CogniShift

Smartphone Application for Public Speaking Anxiety

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Abstract:

Mental health has received increased attention over the past decade, while barriers prevent many from seeking treatment. One of the most common anxiety disorders is Public speaking anxiety (PSA), which can have career and educational consequences, as well as personal. The most common treatment for PSA, which has proven effective, is Cognitive behavioral therapy (CBT). Although CBT has proven effective, barriers like stigma are preventing individuals from seeking treatment. We conducted a study to complement therapy sessions with a smartphone application. The study included a review with a psychologist and interviews with users, aiming to explore the feasibility of utilizing a Digitized Thought record, with automated feedback, in reducing the barriers in seeking treatment while not neglecting the quality of the therapy. Our study provided various findings, including the importance of including mental health professional assistance, the need for limited customization, and a distinction of events, depending on who might be involved in them. Our contributions might serve as a foundation in future research on the topic.

SUMMARY

Over the past decade, mental health has received increased attention, while the global healthcare burden is still growing. One of the most common anxiety disorders is Social anxiety disorder, where the most common sub-disorder is Public speaking anxiety (PSA). In our thesis, we focus on PSA, which is a severe disorder that has tremendous financial and personal consequences for individuals suffering from it due to the barriers in pursuing educational- and career-related goals, as well as complicating personal relationships.

Our thesis can be split into two parts: (i) where we investigate the gaps in existing coping strategies for PSA in a narrative review, and (ii) where we explore the feasibility of a smartphone application which utilize Thought record (TR) and automated coping feedback in order to assist individuals in recovering from cognitive distortions before presenting.

Starting the master thesis, we decided to create a narrative literature review to get a broader understanding of the topic, PSA, and investigate existing coping strategies for handling the disorder, and how these strategies are incorporated into various technology-based coping tools. During the narrative review, we found that the most promising way to treat PSA is through a psychotherapeutic approach called Cognitive behavioral therapy (CBT) or medication, while medication might have long-term side effects. The psychotherapeutic approach, CBT, focuses on cognition, emotion and behavior, and how these three distinctions are connected. To handle these distinctions, CBT uses the main four techniques, Social skill training, Applied relaxation, Exposure therapy and Cognitive reconstruction exercises, with the two latter being the most promising in reducing PSA.

The literature review provided us with the desired broad view on PSA, and outlined the gaps in existing research. We found that most of the existing literature focuses on either exposure therapy or combining the main CBT techniques. In contrast, little focus has been put on Cognitive reconstruction on its own. Furthermore, while there exist many technology-based coping tools, the majority of these are based on very comprehensive Virtual reality therapy or self-help applications utilizing skill training in the form of word counts.

For our master thesis we decided that we wanted to explore the feasibility of creating a Cognitive reconstruction coping tool based on the TR for PSA, CogniShift, which enables users to access therapy at all times, when they need it, and without neglecting the quality of the therapy. While creating a self-help application for Public Speaking Anxiety might seem like the most straightforward solution, due to the many barriers in seeking treatment, this was not an option, due to the ethical concerns of leaving the users on their own with their anxiety. Furthermore, we also found that a mental health professional's assisted treatment is more effective than without, hence why we decided this should be implemented in our artefact.

The artefact was created based on TR, while we explored the feasibility of implementing assisted feedback and guidance. The study of the artefact was conducted in two parts. The first part involved an interview with a mental health professional to verify the concept. Additionally, the second part of the study involved interviews with seven individuals suffering from various anxiety disorders and how they perceived the artefact.

The first interview was conducted with the mental health professional to cover our ethical concerns and verify the concept, before presenting anything for the users suffering from anxiety. During the interview the mental health professional was asked open-ended questions regarding a feature and function list for an application, followed by open-ended questions regarding an initial prototype. The outcome from the interview resulted in a refined prototype, which could be presented to the users suffering from anxiety. The second part of the study involved interviews with users suffering from a variety of anxiety disorders. The users were presented with the artefact as a probe, while they were asked open-ended questions regarding how they perceived the various features within the application.

The study gave us a deeper understanding of the condition of Public speaking anxiety that we did not find in existing literature, while further research could include investigating the collaborative tool in a longitudinal study. Furthermore, our implications serve as a basis for researchers investigating the thesis topic.

CogniShift: Smartphone Application for Public Speaking Anxiety

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ABSTRACT

Mental health has received increased attention over the past decade, while barriers prevent many from seeking treatment. One of the most common anxiety disorders is Public speaking anxiety (PSA), which can have career and educational consequences, as well as personal. The most common treatment for PSA, which has proven effective, is Cognitive behavioral therapy (CBT). Although CBT has proven effective, barriers like stigma are preventing individuals from seeking treatment. We conducted a study to complement therapy sessions with a smartphone application. The study included a review with a psychologist and interviews with users, aiming to explore the feasibility of utilizing a Digitized Thought record, with automated feedback, in reducing the barriers in seeking treatment while not neglecting the quality of the therapy. Our study provided various findings, including the importance of including mental health professional assistance, the need for limited customization, and a distinction of events, depending on who might be involved in them. Our contributions might serve as a foundation in future research on the topic.

CCS CONCEPTS

• **Human-centered computing**;

KEYWORDS

anxiety, human computer interaction, interaction design, coping strategies, coping tools

1 INTRODUCTION

Over the last decade, mental health has received increased attention, which has resulted in numerous action plans, as the once presented by the World Health Organization (WHO) [28, 29, 31]. While there has been put an increased focus on mental health, the global health-care burden is still increasing, where neuropsychiatric disorders account for approximately 14% of the global disease burden [31]. Among the most prominent disorders are depression and anxiety according to James et al. for the year 2017 [19].

