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Recording Thoughts for Mental Health Therapy

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I hereby declare that this dissertation is all my own work, except as indicated in the text:

Signature: _____ Date: ____ /____ /____

Recording Thoughts for Mental Health Therapy

Umar Saghir

Abstract

The research conducted in this project looks at *cognitive behavioural therapy* in depth and and how it is a modern method derived from an older technique with underlying similarities. This modern therapy is used by therapists and psychologists to treat symptoms that are referred to as negative automatic thoughts (NATs), which result to many mental health conditions, two of which are obsessive compulsive disorder (OCD) and depression. The research shown in this report explains why this therapy may be beneficial and how it tries to achieve this. It requires noting down and analysing one's thoughts, becoming aware of the reasons behind their mindset as a result. The purpose of this project is to digitise a current written method for the *cognitive behavioural therapy* process, in the aim of improving its efficiency through a mobile application form, which should enhance one's ability to record and review their NATs and inadvertently improve their mental health and wellbeing.

A link to the GitHub repository for this project where a link to review the developed mobile application prototype can be found in Appendix B.

Acknowledgements

First and foremost, I would like to give thanks to my project supervisor, Julie Greensmith. Her continuous support and encouragement is highly appreciated. My family must also be recognised, without their moral guidance and dedication to my success the project would not be where it is. A special thank you to two of my close friends, one who helped me every step of the way and kept my thoughts rational, and the other who never let me lose focus from the end goal.

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1 Introduction

1.1 Background

It is human nature to be constantly thinking, processing information and the world around us; we think about things like our past, our future, our environment and the people around us all of the time, and this can occur consciously and subconsciously. Many of the the things we think about come to us automatically (therefore these occur subconsciously), and the resulting actions we perform and emotions we experience are determined by these thoughts. As stated by (Ogilvie n.d.), the causes for these thoughts are due to our deeply rooted personal belief systems and opinions which have been formed from all of the experiences we have had, and these give us meaning to all of the things we think about, ultimately determining our reality.

If this is the case, a positive or negative automatic thought can cause a same respective reaction. A Negative Automatic Thought (or 'NAT') is a subconscious thought that occurs in response to everyday events. These thoughts are irrational, self-defeating (Cuncic 2019) and have a direct negative impact on us. The problem is that we do not do anything about these thoughts, and there are many reasons for this. One reason being that we find them too difficult to explain to anyone or even ourselves, so we choose to just dismiss them. Another reason may be that we get so accustomed to them that we begin to not pay attention to them instead of dealing with them; and this is where it can become problematic as the reoccurrence of NATs is where the mental health of an individual can be affected,

leading to low moods, irritability and conditions such as anxiety[1] and depression[2] (Dictionary n.d.).

In order to combat these thoughts an established technique used by therapists is *cognitive behavioural therapy (CBT)*, which is a talking therapy that can help you manage your problems by changing the way you think and behave. It very much focuses on your present problems rather than issues from your past (NHS 2016). The affected person is asked to write down their negative thoughts and the emotions and scenarios that were associated with them. This technique is further discussed in the report (see subsection 3.1).

As one can conclude, addressing NATs is paramount in achieving healthy living and a happy state of mind. We need to make the therapy process as efficient and convenient to help achieve this.

1.2 Motivation

The supervisor for this project Julie Greensmith showcased a current written therapy process used by a psychologist which systematically asks questions to the affected person about their thoughts and emotions to help them focus on determining why they may be experiencing them.

We acknowledged that this method could be changed and improved by digitising it into a mobile application form, which would make the recording and tracking process more convenient as well as simplifying the management of their thoughts. It would also limit the potential to forget the thoughts a person experi-

[1] An uncomfortable feeling of nervousness or worry about something that is happening or might happen in the future.

[2] A mental illness in which a person is very unhappy and anxious (= worried and nervous) for long periods and cannot have a normal life during these periods.

ences as they would be more inclined to record them as and when they occur.

After conducting initial research it became apparent that myself was very interested in this subject in regards to the psychology aspect, as well as how it could benefit a lot of people in their daily lives, not to mention diagnosed mental health sufferers.

1.3 Vision

1.3.1 Aims and Objectives

Aims

The aim of this project is to design and implement a prototype for a mobile application which would transform a current, written mental health therapy technique into a digital version.

Objectives

The *key objectives* are thus:

1. Research around the subject of cognitive mental health therapy
2. Research high fidelity prototyping software/tools
3. Design a high fidelity prototype
4. Learn how to implement database within chosen prototyping tool
5. Implement a basic prototype of the application
6. Get real potential users to test the prototype and report the feedback
7. Implement necessary changes from feedback and evaluate overall project

1.3.2 Vision Statement

Recording Thoughts for Mental Health Therapy is a mobile application designed to be used by sufferers of mental health conditions (e.g. anxiety, depression, obsessive-compulsive disorder [3] (Dictionary n.d.)) whilst on the go, to make recording of Negative Automatic Thoughts (NATs) as convenient and efficient as possible. It will not target any specific age range and would significantly improve the conventional written method used for cognitive behavioural therapy. The application will also be beneficial to mental health therapists and psychologists who wish to either use it for their patients or conduct further research in digital therapy.

There are two functional parts to the thought recording process in this application:

- In-situation
- Retrospective

The 'in-situation' part is where the user is procedurally asked questions which they can answer as and when they are experiencing the negative thoughts and the scenario relating to it. This meets the requirement of efficiency and convenience. The 'retrospective' aspect to the process again procedurally asks the user questions but they have the choice of answering them when they want. This is to allow the user to go back to their thoughts and reflect/view them with better clarity.

The app[4] (techopedia n.d.[b]) will store their thoughts in chronological order along with the user's answers to the questions asked. This way, the thoughts are

[3] A mental illness that causes a person to do something repeatedly for no reason.

[4] An app is computer software, or a program, most commonly a small, specific one used for mobile devices.

recorded and organised so that the user does not forget them and makes it simple to process, analyse, reflect on them as well as edit their initial answers if needed.

1.3.3 Success Metrics

SC-1: Have 75% of users who currently use the app continue to use it after 6 months following initial release.
SC-2: Will show a 25% reduction in anxiety and depression related symptoms of diagnosed users.
SC-3: Consistent usage of app measured by 5 or more NATs recorded by user.
SC-4: Shown an average 10% increase in usage of the app by each user per month.
SC-5: A ratio of 75:25 preference of app users to conventional written therapy is achieved from a sample size of 20 users after the first month of release.

