memory representations [11]. Reduced neural connectivity in the MTL, especially in relation to the strong efferent connections between the retrosplenial cortex (RSC) and the hippocampus, may have negative clinical implications for PTSD patients engaging in TF-CBT. This is because a core component of TF-CBT known as 'reliving', is a form of in-vitro exposure which involves the guided retrieval of episodic memory of traumatic incidents from an egocentric viewpoint in vivid detail.

Aim of the study

Several researchers have found functional and structural plastic changes in neural circuits following the prolonged use of commercial videogames, and have queried the potential for therapeutic application [12-14]. Neuroimaging and behavioural data suggests that fronto-medial circuitry is implicated in generating short-term memory representations related to way-finding, and in memory-based decision making tasks [15,16] as has the use of salient landmarks to aid navigation of novel three-dimensional environments [17]. Additionally, mechanics such as switching between a first or third person perspective and an aerial map perspective of a virtual environment has been associated with recruitment of fronto-medial circuitry [12]. Based on these data, it appears possible that a specifically designed videogame (serious game) could encourage plastic changes in fronto-medial neural circuitry by presenting the player with tasks known to recruit this neural network. For example, a videogame could present a player with a two-dimensional aerial map representation of a novel three-dimensional environment, inside which were placed several objects. The player could then be asked to memorize the location of each object, choose an order to collect the objects in, then navigate the environment and collect each object in the order they have chosen, aided by salient environmental landmarks.

We aimed to find out:

- If a plasticity focused serious game intervention designed to aid response to TF-CBT in PTSD patients would prove an acceptable concept to service users and providers?
- What would be the user requirements for such an intervention to be feasible and accessible?

Methods

The authors conducted a focus group (n=3) and two semi-structured interviews (n=2) with service users; and also conducted a focus group with psychological trauma service clinicians (n=4).

Participants

The recruited number of eligible participants was $n = 9$. 5 participants were service users, and 4 were trauma service clinicians. 1 service user participant was female and the remaining 4 were male. Mean age for service user participants was 59.8 years with a range of 53 – 68 years. The duration of PTSD symptoms reported by service user participants ranged from 3 – 30 years. $n = 3$ had experienced combat related trauma. The natures of the other service user's experienced traumas were unknown. The clinical roles represented by the trauma service clinicians ($n = 4$) were 1 trainee clinical psychologist; 1 assistant psychologist; 1 specialist clinical psychologist and 1 consultant clinical psychologist. Principal inclusion and exclusion criteria are presented in Box 1.

Box 1.

Service users	
Inclusion criteria	Exclusion criteria
≥ 18 years of age	Under 18 years of age
Previous or current diagnosis of PTSD	Inability to provide informed consent to participate
In frequent and regular contact with service	

for treatment or other services e.g. mentoring	
Clinicians Inclusion criteria ≥ 18 years of age Currently working clinically with PTSD patients.	 Exclusion criteria Not working directly with PTSD patients Unqualified/trainee clinicians without ongoing clinical supervision

Materials

A topic guide was developed by the authors and used for both the focus groups and interviews. Open ended questions with prompts addressed a total of five broad domains of inquiry (as summarized in box 1.). All topics were explored in each interview and focus group. Interviews lasted between 30 and 60 minutes and focus groups lasted between 90 and 120 minutes. Demographic data including age and gender were requested from service user participants only. We sought permission from all participants to make live written notes, and to audio record interviews and focus groups on two dictaphones placed on a table around which participants and researchers sat. All audio and written data were transcribed verbatim at a later date.

Box 2.

Topic Guide - domains of inquiry
Service users Current smartphone capabilities Coping strategies employed by service users (and those which involve smartphone applications and/or online resources) Acceptability of the proposed intervention (including concerns) Views on game presentation (in terms of graphics and audio)
Clinicians Acceptability of the proposed intervention (including concerns) Views on game presentation (in terms of graphics and audio)

Procedure

In order to identify and engage members of the target population for recruitment in to the study, the authors approached several organizations, including third sector and NHS services. A branch of a national charity, offering mental health mentoring and practical support to military veterans in South Wales responded promptly and positively to our queries. One to one interviews were carried out here during April 2017. We have decided not to include the name and location of this service in the interests of the confidentiality and anonymity of study participants. The psychological trauma service at Springfield University Hospital in Tooting, London, also responded positively and promptly to our enquiries. Focus groups involving patients and clinical staff were carried out here in June 2017.

Data Analysis

Data were thematically analysed, summarised and described in relation to our domains of inquiry. As interviews were relatively unstructured, and we sought to assess acceptability rather than develop a theory of theoretical framework, we did attempt to calculate inter-rater reliability.

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Results

Current Service User Smartphone Capabilities

Of 5 service user participants, 4 owned a smartphone and 1 owned an older generation mobile phone. Of the four smartphone owning participants, 3 owned a smartphone running Google's Android operating system and the other used a phone running Apple's iOS operating system. Participant's smartphones were capable of running software applications, and all reported social media apps as their favoured and most frequently used apps. These included Facebook, Facebook Messenger, and WhatsApp.