Social anxiety disorder (SAD), also known as Social Phobia, is one of the most common types of anxiety disorders globally, involving the fear of most social situations, including speaking in small groups or socializing at a party [18, 39]. The anxiety emerges from an intense fear of being negatively evaluated or embarrassed. The intense fear poses a barrier in achieving career- or educational goals, resulting in a lesser contribution to growth and development. Furthermore, while social anxiety has financial consequences, it can also have consequences in a private context like lost friendships and failed relationships, resulting in depression or social isolation [41]. Public speaking anxiety (PSA) is the most common sub-disorder of SAD and is something countless individuals experience during their lives [18, 33]. As in contrast to SAD, PSA only involves fear and discomfort in public speaking scenarios such as class presentations and wedding toasts [18]. Individuals suffering from PSA also fear embarrassment and negative evaluation, resulting in avoidance behavior due to harmful and irrational thoughts related to public speaking. Studies have revealed that individuals suffering from PSA are experiencing anxiety primarily before a speech [3]. Due to this, our study will mainly focus on pre-speech anxiety.

1.1 Therapy

Professionals treating PSA and SAD individuals often use Cognitive behavioral therapy (CBT), which is a psychological treatment for depression and anxiety [26]. The therapy is based on the notion that there is a connection between how we think (cognition), how we feel (emotion), and how we act (behavior) [2]. CBT utilizes a variety of coping techniques, with the main four techniques being Cognitive Reconstruction, Exposure Therapy, Applied Relaxation, and Skill Training [35].

Research has indicated that individuals suffering from PSA are amenable to treatment that involves CBT, particularly treatments including Cognitive Reconstruction and Exposure Therapy [33]. While numerous studies concerning PSA have examined exposure therapy, the management of negative thoughts has not received sufficient focus in research [15, 21]. A comprehensive tool used within Cognitive reconstruction exercises (CRE) is Thought record, which aims to help individuals restructure their negative thinking patterns. For this paper, we will focus only on CRE. Cognitive Reconstruction is a CBT technique, which focuses on (I) cognition and how negative thinking patterns about the anxiety-provoking situation is what causes anxiety, and not the situation itself [16] and (II) assisting the client in identifying the automatic thoughts and replacing them with more rational alternatives.

Research suggests that early treatment and diagnosis of SAD and PSA can reduce the impact the disorder has on individuals' everyday lives, including the development of other disabling consequences, such as comorbid conditions [10]. However, many individuals suffering from SAD or PSA do not seek treatment [1, 30, 40]. Some of

the reasons include limited accessibility, stigma, and the desire to handle their problems on their own [13]. Individuals suffering from SAD and PSA fear social situations, making open conversations with mental health professionals about their issues particularly challenging [7]. To address this problem, we used Research through design (RTD) as a research approach.

1.2 Research Approach

RTD can be defined as a research approach, where researchers attempt to create the right thing, with the intention to transform the world into a preferred state [46]. RTD typically involves the development of one or more artifacts, which serves to generate knowledge related to a problem. The outcome of a RTD process is a deeper understanding of the problem and can potentially be utilized by HCI practitioners or other researchers. We utilize RTD to get a deeper understanding of the complex problems related to seeking treatment for PSA, and how treatment can be facilitated regardless of these barriers. We execute this by creating a concept, which we investigate in collaboration with a psychologist and individuals suffering from various anxiety disorders, and finally, suggest an improved future state through the concept.

To support the need for accessible solutions, which require none or less contact with a psychologist, there exist mobile applications which provide self-help through CBT [5]. While these alternatives are easy to access for the user, they raise some ethical concerns in terms of whether the user is receiving the appropriate and necessary treatment. Research suggests that professional guidance is necessary for anxiety treatment to be effective, something most technology-based self-help tools fail to provide [30, 40].

We propose an artifact in the form of a mobile application, CogniShift, that complements therapy sessions while not replacing them. The application enables individuals suffering from PSA to get dedicated Cognitive Reconstruction therapy shortly before an Anxiety provoking event occurs, in the form of a digitized thought record with the possibility of a psychologist to add appropriate coping statements as a response to the users' automated thoughts.

The contributions of this work are summarized as follows:

- We complement therapy sessions with a smartphone application, CogniShift, to maintain the high quality of the therapy
- We facilitate indirect communication between the psychologist and users to reduce their barriers in seeking treatment
- We facilitate a flexible collaboration between the mental health professional and the user, in order to provide professional guidance and feedback
- We show that the utilization of RTD has provided us with a deeper understanding of the condition PSA that we did not find in previous research

2 RELATED WORK

The work that informs our investigation can be broadly grouped into research in Mobile Health (mHealth), treatments including Conversational agents (CAs) for CRE and the treatment of anxiety using digitized Thought records (TRs).

2.1 Mobile Health

Recently there has been a shift from face-to-face treatment facilitated by a mental health professional to self-help interventions [25, 32, 43]. This shift is particularly noticeable in the increased exploration and development of mHealth, including wearables and smartphone applications. A variety of smartphone applications attempt to provide the user with overall good mental health by implementing a wide range of exercises for various disorders, including anxiety and depression [5, 14, 24]. For instance, Roepke et al. explored a computer- and smartphone-based intervention tool, where their findings suggest utilizing the tool effectively improved the mood of individuals suffering from depression [36].

There are various examples of smartphone applications aimed at improving mental health, focusing on supporting the individual in regulating their emotional health [20]. A study by Rickard et al. developed a smartphone application, MoodPrism, focusing on assessing, monitoring, and providing feedback on the individuals' mental state to provide them with the opportunity to self-regulate their mental health [34]. The results revealed that the technology complements the existing approaches and tools supporting mental health by overcoming the barriers challenging the reliable surveillance of emotional well-being. Furthermore, the technology provides an automated prediction of mental health risk, gains insight into mental health and social context by leveraging behavioral data on social media, predicts resilience patterns to significant daily events, and improves mental health and well-being outcomes. However, their findings suggest rigorous research to examine further mental health benefits of MoodPrism.