1.3.4 Risks

This mobile application will not target a specific age range but the types of users it aims to be of benefit to are current sufferers of mental health illnesses, therapists and psychologists. Furthermore, it will be an innovative product which provides a new technique for therapy, and so will be appealing to those who are not satisfied with their current therapy, whether that be an alternative tool or the treatment they are receiving from their therapist.

There are some risks involved for the types of users mentioned. Firstly, from a sufferer's perspective using the app when experiencing a Negative Automatic Thought may invoke further stress or anxiety, or worsen their symptoms in general. This could be due to reasons such as being a new user of the app and not being familiar with how it works. Another reason could be that the person con-

cerned is elderly and may not be as familiar or competent with modern technology, making this digital form of therapy obsolete for them.

Continuing on from the previous point, sufferers and therapists may not accept this new digital therapy technique and reluctant to move away from tried and trusted methods. We must expect this to be the case and account for it by developing the necessary training or tutorials for using the application. There must also be thorough product and market research conducted so that potential issues can be resolved beforehand. The research should also prove the effectiveness of digital cognitive behavioural therapy to alleviate some of these risks.

1.3.5 Assumptions and Dependencies

Assumptions for this project are things which we can assume that the user has or can do, but is not necessarily required to use the mobile application. Also, they could be things that are true to the purpose of the project.

On the other hand, dependencies are things which are mandatory for the app to run as expected.

Assumptions

AS-1: Current techniques used for cognitive behavioural therapy (i.e. written technique) could be improved.

AS-2: Users are able to control and navigate their mobile device, and perform general actions on them such as type text or select on-screen buttons.

AS-3: Users can read and understand information and answer questions as appropriate.

AS-4: Purpose of application use is related to cognitive behavioural/mental health therapy.

Dependencies

DE-1: Hardware and memory capacity of user's mobile device is adequate to run the application.

DE-2: Necessary operating system running on device on which the app will be installed.

1.4 Scope and Limitations

1.4.1 Major Features

The mobile app prototype will have the following *fundamental features*:

1. An intuitive, simplistic and appealing user interface and experience to reduce complication and allow user to focus on recording their thoughts
2. Add responses by user to questions related to their NATs
3. Record thoughts in a variety of methods, including text, audio, visually (i.e. photo/video)
4. Save thoughts for accessing, analysing and editing at a later time
5. Save date and time of thought
6. Select appropriate emotion(s) related to their thoughts and rate the strength of them
7. Allow user to rate their own belief in the thoughts they record

1.4.2 Scope of Initial Release and Subsequent Releases

Table 1 on Page 8 showcases the scope of the project. Each row correlates to a numbered feature mentioned in subsubsection 1.4.1.

Note: The term 'Thought Diary' mentioned in the table is the name given to where all the user's recorded thoughts will be located in the app.

Feature	Release 1	Release 2
1	Basic functions of app possible and UI matching initial design	Enhancements to all aspects of UI following feedback
2	Able to input text and save as user response	Edit/delete the response
3	Provide UI options for using device camera, inserting photo/video, audio recording but not fully implemented	Implement camera usage of device
4	Able to save one thought in a database which can then be viewed from Thought Diary	Save multiple thoughts and ability to edit some aspects of already saved thoughts
5	Enter date and time manually as initial step when adding a new thought, which is saved in thought diary	App saves date and time automatically when user saves the thought, initial step no longer required
6	Select emotion from options in drop down menu. Rate strength of emotion by selecting appropriate option button	Select multiple emotions
7	Be able to select option button	Improve UI

Table 1: Project Scope

1.4.3 Exclusions

The idea of this project is to provide an alternative and improved method for recording negative automatic thoughts. Exclusions would be that it should not be used as an alternative to medicinal treatments prescribed by a doctor. Furthermore, the mobile app will not cure mental health symptoms or conditions - its purpose is to improve the efficiency of *cognitive behavioural therapy* and make it more convenient. This may however in turn improve or even alleviate stress for example that may be occurring as a result of the current written method. There is potential for some symptoms or conditions of mental health sufferers to be made worse; not all symptoms will be reduced or improved.

1.5 Deployment Consideration

The initial considerations for the utilities that will be used to make the project possible were the software, technologies and platforms that would be best suited to meet the requirements and standards set out. These considerations were composed of propositions by the project supervisor, Julie Greensmith and from the author's research and initiative. They are listed below:

- Adobe XD, InVision - for high fidelity prototype
- MIT App Inventor, BuildFire, Thunkable, Appery.io - for implementation of app prototype
- Git and GitHub - technology for version control of app and final report, remote repository for back up
- LaTeX - typesetting system for write up of final report

2 Requirements Specification

2.1 Overview

This section will lay out all of the specific requirements that wil be adhered to for the final outcome of the mobile application prototype. Following the requirements classification hierarchy (altexsoft 2018), the system requirements are categorised into *functional* and *non-functional* requirements. They are listed using the terminology convention 'shall', 'should' and 'will', as per many international standards for requirement specification including ISO (ISO n.d.). They are defined below (Wheatcraft 2012):

- *Shall* - used to indicate a requirement that is contractually binding, meaning it must be implemented, and its implementation verified.
- *Will* - used to indicate a statement of fact and are not subject to verification.
- *Should* - used to indicate a goal for the product which must be addressed in its design, but is not formally verified.

These have been elicited carefully from research carried out beforehand and they form the basis of the design (see section 4), as well as the evaluation (see section 6) stages of the project where validation of the requirements was carried out to analyse the final prototype's functionality. The requirements have also been modified as necessary throughout the design and development stages. They build upon the features and scope of the app prototype discussed in subsection 1.4 and detail exactly what the system needs in order to achieve these.

2.2 Functional Requirements

2.2.1 The Home Screen

The home screen is the initial interface that the user can see when they run the app. It is intuitive, simplistic and will function as a base from which the user can access the rest of the app.

2.2.1.1 The prototype shall have a call to action to begin the process of adding a thought which will take the user to the initial stage of the therapy process.

2.2.1.2 The prototype shall have a button that navigates the user to their Thought Diary when tapped.

2.2.1.3 The prototype shall have a button that opens a user interface with guidance on the purpose of the app in regards to cognitive behavioural therapy and recording negative automatic thoughts, and how it works to meet this purpose.