Existing Coping Strategies Reported by Service Users

All participating service users reported reliance on particular lifestyle related strategies to cope with PTSD symptoms. The majority of participants reported social support (through either friends or family or organised support groups) and engagement in outdoor activities, including cycling and dog walking. All but one participants reported using mobile applications in seeking support from others (e.g. Facebook, WhatsApp, SMS, phone).

All participating service users reported that PTSD had adversely affected their memory. Participants gave examples of impaired episodic and prospective memory capacity, such as frequent examples of the 'doorway effect' and forgetting seemingly meaningful upcoming or past events, particularly when stressed. Out of the 5 service users, 3 participants did not use any memory specific coping strategies, whilst 1 participant reported using their smartphone to create calendar reminders, and 1 reported writing things down using a pen and paper. Walking and cycling were reported to be helpful activities by 2 participants, and 1 reported using Google Maps for planning cycling routes. All but 1 had previous TF-CBT, all reported current medication with SSRIs (selective serotonin reuptake inhibitors).

No participants had used online resources to help them cope with PTSD symptoms. Only 1 of 5 participants reported having used an app called PTSD Coach [18] released by the United States department of veterans affairs. The app focuses on education around PTSD and symptom tracking and is marketed as a therapeutic tool. They described the app as unhelpful, and were no longer using it. No participants reported actively using general health or wellbeing related apps. Usage of relaxation and meditation apps were reported by 2 participants (these were the freely available 'Stop, Breath and Think', and 'Smiling Mind' Android apps) [19,20], which including scripted meditation and relaxation exercises. Both participants described these as unhelpful, with 1 participant describing the sensation of being "out of control" when using the app as anxiety inducing.

Service Users Reported Acceptability of Proposed Serious Game

All participants described themselves as being willing to try the proposed serious game intervention. Only 1 participant described themselves as less enthusiastic about using the app alongside therapy than before therapy, and 1 described themselves as concerned that using the app would interfere with therapy rather than enhance it, but that these concerns could be alleviated if they received assurance of the game's efficacy from a clinician. All participants stated that they would be more confident about using the app under the guidance of a clinician.

Of the 5 participants, 3 stated that they would be unlikely to use the app at times when they were experiencing acute symptoms of PTSD e.g. experiencing a flashback or symptoms of panic. Only 1 participant described long periods of inactivity alluding to depressive symptoms as potential barrier to using the app. All agreed that the app would have to be easy to use and intuitive in its design. All

participants expressed concern that if the game were too difficult, they may become frustrated and cease using it relatively quickly. Should this not be the case, 2 participants both stated that they would be willing to use the app for 30 minutes a day every day over a prolonged period (defined by the interviewer as between 3 and 6 weeks). The remaining 3 participants stated they would be willing to use the app for 30 minutes every other day over the same period. All participants were enthusiastic about the prospect of patients using the serious game whilst on a waiting list. They described positive implications for self-efficacy; “you’re not just waiting for someone to help you then, you are doing something [to help] yourself”.

All participants were positively inquisitive about the concept behind the proposed serious game, especially the fact that the game would not include a psychotherapeutic component to address PTSD or PTSD-related symptoms directly. No participants reported any concerns, or negative attitudes towards the concept underpinning the proposed serious game when prompted e.g. “What do you think of the HAPPIA game concept? - Do you think this could work for you?”

Service Users Views on Proposed Serious Game Graphics and Audio Components

In terms of graphical and audio design features that would be beneficial to the user experience; all participants favoured an expansive outdoor environment. Water, in the form of rivers and lakes, including the sound of naturally running water was described as desirable by 4 participants. However, beaches were described as reminiscent of combat trauma and, therefore, especially undesirable by 2 of the 4 participants. Desert landscapes were also described as undesirable. Woods and greenery were described as desirable by 4 participants and 1 participant described the ideal aesthetic to be that of a garden. The need for the player to be able to choose different seasons for the environment prior to play was expressed by 3 participants. No participants desired the inclusion of human characters in the environment, but 3 enthusiastically favoured the inclusion of wildlife such as dogs, birds, and horses.

During the focus groups and interviews, the researcher would describe the need for novel landmarks to be located in the environment and ask the participants how they would like these to be represented. In response to this query, mountains and trees were described as being ideal landmarks by all participants. Man-made structures were described by 3 participants; with Buddhist temple or similar architecture being the favoured choice.

Clinician’ Reported Acceptability of Proposed Serious Game

As with service user participants, clinicians were positively inquisitive about the concept behind the proposed serious game. Clinicians were more likely to inquire about the theoretical basis for the intervention. No clinicians reported any concerns about potential adverse effects, however all participants favoured clinician guided use of the game as opposed to independent use. It was the prevailing view that a significant proportion of patients would require coaching in using the game with adequate frequency.