Another study explored CBT facilitated with smartphone technology to help users overcome SAD [23]. They developed the Challenger application in the Stockholm University Department of Psychology for treating SAD using several new features, including real-time location awareness, notifications, personalization, and utilization of gamification techniques. The results suggest a reduction in the disease burden of SAD as well as other mental disorders. However, their findings suggest that further research is needed to determine the efficacy and effectiveness of the application in a real-world setting. Additionally, the authors claim that more features need to be added, including gamification and reportage on user development to help further reduce SAD.

2.2 Conversational agents for cognitive reconstruction

CBT is a psychological treatment that mental health professionals commonly use to treat patients suffering from depression and anxiety [26]. Although CBT has proven to be effective, there are barriers related to seeking treatment for social anxiety, including financial cost, geographical restrictions, health system capacity, long waitlists, and fear of stigma [6, 27, 42]. While most research has focused on Social skill training and Exposure therapy, insufficient research has explored CRE to its fullest. However, a study by

Wang et al. 2020 explored CRE by utilizing CA to reduce PSA [45]. The study involved creating a Public speaking tutor using Amazon Alexa, which could guide the participants through CRE, aiming to receive and give feedback through an Amazon smart speaker. In addition to reducing PSA, Wang et al. 2020 also wanted to explore the required level of sociability needed for the CA to achieve the highest effectiveness. The results suggest that CAs helped participants reduce pre-speech state anxiety. A higher sociable CA gave a better user experience and increased engagement due to the established interpersonal closeness with the user. However, the focus of their work is mainly on reducing PSA through the technology of CAs. Thus, there is a lack of focus on other technologies that facilitate CRE while also providing guidance and feedback.

2.3 Digitized Thought Record

A widely used tool related to CRE that has attracted considerable interest by mental health professionals is TRs, sometimes referred to as Daily Thought Records, Dysfunctional Thought Records, and Thought Logs [4, 8, 44]. A TR is a tool based on the cognitive part of CBT, which is intended for individuals with various mental conditions who aim to change their negative thinking patterns, commonly referred to as cognitive distortions. The tool records experiences in conjunction with thoughts, emotions, and behaviors. A TR is outlined as a worksheet and is used to review the recorded events with a mental health professional. TR assists patients in identifying cognitive distortions while also challenging these thoughts. The tool strives to create awareness towards an individuals' subjective experience, leading to a change in their thoughts and behavior. One of the first TRs was developed by David Burns in 1999, which included a worksheet with the anxiety-provoking situation, emotions, automated thoughts, cognitive distortions, and a rational response [4]. A mobile application that attempts to reduce anxiety using TR is Thought Diary [9]. The application has implemented the paper-based TR, with the most significant difference being typing instead of writing. Even though paper-based TR is one of the most used tools within CRE, the utilization of technology has not been explored to its fullest [44]. Technology facilitation can improve the technique in several areas, including shorter time to perform the exercise, mobility, unlimited accessibility, additional guidance and feedback, and the possibility of personalization.

3 COGNISHIFT

Previous research has illustrated several attempts to design smartphone applications to reduce patients' mental challenges including depression and anxiety. This paper will explore the feasibility of creating a smartphone application that utilizes TR and automated coping feedback to assist individuals in recovering from cognitive distortions before presenting [4]. While the concept builds on the basis of TR, as described in related work, some modifications have been made to make it more accessible, and include guidance and feedback for the patient while not compromising the essential element of collaboration between a mental health professional and the user [43]. The features included in the concept were: choosing an anxiety-related situation, assessing emotions experienced in the situation, thoughts related to the situation, evidence that supports

and rejects the thoughts, a coping mechanism that enables the user to reduce their anxiety, and finally, a summary log.

3.1 Mobility and accessibility

To increase the accessibility of therapy, enabling it to be utilized at all times by individuals suffering from PSA, it was decided to create a mobile application, which can be used as a collaborative tool between mental health professionals and users [43]. The mobile application would enable users to access therapy at all times, also without an internet connection.

3.2 Guidance and Automated feedback

Research suggests that for anxiety treatment to be effective, guidance by a mental health professional is necessary, and it is something most technology-based CBT tools fail to provide [30, 40]. We implement guidance by leading the user through the TR in steps and adding transaction pages, enabling the users to be prepared for the next step [43].

CogniShift will have predefined generic automatic thoughts and coping statements but also include a collaborative feature. The collaborative feature will include where users can add new automated thoughts, and the psychologist can help them define new alternative coping statements for the specific automated thought. Finally, the application will have a feature to save completed TRs, making collaboration between the user and the psychologist more straightforward, and enabling them to follow their progress.

4 EXPERT REVIEW WITH INITIAL PROTOTYPE

To verify the concept and features thereof and explore the feasibility of creating a smartphone application, enabling users to have less direct contact with the psychologist, an interview was conducted with a mental health professional and analyzed.

4.1 Procedure

The procedure consists of an interview split into two parts. In the first part of the interview, the psychologist was introduced to a feature- and function list based on Burns' Daily Mood log [4]. In the second part of the interview, the psychologist was presented with an initial prototype, based on these features and functions (see figure 1). Prior to the interview, the psychologist received an email covering the interview agenda, describing the concept and a detailed description of the expected features for the smartphone application.