2.2.2 Adding Negative Automatic Thoughts

The functionality of the user recording their thoughts in the app encompasses a lot of other, smaller functionality. Therefore, it is important to be specific with these set of requirements and incorporate as much of them in the first release as this is the gist of the project.

2.2.2.1 The prototype shall have a call to action to begin the process of adding a thought, displayed on the home screen of the app.

2.2.2.2 The prototype shall be able to record date and time manually or by tapping a button which records current date and time.

2.2.2.3 The prototype shall have a method of responding to questions throughout the therapy process by text input. Should enable user's device keyboard.

2.2.2.4 The prototype shall provide user the option to add a photo/video, voice recording or drawing to give context to their thought and emotions.

2.2.2.5 The prototype shall allow the user to select from a range of emotions.

2.2.2.6 The prototype shall have a rating system for strength of emotion and strength of the user's own belief in their responses.

2.2.2.7 The prototype shall allow the user to save their current thought and return to it another time.

2.2.3 Thought Diary

The 'Thought Diary' is the area of the app where the user's recorded thoughts are saved and can be viewed and analysed in retrospect.

2.2.3.1 The prototype shall have an icon on the home screen of the app which takes the user to their Thought Diary.

2.2.3.2 The prototype shall have a database system which saves all of the user's thoughts along with the affiliated information (i.e. date and time of thought, answers to questions, any media context added, emotions recorded etc.).

2.2.3.3 The prototype shall have a user interface for viewing thoughts in chronological order, with last thought added at the top.

2.2.3.4 The prototype shall open a new user interface when the user taps on a thought where they can review all aspects of the thought recorded.

2.2.3.5 The prototype shall allow the user to continue completing a thought from the new user interface.

2.2.3.6 The prototype shall allow the user to be able to edit any aspect of a thought as well as add more media if desired from the new user interface.

2.2.3.7 The prototype shall allow the user to save the thought after editing and/or completing the recording of it from the new user interface.

2.3 Non-Functional Requirements

2.3.1 Security

The security of the mobile app is important as it affects two major aspects: 1) The storage of user data on the database 2) Accessibility to data within the app. The data that is being transmitted and stored will be personal and private, and therefore will require protection. All of the security measures mentioned adhere to the three aspects of the *CIA* model for maintaining security, those being *Confidentiality*, *Integrity* and *Availability* (Rouse 2014).

The stored data will be protected by using a suitable and established database management system (DBMS) (techopedia n.d.[a]) so that data is not manipulated

or sabotaged, and limiting data leaks. The database will also be encrypted to maintain integrity of user data.

A user's Thought Diary will potentially contain personal and private data, so it will be detrimental if accessed or misused without authorisation and consequently be in breach of the General Data Protection Regulation (GDPR) (consulting 2018). Unauthorised access to data within the app will be prevented by providing the user with an option to set a password, which would be requested every time the app is ran.

The database will be local to where the app is stored, therefore negating security concerns such as unauthorised access to a remote server, should the app use a database accessed remotely. Having said this, these concerns should still be considered if storage of the data cannot be maintained locally in the future.

2.3.1.1 The prototype should protect stored data by using a suitable and established database management system (DBMS).

2.3.1.2 The prototype should encrypt the database to maintain integrity of user data.

2.3.1.3 The prototype should prevent unauthorised access to data within the app by providing the user with an option to set a password, which would be requested every time the app is ran.

2.3.1.4 The design of the prototype should consider security concerns regarding storage of data which cannot be maintained locally.

2.3.2 Privacy

The privacy aspect of the app concerns the ‘in-situation’ part. Again, the data the user will be entering is personal and may be sensitive, and therefore the user may be reluctant to take a video or voice recording to record their thought. This requirement will be met as they will be given the option to record their thoughts in other ways than text input; those options are not enforced by the app.

2.3.2.1 The prototype shall provide alternative options to text input for recording thoughts.

2.3.2.2 The prototype shall not enforce using the alternative methods for recording thoughts; they shall be provided as options.

2.3.3 Usability

It is vital that usage of the mobile app is simple and easy as the idea is to be able to record their NATs with as much efficiency and convenience as possible in any given scenario. This requirement will be enforced through an intuitive and minimalistic user interface, with clear and understandable text and icons. Inspiration for this methodology for usability requirements was also gained from (First 2015), whereby it is stated that there should be a ‘low perceived workload’ so that the user interface seems easy to use, rather than intimidating, demanding and frustrating. Also, that it should be simple to use the first time around without instructions.

2.3.3.1 The prototype shall have an intuitive and minimalistic user interface, with clear and understandable text and icons.

2.3.3.2 The prototype will have a low perceived workload such that the user interface seems easy to use, rather than intimidating, demanding and frustrating.

2.3.3.3 The prototype should be simple to use the first time around without instructions.

2.3.4 Supportability

There are a number of ways that supportability for the mobile app will be met. Firstly, a minimum memory capacity of 50mb will be required on the user's mobile device to install the app. Furthermore, management of the development of the app will be coordinated using a Git repository hosting service called GitHub (Finley 2012). Response time for running the app should be under 20 seconds - faster or slower depending on device hardware and operating system[5] (Hope 2018). Lastly, a general knowledge and competency in using mobile apps is required.

2.3.4.1 The prototype will require a minimum memory capacity of 50mb on the end user's mobile device for installation.

2.3.4.2 The development of the prototype shall be managed and coordinated using a Git repository hosting service called GitHub.

2.3.4.3 The prototype should have a response time of under 20 seconds dependent on the end user's hardware and operating system.

[5] A software program that enables the computer hardware to communicate and operate with the computer software.

3 Related Work

In this section *cognitive behavioural therapy (CBT)* will be explained in more detail. This is the underlying method that this project aims to digitise into a mobile app form, and so it needs to be researched and understood.

3.1 Cognitive behavioural therapy

According to (FNP 2018), CBT is a short-term therapy technique that can help people find new ways to behave by changing their thought patterns. It works on the basis that the way we think and interpret life's events affects how we behave and, ultimately, how we feel. As mentioned before, therapists and psychologists commonly use this method to work with their patients to change or improve their thought patterns get a better understanding of why they think the way they do. This technique can be used to address many psychological and in fact non-psychological symptoms too. One benefit of the app is that it will help make the user eventually less dependent on their therapist and use the app as a form of self-therapy. (FNP 2018) says, 'according to the American Psychological Association (APA), the person eventually learns to become their own therapist'.