Clinician’s Views on Proposed Serious Game Graphics and Audio Components

When discussing the sound and graphics content of the game, all participants agreed that the game must avoid sound and graphic content likely to trigger symptoms of PTSD. All were agreed that the more realistic the environment the more difficult this task becomes and so a “cartoon-like” or abstract appearance for the environment was favoured. It was accepted that creating an environment which could be guaranteed not to trigger symptoms of PTSD in any player would be infeasible.

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However, it was accepted that creating an environment which would be unlikely to trigger PTSD symptoms for the majority of users was feasible, especially if the environment was customisable, and the game was carefully prescribed.

Clinicians stated that the game should match the patient's' abilities: “if the game is too boring, the patient would disengage, weakening the effect of the experimental manipulation”. Service users on the other hand, were more concerned with the amount of concentration required to sustain while playing the game: if they have to concentrate too hard, they might get frustrated and give up. This balance of skill and difficulty is referred to as a component of “flow” theory, and is frequently referenced when designing games for educational and clinical purposes [21].

Clinicians raised the issue of increasing numbers of asylum seekers seeking help for PTSD in the UK in recent years. As many of these service users may have difficulty understanding English, the game interface must be intuitive and include very little text guidance. Alternatively, translating the game into many different languages would present a less feasible option given available funding and resources. Additionally, in the clinician’s experiences, many patients who had arrived in the country seeking asylum had come from Middle Eastern and North African countries and had experienced trauma not only in the countries they were escaping but also during perilous journeys to the UK. For this reason graphics of beaches, large expanses of open water, boats, lorries, and desert landscapes were deemed undesirable.

Discussion

Principal Findings

We captured qualitative data regarding the acceptability of a plasticity focused serious game to aid response to TF-CBT for PTSD from a small sample of service users and clinicians. These data suggest that the concept of such an intervention is acceptable to both groups, and can be made accessible to the target population who mostly have access to capable hardware. Care must be taken in terms of graphical and audio content to ensure that the game does not elicit trauma symptoms in service users, and is accessible and easy to use. This represents a significant design challenge given the highly varied clinical population in question. It was the view of service users and of clinicians that game usage should be guided by a therapist. The issue of negative affect influencing motivation, and poor prospective memory in PTSD patients reinforced the need for therapist involvement. It was also accepted that the game would not be suitable for all patients, and so clinicians would have to use their knowledge and expertise to appropriately prescribe usage of the game.

Limitations

Our study was limited by a small and opportunistic sample, most notably missing asylum seeker representatives. Participants had received a diagnosis of PTSD by specialist trauma clinicians. Details of individual’s diagnosis, including the nature of the trauma or traumas, or of symptom severity at the time of participation, were not available to the researchers. Additionally, we did not collect data related to spiritual or religious beliefs, which could have helped put in to context the preference for Buddhist style structures in the virtual environment.

Future Steps

The authors now propose to complete user experience testing with service users and clinicians using a prototype video game running on a medium-spec Android device. We will measure readiness to use a digital intervention such as HAPPIA using a previously validated method of assessment, such as

the eHealth Readiness Scale [22], and include a user satisfaction questionnaire to supplement our qualitative data collection. We will also formally measure aspects of participant's individual pathology using validated tools. For example, we will measure engagement in existing coping strategies for trauma symptoms using the Trauma Coping Self-Efficacy (CSE-T) scale [23]; the Life Events Checklist (LEC) will be used to assess the nature of experienced trauma events [24]; and The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) will be used to measure symptom severity [25]. Data from this testing will be used to refine the design of the software, and further inform the choice of hardware used to deliver the intervention prior to clinical evaluation. Screenshots from the in-development prototype informed by the qualitative data reported here are presented below. The prototype, dubbed 'HAPPIA' (Hippocampal and Prefrontal Plasticity Inducement Application) has begun development using the Unity software engine and optimised to run on medium-spec Android devices including smartphones and tablet PCs.

Following further refinement and development of the HAPPIA application by way of user experience testing, we will seek to evaluate HAPPIA as a clinical intervention by carrying out a randomised controlled trial (RCT). Patients awaiting a course of TF-CBT will be randomly assigned HAPPIA plus treatment as usual (TAU), or TAU alone. Symptom severity at the outset of treatment, at cessation of treatment and at follow up will be measured using validated psychometric measures and compared between groups. Attrition rates and changes in psychotropic medication (e.g. anxiolytics) dosage will also be compared between groups. We will capture demographic data for clinical participants including age and gender. HAPPIA will record game related data; including time spent playing the game, time taken to complete tasks and efficiency of task completion for within-group analysis.

HAPPIA screenshot depicting a salient landmark (mountain)

HAPPIA screenshot depicting a lake, tree and boundary of environment (distant mountains)

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Author Disclosure

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