The interview was facilitated through Microsoft Teams due to COVID-19 limitations, where both the psychologist, the interviewer, and a referent were present. Microsoft Teams was used due to the team call feature, the possibility of using a webcam and being the psychologist's preferred media. The interview was divided into two parts: one part where the psychologist was asked questions about the feature- and function list, and another part where the psychologist was asked questions about the initial prototype. The purpose of splitting the interview into two parts was to get sufficient insights

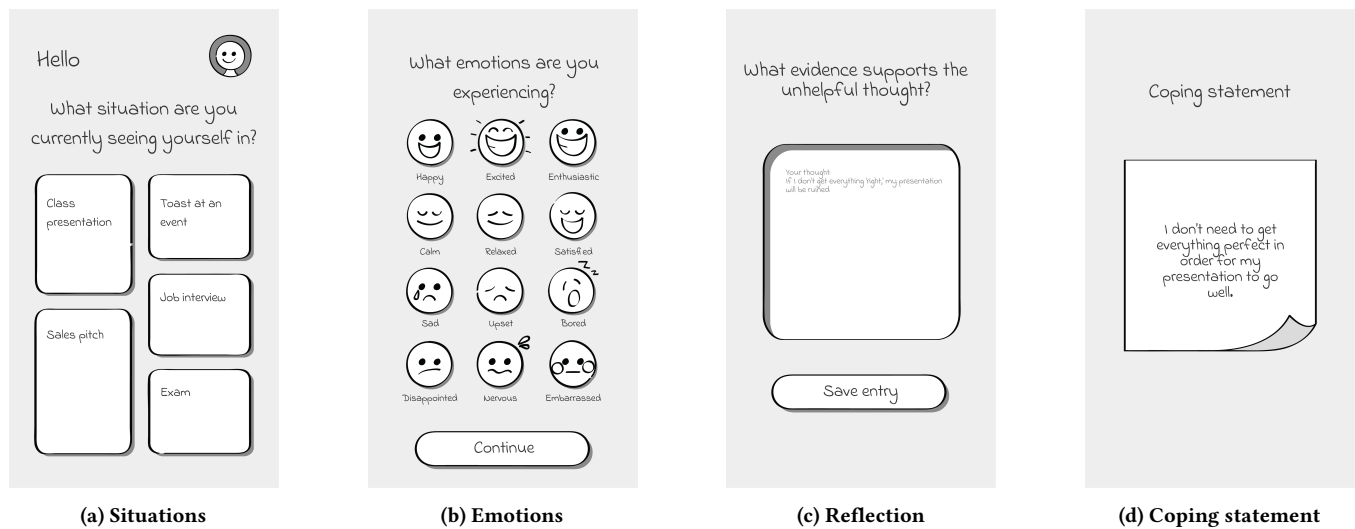| (a) Situations | (b) Emotions | (c) Reflection | (d) Coping statement |

Figure 1: The initial prototype presented to the mental health professional including: (a) Situations that cause anxiety for individuals with PSA (b) Emotions the user experience in an anxiety provoking situation (c) Evidence for and against the automated thought (d) Coping statement is presented to the user as a temporary coping strategy.

into how therapy could be facilitated with less direct communication without the presented elements causing biased feedback.

The first part of the interview was conducted by asking the psychologist open-ended questions regarding their clinical sessions, where a TR and feature- and function list was used as a probe [37]. The purpose of the first part of the interview was to get insights into the interviewee's clinical approach to anxiety, and get insight into their professional opinion related to CRE. The interviewee was not introduced to the prototype in the first part of the interview to enable him to speak more freely about their clinical approach and how this may differ. The second part of the interview was carried out by asking the interviewee questions regarding the low fidelity prototype, which served as a probe for the conversation (see figure 1). While the prototype created a more set layout for the interview, the interviewee was still asked open-ended questions, enabling him to add anything he found relevant.

4.2   Data gathering and analysis

During the interview, data was gathered through audio-recording, while the referent also logged data manually. Following the interview, the audio-recording was transcribed into a text editor, enabling it to be interpreted and analyzed. The analysis was conducted using an exploratory content analysis approach, emergent coding, where we started by reading the interview and scanning for emerging patterns [17]. The patterns were first highlighted in the text editor and afterward moved to an online Affinity Diagram. The first step in the Affinity Diagram included splitting the various statements into each feature in the application. Continuing, reoccurring patterns were grouped into clusters, which were interpreted and given a title. Finally, the clusters were ranked based on their importance.

4.3   Results

The findings from the interview imply that the psychologist was overall pleased with the features, while he did mention the need to add a private situation, as well as consider increased personalization, basic and scalable emotions.

4.3.1   Situations. For the first part of the TR, anxiety-related situations feature, the psychologist proposed including more private situations, such as a get-together with a few close friends (see figure 2a) [18]. They argued that individuals suffering from PSA find private settings particularly challenging due to this being the context where we are supposed to relax and recharge.

4.3.2   Emotions. The psychologist was presented with the emotion part of the TR, where the emotions were in English, something he mentioned was problematic due to emotions not easily being translated. He was worried that some emotions might get lost in translation and that the patients suffering from anxiety will have to use too much energy to make this connection. Additionally, while he mentioned the feelings included being sufficient, he suggested a look into Basic Emotions [12]. He argued that patients often refer to Basic Emotions when asked how they feel in a specific situation and that this might be more appropriate for the context. For the emotion feature, we envisioned visualizing the emotions, making them similar to emojis. The psychologist was satisfied with the idea, which he justified with the following statement: *"Most individuals look at a picture and say - This is how I feel."* Following, he supported the statement with the following: *"People are having a hard time expressing themselves, but with pictures, this becomes easier."*

The psychologist suggested that the users could choose how much they feel a particular emotion on a scale (see figure 2b). His argumentation was based on how his users experience their emotions in the situation and how it can be difficult for them to identify

with an emotion without stating to what degree they feel it. Furthermore, he mentioned that the tool should enable the users to choose more than one emotion, since it rarely will be one. This is also supported by the statement from David Burns, The Feeling Good Handbook *"You can put down several negative feelings, because you will usually have more than one"* [4].

4.3.3 Thoughts and Coping Statements. Continuing, regarding the thought feature and the coping mechanism, the psychologist mentioned the need for being able to create personalized thoughts and coping statements - possibly in cooperation with a mental health professional. While the automatic thoughts and coping statements are excellent and general, anxiety is not always that simple. Furthermore, he mentioned that personalizing these would make the application more linked with the real world.