Even though this project focuses on the recording of NATs which one aspect of the CBT procedure, there is a wide array of CBT techniques that are used which can address other mental or emotional challenges, namely coping with grief or loss, resolving relationship conflicts and overcoming trauma. There are also non-psychological issues, an example being managing chronic physical symptoms (Clinic 2019). Some researchers also reported in 2012 that an online self-help program for CBT was even beneficial for chronic back pain (FNP 2018). As one can interpret, cognitive behavioural therapy is an 'umbrella term' given to many

different therapies which share common elements and follow similar protocol.

As discussed in subsection 1.1, what we think about determines our reality and actions. This is why analysing one's thoughts and recording them is beneficial as it makes the person more aware and self-reflective of their negative interpretations, and only then can they take steps to change their perceptions and behavior. The psychological distress that a person experiences can skew their interpretations of situations, and then the person's behavioural patterns will further reinforce the distorted thinking (McLeod 2019), which is what CBT aims to confront; identifying the thoughts and when they occur can help to understand why these thoughts may be occurring and ensure that the sufferer does not get into a cycle of reoccurring negative automatic thoughts.

3.1.1 Rational Emotive Behaviour Therapy

One way that causes the distortion in one's mental representation of the world is through 'irrational thinking' as suggested by Albert Ellis in the 1950s. He proposed that each of us hold a unique set of assumptions about ourselves and our world which determine our reactions to the various situations we encounter (McLeod 2019). Changing the irrational thoughts one holds to rational ones is the underlying concept of the original cognitive behaviour therapy called *Rational Emotive Behavior Therapy (REBT)*, which Ellis developed. The way that this therapy worked was defined by what Ellis called *the ABC model*.

3.1.1.1 The ABC Model

The basic idea behind *the ABC model* is that 'external events (A) do not cause emotions (C), but beliefs (B) and, in particular, irrational beliefs (IB) do' (Sarracino et al. 2017). This model can also be referred to as *the ABCDE model* (Selva

2018), see below.

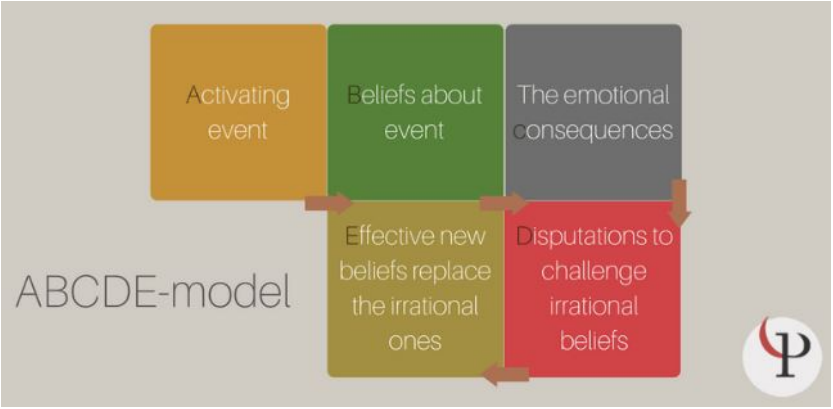


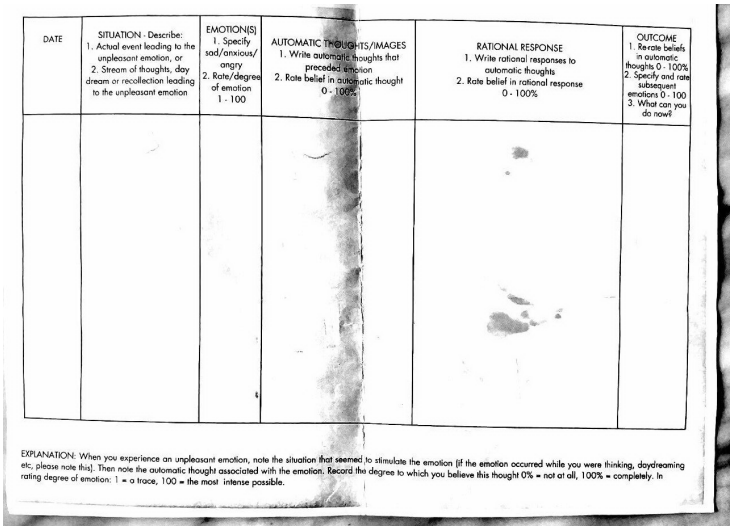
Figure 1: A flow chart for *the ABCDE model* (Selva 2018)

The visual above depicts a skeleton for the REBT process. (A) is the the event, scenario or stream of thoughts that led to the person feeling the unpleasant emotion; (B) is the rational or irrational belief that the person has as a result of (A); (C) is the emotional consequence as a result of the belief, which could be healthy or unhealthy respective to the rationality of the belief; (D) is the stage where the person identifies their irrational thought; and (E) is where the person has changed their irrational thought into a rational one and therefore should experience a healthier emotional consequence (A) occurs again (Selva 2018).

This research is presented in this report as it is the underlying methodology to how cognitive behavioural therapy is done today, and the written method that this project aims to digitise uses this technique. As discussed in subsubsection 1.3.2, the 'in-situation' part of the app refers to A, B and C of *the ABCDE model*, and the 'retrospective' part referring to D and E. This will be shown in more detail in the design stage of the report (see section 4).

4 Design

4.1 Current Written Therapy



DATE	SITUATION - Describe: 1. Actual event leading to the unpleasant emotion, or 2. Stream of thoughts, day dream or recollection leading to the unpleasant emotion	EMOTION(S) 1. Specify sad/anxious/ angry 2. Rate/degree of emotion 1 - 100	AUTOMATIC THOUGHTS/IMAGES 1. Write automatic thoughts that preceded emotion 2. Rate belief in automatic thought 0 - 100%	RATIONAL RESPONSE 1. Write rational responses to automatic thoughts 2. Rate belief in rational response 0 - 100%	OUTCOME 1. Re-rate beliefs in automatic thoughts 0 - 100% 2. Specify and rate subsequent emotions 0 - 100 3. What can you do now?

EXPLANATION: When you experience an unpleasant emotion, note the situation that seemed to stimulate the emotion [if the emotion occurred while you were thinking, daydreaming etc, please note this]. Then note the automatic thought associated with the emotion. Record the degree to which you believe this thought 0% = not at all, 100% = completely. In rating degree of emotion: 1 = a trace, 100 = the most intense possible.