The psychologist argued, *"If you have a step before coping statement, then it makes it more complicated and makes me more confused [...] I am out of control when the anxiety hits me, I need the Coping statement as fast as possible."* He suggested we could include evidence features, as in the regular thought record, but he argued that not all users would benefit from the feature, and it should be optional (see figure 2c). Furthermore, the psychologist also mentioned his practice and how he writes "what-if" statements on a whiteboard. The what-if statements are thoughts the user might have related to an event, which he counters with a coping statement of some kind. It could be *"I am scared I will crash on the highway,"* where the coping statement could be *"I have been driving for a long time, and I have never crashed. It will not happen today."*

4.3.4 Summary- and save log. Our concept included a summary log, that presents the user with all their entries, and a save log with all previous TRs. The purpose of the summary was to provide the user with an overview of all their entries, enabling them to conclude on their experienced anxiety. The save log served as a data logging primarily for the therapy sessions (see figure 2d). The psychologist mentioned the importance of the coping statement being presented at the top of the summary log. He sees great potential in both features in terms of data logging.

4.4 General results

The psychologist stated that he saw great potential in the app providing the user with feedback in the moment of anxiety - while he does not believe it can replace therapy, he sees it as a great mediator for therapy in terms of communication between user and psychologist. The findings from the expert review urged for minor improvements before the concept could be presented to individuals suffering from anxiety. Based on the findings from the review, the low fidelity prototype was refined and used as a foundation for a user evaluation with individuals suffering from various of anxiety disorders.

5 REFINED PROTOTYPE AND EVALUATION WITH PARTICIPANTS

Following the interview with the psychologist, the initial prototype was refined and evaluated in cooperation with individuals suffering from various anxiety disorders. The evaluation explored how we

can ensure high-quality therapy without exposing the users to unnecessary anxiety. The main priority of these interviews was to ensure the users' experience with the application remained safe.

5.1 Participants

We recruited seven participants, consisting of six males and one female with an average age of 26.57 (SD: 1,50), ranging from 26 to 29, all of which reside in or around Aalborg, Denmark. The majority of the participants were recruited through social media, while the psychologist recruited a few among his clients. The participants included individuals suffering from various anxiety disorders, including Generalized anxiety disorder (GAD), SAD, PSA, and exam anxiety, where six has received professional treatment.

5.2 Procedure

In order to evaluate the concept with end-users, the initial prototype was refined after the expert review. The low fidelity prototype was modified according to the experts' statements, which included a new private situation, basic emotions, as well as some common emotions experienced by individuals suffering from SAD, scalability for the emotions, personalization of automated thoughts and coping statements, and lastly, relocation of the evidence features (see figure 2 and 3).

Prior to the evaluation, the participants were introduced to the topic of the master thesis and required to sign a statement of consent. The purpose of the consent statement was to enable the facilitators to record and listen to audio recordings from the interviews and use the data from the interviews for academic research. The evaluations were facilitated through online platforms chosen by the participants, including Microsoft Teams and Discord. The evaluations were facilitated by presenting the low fidelity prototype to the users while asking them open-ended questions about the various features and functions [37]. The purpose of the evaluation was to gain insights and a better understanding of the users' experience with such a prototype and their thoughts about it.

5.3 Data gathering- and analysis

Data was gathered through audio recordings of the interviews with the participants. The audio recordings summed up to 5 hours and 31 minutes and were transcribed and analyzed continuously. Both of the thesis authors reviewed the transcripts to gain familiarity with the data and to avoid bias interpretations of the data. Continuing, an exploratory content analysis was performed, where emerging coding was made. The codings were then compared and categorized into larger groups iteratively [17].

6 FINDINGS

The goal of the user study was to explore how the participants experienced the proposed concept. We explored the use of a mobile application, CogniShift, guidance, and feedback regarding PSA, but recognize that the concept might be applicable for other anxiety disorders. Here, we will highlight the qualitative results from the evaluation with participants. We will present what participants approved of and suggested improvements.