Figure 2: Written CBT procedure

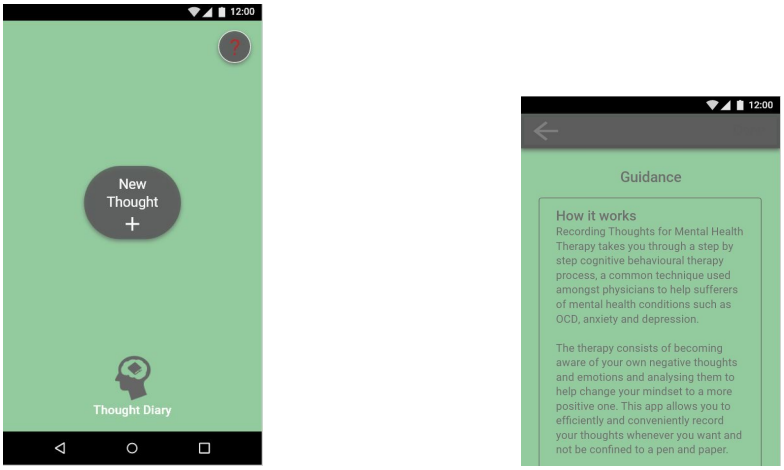
Above is an example of a written *cognitive behavioural therapy* procedure that is currently used to record NATs and treat symptoms of mental health conditions, and this is what the project aims to digitise into an app form. The design should be one that is similar to this, such that it works procedurally in asking questions to the user for the goal of changing their irrational thoughts to rational ones. This written method directly correlates with the *ABCDE* model discussed in paragraph 3.1.1.1, whereby each letter represents each stage in the therapy in the same order. This written therapy forms the basis of the design for the final app prototype, whereby the first three questions shown in Figure 2 will be reflected in the 'in-situation' part of the app, and the last two questions in the 'retrospective' part.

5 Implementation

In this section of the report the final implementation of the high fidelity prototype will be showcased along with description of the functionality that is present. It is split up into subsections which correlate with the functional parts of the thought recording process that are described in subsubsection 1.3.2, and other aspects of the application. This is so that functionality can be explained with better clarity and understanding.

It was decided that the prototype would be developed in Adobe XD due to the simplicity of the prototyping process yet having a wide array of features available. The software is updated frequently and well maintained so resources for information on the product were easily available when required. The author having a good standard of familiarity with Adobe products prior to starting the project also aided the decision.

5.1 The Home Screen



(a) Home screen (b) Guidance screen

Figure 3: Home and Guidance screens

Figure 3a above shows the user interface for the home screen of the app. As one can see, it is designed to be minimalistic, with only three possible paths that can be navigated from here. Furthermore, a simple yet appealing mint green and dark grey colour scheme has been used, and this remains consistent throughout. The main button in the centre will begin the therapy and recording of a new thought when tapped. Referring to the efficiency goal of recording NATs, this is the first screen the user sees when they open the app, making it very quick to begin recording their thought.

The icon at the bottom of the screen leads to the user's *Thought Diary* when tapped. This will be discussed later in subsection 5.4, but essentially the user can navigate to it from the home screen, and was decided when designing that this is appropriate placement for it.

The button in the top right depicting a question mark takes the user to a "guid-

ance" screen (Figure 3b) when tapped, where they can find information on the purpose of the app and how to use it. There is an arrow pointing left at the top left of the screen too which allows the user to go back to the home screen, and this button is used to perform the same function throughout the app.

5.2 In-situation

In this subsection the interfaces for the 'in-situation' part of the therapy process are shown.

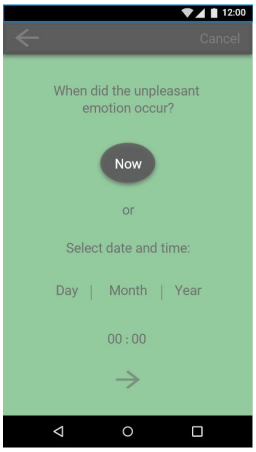
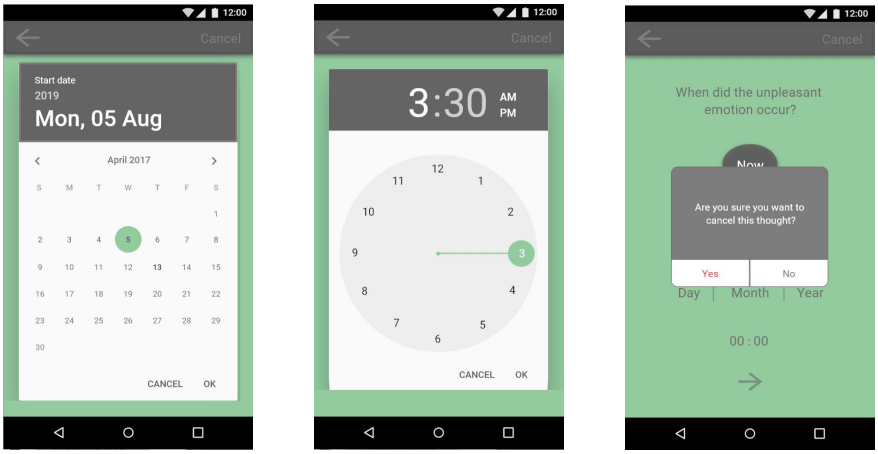


Figure 4: Recording date/time

The above figure shows the initial interface that a user sees when they begin recording a new thought. They are asked to enter the date and time of when their thought occurred which is useful information in terms of its analysis. The user is given the option to record the current date and time by tapping the 'Now' button, or they can manually enter the information should they wish to by tapping on the relevant buttons at the bottom of the interface. Also, tapping the arrow at the bottom will navigate the user to the next stage of the therapy.



(a) Selecting date (b) Selecting time (c) Prompt when tapping 'Cancel' button

Figure 5: Overlays for date/time screen

The above figure displays all of the outcomes for the functionality on the date/time screen. Figure 5a shows a calender overlay which allows the user to enter the date of their thought when they tap any of the text *day*, *month* or *year* on the screen. Figure 5b shows a clock face overlay which is displayed when the user taps on the time entry text on screen, to enable them to enter the time of their thought manually. Lastly, Figure 5c is a prompt which appears when the user taps on the 'Cancel' button, asking them to confirm that they wish to cancel recording their current thought. This is so that no entered data is lost by accidental cancellation. Tapping 'Yes' will take the user back to the home screen, whereas 'No' will keep the user on the current screen. This functionality is present throughout the app wherever the a cancel option is available.

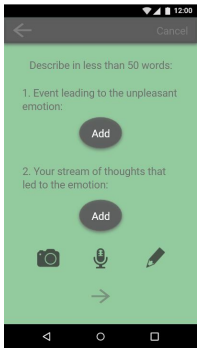


Figure 6: Question 1 and 2

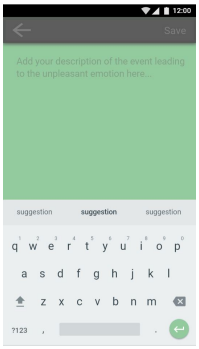
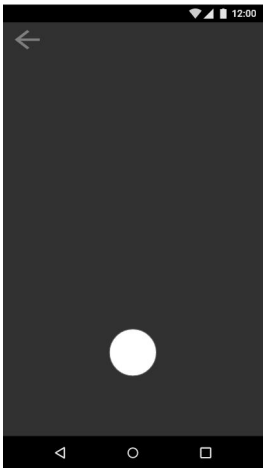


Figure 7: Adding description screen

On the left above can be seen the first couple of questions that the user is asked in the therapy process. This correlates with the first stage of the current written therapy shown in subsection 4.1. Both questions asked require the user to record a description, one of the event that led to experiencing the NAT and one of the stream of thoughts that the user was having beforehand. The user is able to provide these descriptions by tapping the corresponding 'Add' button which takes them to another interface shown in Figure 7. Additionally, the user is able to add context to their thought should they wish to by tapping the intuitive icons at the bottom. The camera icon when tapped opens their device's camera for taking photos/videos, the microphone icon is for taking an audio recording and the pencil icon opens a digital drawing pad. Currently, there is no element to the prototype showing how the audio recording functionality would happen, but the other two forms of media will be shown on Page 26.

Figure 7 shows the interface which allows the user to input their descriptions (a separate interface with the same layout opens for both question 1 and 2). The user can tap on the text input area which brings up a keyboard to enter their description. Tapping the 'Save' button in the top left records their input and takes them back to the previous screen.

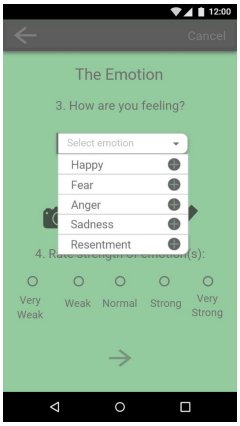


(a) Camera screen

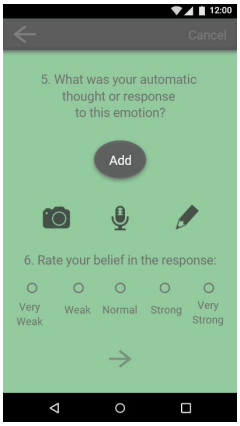
(b) Drawing pad screen

Figure 8: Adding media context to thought

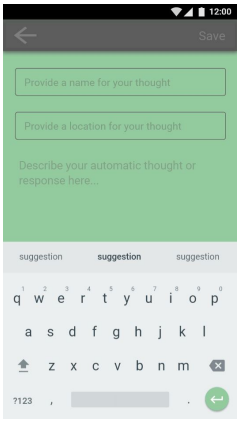
Figure 8a shows a conventional camera screen interface which is what the user will see when they tap the camera icon in the app. From here they will be able to take photos and videos. Figure 8b shows a drawing pad interface which the user will be able to digitally draw on and save the result as context to their thought.



(a) Question 3 and 4



(b) Question 5 and 6



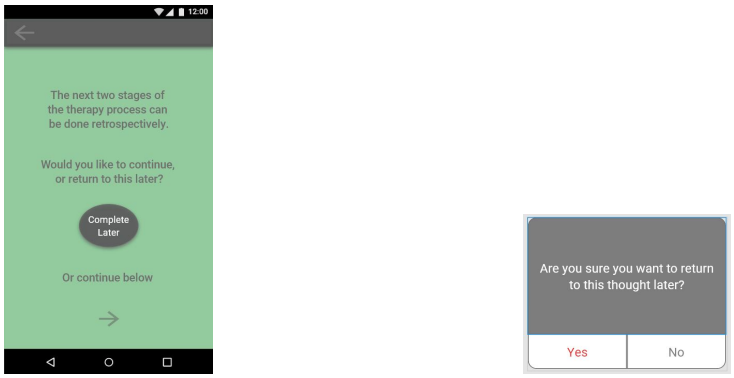
(c) Recording NATs

Figure 9: Questions related to emotions and subsequent thoughts

The following two screens in the therapy process ask questions about the actual emotion(s) that the user has experienced and the negative automatic thought(s) that have occurred as a result. As one can see from Figure 9a, the user is asked to select to record their emotion(s), and the functionality used is a drop down menu from which they can select as many as they wish. Furthermore, they are asked to rate how strongly they felt the emotion using a rating system where they select the relevant radio button.

In Figure 9b, the user is asked to record the automatic thought that they experienced as a result of the emotion. They are also then asked to rate their personal belief in the thought i.e. rate how strongly they believe in it.

Figure 9c is the interface displayed when the user taps the 'Add' button for inputting the actual thought. Not only can they add their description here but there is functionality for providing a name and location for the thought, and this is for the purpose of identification of thoughts in the *Thought Diary*. Once again, when the user taps to enter the text the keyboard is displayed.



(a) Screen for option to continue or not with therapy

(b) Prompt overlay

Figure 10: User asked to continue or postpone therapy

The next screen asks the user whether they would like to continue on with the therapy and recording their thought or return to it later, as shown in Figure 10a. This marks the end of the 'in-situation' part and the following questions can be answered in the user's own time. Tapping the 'Complete Later' button will prompt the overlay shown in Figure 10b asking the if they are sure about their decision; if they are the thought will be saved and the app will navigate to the home screen. Tapping 'No' to the overlay will keep the user on the current screen from where they can continue by tapping the arrow at the bottom.

5.3 Retrospective

At this stage of the therapy questions that are asked enable the user to reflect on their negative thoughts and emotions and detail rationally how they felt, making better sense of their mindset. These questions correspond with stages 'D' and 'E' of the *ABCDE* model as discussed in paragraph 3.1.1.1.