(a) New situations

(b) Scalable emotions

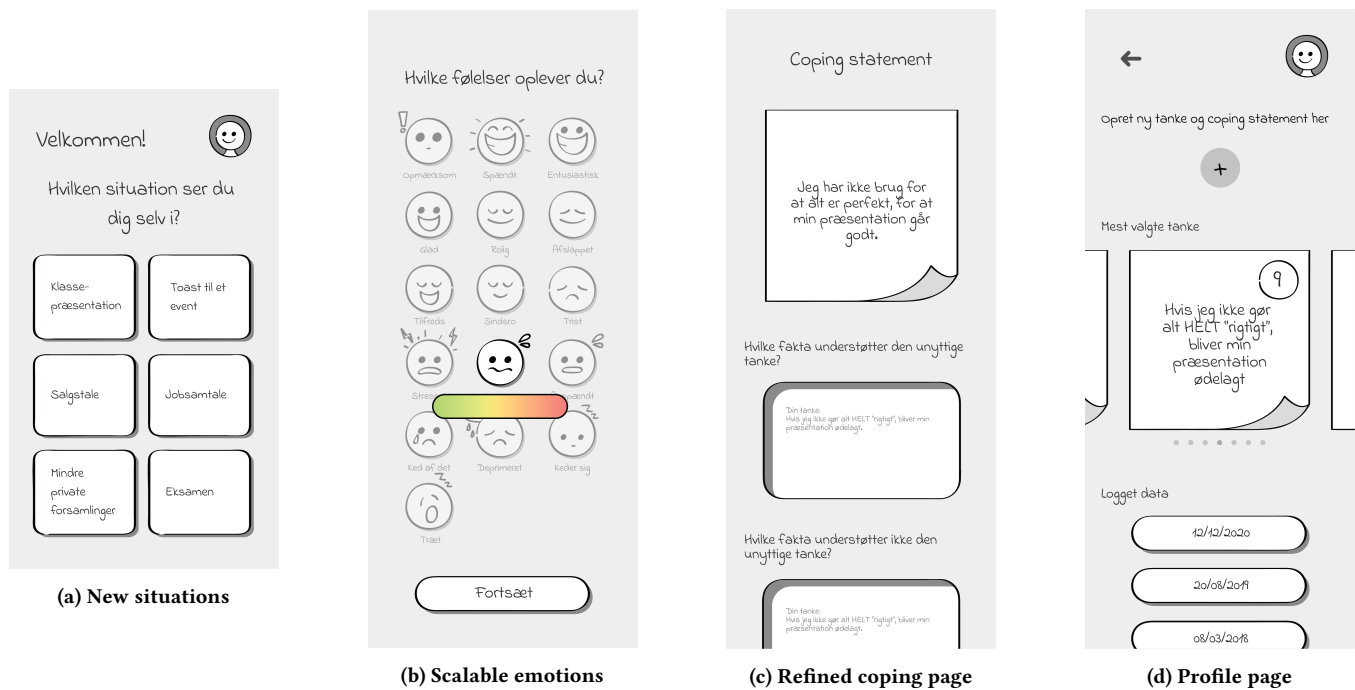(c) Refined coping page

(d) Profile page

Figure 2: Refined prototype presented to the users, based on psychologists feedback including: (a) A new situation, smaller private gatherings (b) Scalable emotions with gradient (c) Coping statements before evidence for- and against automated thoughts (d) Profile page with frequently selected automated thoughts.

6.1 Mobile technology

We proposed the smartphone application, CogniShift, which enables the users to access the therapy at all times [43]. The participants expressed great potential in having a mobile solution as an alternative to the paper-based Thought Record. P1 mentioned: *"You have your process in your hand or pocket, quite literally."* Additionally, several participants mentioned that they already use their smartphones to take notes about their thoughts when they are in an anxiety-related situation while implying that improvement of their current experience would be favored. *"I have a list on my phone [...] I could easily imagine having this app instead if it existed"* - P7.

6.2 Guidance

As mentioned in *3 CogniShift*, research suggests that treatment is more effective with guidance from a mental health professional [30]. We propose a tool that guides users through an anxiety-provoking situation by leading them through the application step by step. The participants highlighted the importance of guiding the users in an anxiety-related situation, confirming our concept. P1 stated, *"If this just popped up now, saying 'now you need to tell us about your feelings,' then I probably would not be able to handle it."* Furthermore, the participants expressed the necessity of making the application as comprehensible as possible, including adding more guidance than first proposed [43]. P1 also said: *"This is also what you do with a psychologist or in psychiatric treatment. You 'take the patient by the hand' all the way."* The participants commented on the transaction

pages, which are pages guiding the user through the process, saying: *"I think it makes perfect sense for you to get some presentation pages from time to time that tell you what exactly you need to do now, rather than just being thrown into the situation instead. [...] I think it works very well. It makes it more enjoyable and easy to use the application."*

Several participants suggested including a tutorial throughout the application to further increase guidance for the application users [37]. P1 mentioned: *"Maybe you could include a flow to start with, that is, these are the five things you need to go through, or this is what you need to do through the app. [...] Something tutorial-like."* This finding suggested that further guidance is necessary for the users to feel comfortable utilizing the application without causing an increase in anxiety.

As mentioned, research suggests that for treatment to be effective, it needs to be supported by a mental health professional [30]. Furthermore, the participants emphasized the relevance and applicability of the application in collaboration with a professional, saying: *"It is a great idea that you can do it with the psychologist"* - P7. Additionally, P3 mentioned the danger of utilizing the application without the assistance of a professional, saying: *"It can be challenging to figure out because it feels a bit like self-diagnosis, which can be super unhealthy and unhelpful."* This statement also supports Palmqvist et al.'s findings of the psychological treatment being more effective when involving a mental health professional [30].

6.3 Feedback

In terms of feedback, and particularly coping statements, the participants initially misunderstood how coping statements are created 3. One participant mentioned: *"The part of finding your coping statement… That is probably a bit hard [...] Otherwise you might have… If you can create coping statements… Then you would not be on the application at all."* - P5. After it was made clear to the participants that the formation of a coping statement is made in collaboration with the psychologist, P2 said: *"When you are in a situation, then you might not think logically, so the element of limiting it so it can be treated with your psychologist is probably smart. Especially because the thoughts you are having are analyzed and interpreted."*

The participants conveyed that feedback in the shape of a summary at the end of a process will help with clarity and a conclusion on an anxiety situation. P7 specifically mentioned: *"I like the idea about getting a result. It is like a conclusion. It is a process you are working through, and when you are done with the process, you get a black and white result, then you are done."*

6.4 Customization

Several users expressed ambivalent feelings about personalizing the application since they only wanted the application to have customization to some degree. P3 mentioned: *"I would like it to be specified for my needs, but I do not want my face on it [...] I do not want to personalize mine at all! Living with anxiety and living with being afraid of these situations, it is so embarrassing to me."* Another participant expressed that the application should not give an individual many options to choose from if they are in an anxiety situation: *"No, it will give me too many possibilities, and when you already have too many anxious thoughts, it might be better to… That the most common is determined."* - P7.

6.5 Familiar vs. unfamiliar

The majority of the participants expressed a need to clarify in the application whether the anxiety-provoking situations occur while being with individuals they have a relation to or individuals they do not know. The participants had a presumption that their level of anxiety would depend on the individuals they were to interact with (see Figure 2a). P1 mentioned: *"If I am sitting with you, or someone I do not know that well personally, or some complete strangers I need to get to know, then it is three very different scenarios to be in."* Additionally, the participants expressed to be less anxious being surrounded by individuals they had a relation to, P7 stating: *"Toast at an event [...] It is a bit two sided. There is an event, where you know most of the people you are with, and then you might feel it is a bit easier, compared to if it is one, where the ones invited are complete strangers."*

6.6 Visual elements

In terms of visual elements in the application, the participants indicated that there is a need for the application to have a high degree of visibility and simplicity, as it should be easy to access when standing in an anxiety-related situation [43]. P6 mentioned: *"As visual as possible… As simple… Like I am an old person. A visually impaired person. It needs to be as easy as possible to use."* They liked

the idea of including visual elements throughout the application, as we mentioned during the interviews. Additionally, one participant mentioned: *"He (the psychologist) is creating it with me, and he is making it very visual for me by writing it on a whiteboard."* - P7.