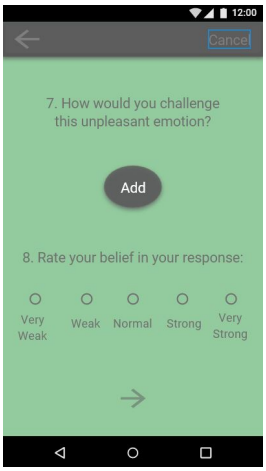


Figure 11: Question 7 and 8

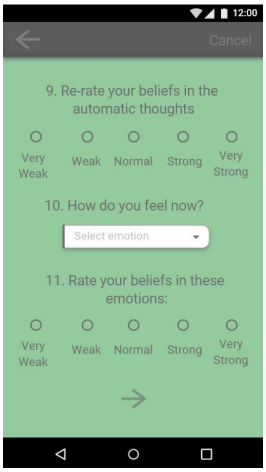


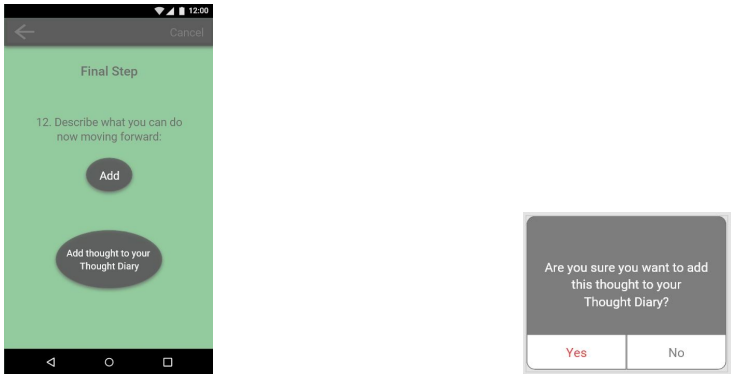
Figure 12: Question 9, 10 and 11

Question 7 asks the user to state how they would challenge the negative emo-

tion rationally in hindsight. In the same fashion, the user can add their response via the ‘Add’ button which opens a new interface. Question 8 asks to again rate the user’s strength in belief of their new rational response.

Figure 12 shows question 9 which asks the user to re-rate their belief in the negative automatic thought(s) they experienced now that they can view it with better clarity. Question 10 asks them to record the emotions they feel now and then 11 rating their the strength of their belief in these current emotions.

We are now on the final step of the thought recording and therapy process. Figure 13a shows that Question 12 asks the user to add a description of how they plan to do things differently now after questioning their thoughts and emotions. The idea is to adapt their mindset so that when they experience a similar thought or situation that they can better deal with the negativity and overcome it quicker.



(a) Final step

(b) Confirmation to add thought overlay

Figure 13: Final step of therapy and saving completed thought

When the user taps the ‘Add thought to your Thought Diary button’ a check is made to confirm that they wish to complete the therapy and save the thought (Figure 13b). If they tapped ‘Yes’ to this, the thought will get saved and the app will navigate to their *Thought Diary* for convenience.

5.4 Thought Diary

This section refers to the saving of the user's thoughts in one central location in the app so that they are able to review, edit and analyse them, as well as complete unfinished ones. This functionality is achieved by the *Thought Diary*.

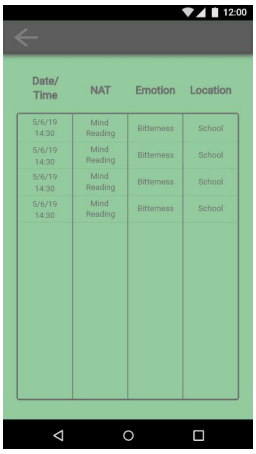
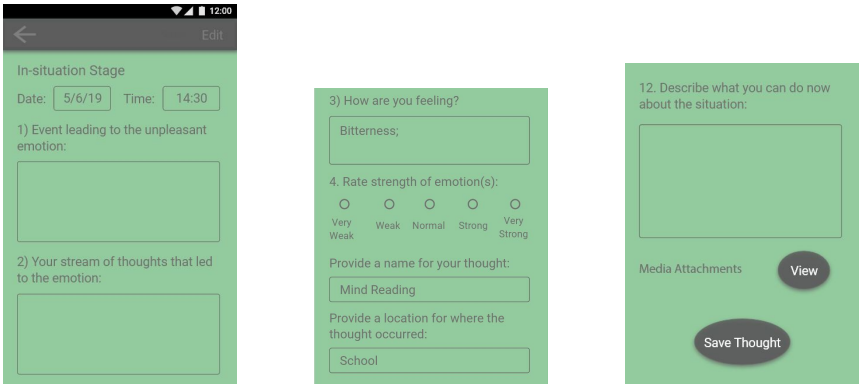


Figure 14: Thought Diary

This is a database of all of the user's thoughts that they have recorded, and they are abstracted such that only the key information about the thoughts is available here - Date/Time of thought, the name the user gave to the thought, the first emotion they associated to it and the location. This is all information that will easily remind the user of the thought. They are able to tap on any thought in the log to review it.

Figure 15 on Page 31 presents the reviewing interface when the user taps on a thought in the *Thought Diary*. Here, they will be able to view all of the answers they provided during the therapy process in one area. They are able to edit the thought by tapping the 'Edit' button shown in Figure 15a. They can also view any media they added such as photos and drawings, as well as save the thought if they have edited any parts. (Figure 15c).



(a) (b) (c)

Figure 15: Reviewing thoughts

6 Evaluation

In this section an evaluation of the project outcome will be validated using two methods: 1) A 'usability' questionnaire 2) A requirements validation, where the final prototype developed will be validated against the *functional* and *non-functional* requirements laid out in section 2. There are a few requirements left out due to unnecessary duplication of proof of validation. Also, the questionnaire was used to validate some of the *non-functional* requirements as they are difficult to measure from just the prototype itself.

6.1 Usability Questionnaire

This usability questionnaire was carried out to establish a general consensus of the initial user experience of using the app. This was created by the author before conducting the validation so that some initial feedback was gained before it could be documented in the *Requirements Validation* table (Table 2). The sample size of

people who undertook the questionnaire was five - two people were mental health sufferers and three were not, with the age range between 10 and 50. They were given the opportunity to use the app to its current potential and explore all aspects and features. The questionnaire can be found in Appendix A. Here were the key findings:

Firstly, all participants gave high ratings for how intuitive the prototype and as a result its ease of use. Everybody was easily able to add a thought with their first use without using the guidance, with comments saying the minimalism of the app made it easier to use and more enjoyable. High ratings were also given for the understanding of text and icons, with positive comments made on clarity of assets used and three out of five participants mentioning that the that the colour scheme used was calming, making it ideal for the target user of the app. The participants who had mental health conditions claimed the process of the therapy was clear and simple which made it less demanding and intimidating.