7 DISCUSSION

Here, we will discuss several conflicting aspects along with possible solutions for overcoming them in future work. The discussion focuses on the possibility of implementing audio input, excluding positive emotions, ethical concerns, Research through Design, and limitations.

7.1 Possibility of implementing audio input

During the user evaluation, a participant suggested adding a feature involving audio recorded of the user's voice - in addition to the

(a) Automated thoughts and add new thought button

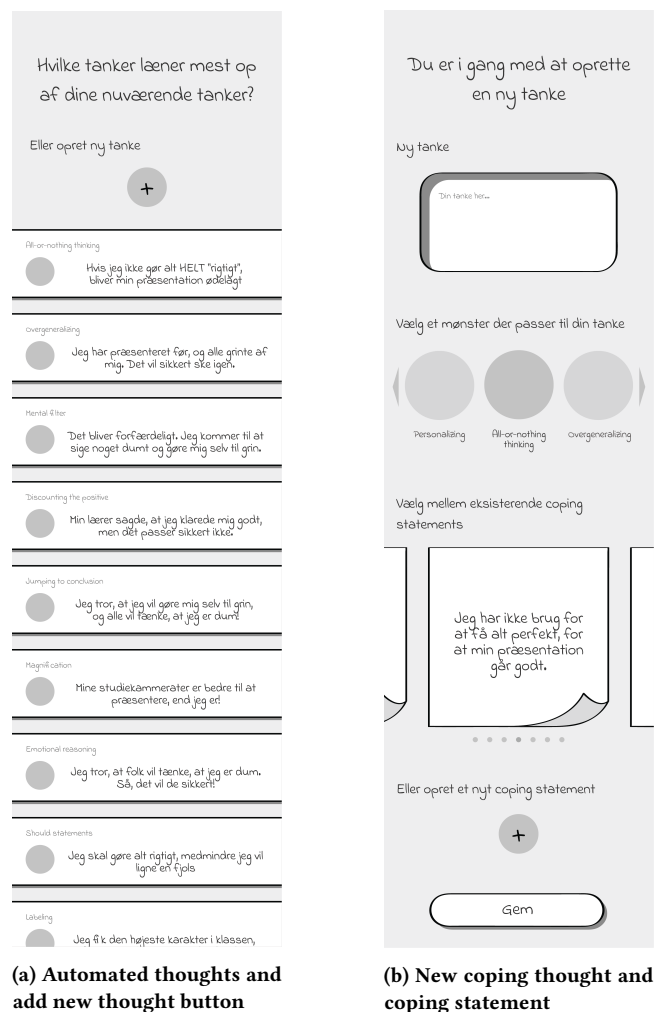**(b) New coping thought and coping statement**

Figure 3: Elements of the refined low-fidelity prototype presented to the users including (a) Choose between existing thoughts or create a new and (b) Customize automated thoughts and coping statements.

click-through concept. The participant mentioned that they found it helpful to say their thoughts out loud, saying: *"Sometimes when you have to write, you can disappear a little in your thoughts, so to say it out loud helps a lot."* - P1. However, this contradicts with another participant's statement, in which the participant states that it is intimidating to speak out loud about their disorder, saying: *"It can be very frightening to talk loudly about your anxiety [...] It is personal, so it (typing on mobile) will work much better."* - P3. Based on participants' contradictory statements, there is a need for further investigation on benefits from including audio input and whether the audio input should be implemented in the application.

7.2 Excluding positive emotions

The expert and several participants questioned the positive emotions included in the application, where participants are asked to choose the emotions they are experiencing in the anxiety-provoking situation [11]. The expert mentioned that it was optimistic to include the positive emotions because individuals suffering from anxiety do not experience the positive emotions, while he did mention they should be kept in the application if some users might experience them. It was further confirmed by the participants, who expressed that they did not experience positive emotions during an anxiety-provoking situation, including P3 that mentioned they only experienced negative emotions while they are in an anxiety-related situation. Participants' statements regarding the exclusion of positive emotions contradict the psychologist's suggestion on keeping the positive emotions in the application. While existing applications have maintained both negative- and positive emotion, our application differs, due to usage, making it challenging to include positive emotions. However, we acknowledged that further investigation is needed to explore whether positive emotions should be excluded.

7.3 Ethical concerns

The application is meant to serve as a collaborative tool between the individual suffering from PSA and the psychologist to reduce the barriers to seek treatment. These barriers include financial cost and geographical restrictions, health system capacity, long waiting lists, and fear of stigma. The solution to some of these barriers might be to enable the individuals suffering from PSA to start utilizing the application on their own. However, this can cause ethical concerns since it may be unethical to hand out the application to the individuals without further introduction or assessment. Individuals suffering from PSA need to receive the appropriate and necessary treatment, and handing out the application may have drawbacks.

7.4 Research through Design

Prior to the concept development, we found that most individuals suffering from PSA fail to seek treatment due to various barriers. This creates a complex problem due to the need for treating PSA, while the barriers are not easily removed. We utilized RTD in an attempt to make the right thing by developing an artifact based on existing research, and our attempt to workaround the barriers. While our workaround is a feasible solution, we acknowledge that the problem might be solved in various ways. We perceive RTD as a preferred method in uncovering knowledge related to how to workaround the mentioned barriers due to the need for cautious

and direct communication with the users during the evaluation, which might not have been possible to provide through a more participatory process. Utilizing RTD provided us with deep insights into the condition PSA that we believe we would not have uncovered otherwise. While RTD serves well if the problem is not fully understood, it provides the researchers with a lot of data to navigate, which might result in a complex and challenging analysis. We imagine that while RTD provided us with a deeper understanding of the problem, it might also have limited the users' creativity in how they see the problem solved.

7.5 Limitations

The purpose of developing the initial prototype was to have it reviewed and validated by a mental health professional, which was arranged online through Microsoft Teams. After the professionals' assessment of- and input to the application, the application was modified. We evaluated the modified application with participants, one by one, through either Microsoft Teams or Discord, depending on the participants' preferred media. Ideally, we could have conducted a co-design workshop with participants and multiple mental health professionals and collaborated creatively. The workshop would enable the mental health professionals and participants to provide domain knowledge while participating in the informing, ideation, and conceptualizing activities in the early stages. However, while a workshop might be more insightful, it can be argued that it would be unethical to conduct workshops with participants dealing with anxiety related to specifically SAD and PSA.

Based on the expert review, the initial concept was verified, followed by minor modifications. Furthermore, the refined prototype was evaluated in cooperation with participants while exploring how we could ensure high-quality therapy and ensure that the participants' experience with the application remained safe. Although 5/7 participants stated that they would use such an application, several issues are worth mentioning regarding whether the solution is feasible. First, it can be argued whether one expert is sufficient to review the application. The psychologist's positive attitude towards the application's features and functions causes a lack of criticism towards the concept. Thus, we can argue whether we should include more mental health professionals to review and verify the concept. In addition, whether a single online semi-structured interview with the expert and the participants, respectively, is enough to gain insight into whether the application will function as a collaboration tool between participants and the psychologist and remove the barriers in seeking treatment. Thus, to determine whether the collaboration tool works, it is necessary to perform a longitudinal investigation. This longitudinal investigation can further include the expert and the participants in the development process.

During this study, the main focus has been on CRE and how this can be utilized in reducing PSA pre-speech. However, while this is our focus, we acknowledge there might be a need for a tool that encompasses several CBT techniques, including Exposure Therapy and Mindfulness exercises. Furthermore, during our user study, two participants mentioned that while the thoughts were the primary

trigger in their anxiety, they did perform exposure therapy and breathing exercises in an attempt to overcome these thoughts.

7.6 Implications for Design

We uncovered insights through the user evaluation, where we share the main takeaways as implications for design, which are supported by relevant literature on anxiety and mHealth.

7.6.1 Mental health professional assistance. When creating tools for people suffering from PSA, our findings suggest the users might perceive the application with guidance from a professional as more reliable and effective, while perceiving self-help without the assistance of a professional harmful. This finding supports existing research, which implies treatment is more effective when involving assistance from a mental health professional [22, 30].

7.6.2 Limited customization. One of the main takeaways from our study suggests that people suffering from PSA and SAD might not appreciate too much customization due to the stigma of portraying anxiety in the form of the application. This differs from existing research, like the study presented by Simm et al. Their study focused on individuals suffering from both Autism and Anxiety, where they state the uniqueness of anxiety and that a 'one-suits all' does not always work [38]. While limited customization is necessary for individuals suffering from PSA and SAD, some customization is needed to encourage continued usage. Research by Vaghefi and Tulu state that if the features included in the does not fulfil their needs, the users will either supplement the application, or completely replace it [43]

7.6.3 Familiar vs. unfamiliar. During the user evaluation, our findings suggest clarifying whether anxiety-provoking situations occurred while being with individuals they have a relation to or individuals they do not know, as their anxiety will vary depending on who they are with. Based on this notion, when developing tools for PSA, we recommend distinguishing social events and who might be involved in these.

8 CONCLUSION

Throughout this study, we examined a collaborative tool, CogniShift, enabling the psychologist to receive feedback from- and give feedback to the user while exploring the feasibility of reducing direct communication between user and psychologist, thus enabling more users to seek treatment. Our findings indicate the following: (i) the importance of having accessibility to the application at all times; (ii) by including a mental health professional, the application will be perceived as more reliable and effective, while further guidance was suggested; (iii) self-diagnosis or self-help without the assistance of a mental health professional is assumed to be harmful; (iv) getting a summary from the exercise was preferred, despite its negative elements; (v) the personalization of the application to some extent was preferred, while limiting it, to avoid the application portraying them; (vi) the participants' anxiety will vary depending on who they are with, thus a clarification of that was requested, and (vii) a visual and straightforward application was required due to everything being unmanageable in an anxiety-related situation; We created an artifact, CogniShift, which complements therapy sessions while maintaining the quality of the

therapy. Furthermore, we found that the communication between a professional and individuals suffering from PSA was necessary, which we implemented through indirect communication by users creating automated thoughts and coping statements in collaboration with a mental health professional. Additionally, the flexible collaboration is facilitated by enabling users to receive guidance and feedback from the psychologist through customizing coping statements. Moreover, an RTD approach has given us a deeper understanding of PSA that we did not gain through previous research on the subject. Some of our unexpected insights include the need for limited customization and clarifying whether the people to be engaged with are known or unknown. Future work could include making a longitudinal investigation of the collaborative tool, CogniShift, in the field, which would provide a deeper understanding of the benefits and implications of the application. Although the focus of this project has been on PSA, we acknowledge the feasibility of using the concept as a generalized anxiety tool.

9 ACKNOWLEDGEMENTS

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GLOSSARY

CA Conversational agent. 4, 5

CBT Cognitive behavioral therapy. 3–5, 10

CRE Cognitive reconstruction exercises. 3–6, 10

GAD Generalized anxiety disorder. 7

mHealth Mobile Health. 4

PSA Public speaking anxiety. 3–7, 10, 11

RTD Research through design. 4, 10, 11

SAD Social anxiety disorder. 3, 4, 7, 10, 11

TR Thought record. 4–7

WHO World Health Organization. 3