Four out of five of the participants stated they would prefer some sort of password protection, either on viewing their thoughts or the app itself. The main reasons given were that thoughts and emotions can be very personal and so a method of keeping them private would be well received.

The most popular aspects of the prototype were the colour scheme and the speed of usage, with three out of five participants including these in their answer to their favourite part of the app. There were not any disliked aspects, only suggested improvements such as ability to add media that already exists on the user's device and to implement the voice recording feature of the app, with no suggested alternatives on method of recording thoughts. The emotional response to using the app was also generally positive, with four out of five participants answering

that they felt calm and positive throughout their experience.

6.1.1 Summary

The UI and UX received very positive feedback with not many suggestions for improvement, from all participants. The minimalistic UI as well as the simplicity and clarity of the app is something that will be continued and maintained in future releases. The feedback on the security question is evident that it is something that is of priority to the sample of participants of the questionnaire. Therefore, there will be more focus on security during the next design phase as a whole before the second release of the prototype, and steps towards a password protection feature as well as database security and encryption will be made. There were no suggestions for alternative methods of recording thoughts to the ones currently available, but was emphasised to definitely include a voice recording feature, as well as the ability to add existing media from the user's device to their thought in the app. These features will be focused on before the app's next release. To finish with, another questionnaire will be carried out after improvements have been implemented but with a larger sample size of participants and set of questions asked.

6.2 Requirements Validation

Note: F/NF = Functional/Non-Functional P/F = Passed/Failed

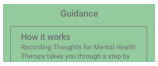
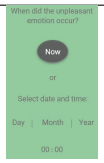
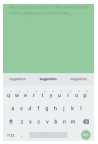
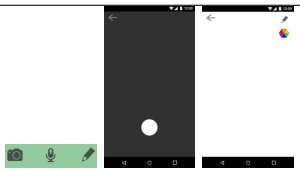
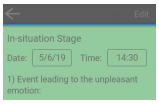
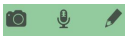
Requirement	F/NF	P/F	Evidence/Solution
2.2.1.1 The prototype shall have a call to action to begin the process of adding a thought which will take the user to the initial stage of the therapy process.	F	P	
2.2.1.2 The prototype shall have a button that navigates the user to their Thought Diary when tapped.	F	P	
2.2.1.3 The prototype shall have a button that opens a user interface with guidance on the purpose of the app in regards to cognitive behavioural therapy and recording negative automatic thoughts, and how it works to meet this purpose.	F	P	 
2.2.2.2 The prototype shall be able to record date and time manually or by tapping a button which records current date and time.	F	P	 UI completed but not functional
2.2.2.3 The prototype shall have a method of responding to questions throughout the therapy process by text input. Should enable user's device keyboard.	F	P	
2.2.2.4 The prototype shall provide user the option to add a photo/video, voice recording or drawing to give context to their thought and emotions.	F	F	 Voice recording icon completed but not functional

Table 2: Requirements Validation

2.2.2.5 The prototype shall allow the user to select from a range of emotions.	F	P	
2.2.2.6 The prototype shall have a rating system for strength of emotion and strength of the user's own belief in their responses.	F	P	
2.2.2.7 The prototype shall allow the user to save their current thought and return to it another time.	F	F	 UI implemented but not functional
2.2.3.2 The prototype shall have a database system which saves all of the user's thoughts along with the affiliated information (i.e. date and time of thought, answers to questions, any media context added, emotions recorded etc.).	F	F	 UI implemented but not functional
2.2.3.3 The prototype shall have a user interface for viewing thoughts in chronological order, with last thought added at the top.	F	F	Currently can view thoughts but no implementation of chronological order yet.
2.2.3.4 The prototype shall open a new user interface when the user taps on a thought where they can review all aspects of the thought recorded.	F	P	
2.2.3.6 The prototype shall allow the user to be able to edit any aspect of a thought as well as add more media if desired from the new user interface.	F	F	 Can edit thought but currently can only view already added media, cannot add more.
2.2.3.7 The prototype shall allow the user to save the thought after editing and/or completing the recording of it from the new user interface.	F	P	 UI implemented but not functional

2.3.1.1 The prototype should protect stored data by using a suitable and established database management system (DBMS).	NF	F	Only UI created for database, no DBMS utilised
2.3.1.2 The prototype should encrypt the database to maintain integrity of user data.	NF	F	No encryption implemented
2.3.1.3 The prototype should prevent unauthorised access to data within the app by providing the user with an option to set a password, which would be requested every time the app is ran.	NF	F	No functionality developed for setting a password
2.3.1.4 The design of the prototype should consider security concerns regarding storage of data which cannot be maintained locally.	NF	F	Additions will be made to design to accommodate this in release 2
2.3.2.1 The prototype shall provide alternative options to text input for recording thoughts.	NF	P	
2.3.2.2 The prototype shall not enforce using the alternative methods for recording thoughts; they shall be provided as options.	NF	P	Text input option is always encouraged first, but the alternative options are available too
2.3.3.1 The prototype shall have an intuitive and minimalistic user interface, with clear and understandable text and icons.	NF	P	Simple and consistent colour scheme used, legible text, clear and intuitive UI
2.3.3.2 The prototype will have a low perceived workload such that the user interface seems easy to use, rather than intimidating, demanding and frustrating.	NF	P	No negative feedback from usability questionnaire regarding this
2.3.3.3 The prototype should be simple to use the first time around without instructions.	NF	P	Tests carried out for first time usage without instructions. No negative feedback

2.3.4.1 The prototype will require a minimum memory capacity of 50mb on the end user's mobile device for installation.	NF	P	Not deployed for mobile devices yet so memory capacity requirement unknown
2.3.4.2 The development of the prototype shall be managed and coordinated using a Git repository hosting service called GitHub.	NF	P	A Git repository on GitHub was used to manage, back up and version control the prototype
2.3.4.3 The prototype should have a response time of under 20 seconds dependent on the end user's hardware and operating system.	NF	F	Prototype is not ready for deployment on a mobile device, therefore this requirement cannot be validated

7 Summary and Reflections

7.1 Project Management

Project management could have been conducted better considering the time frame of eight months for the project. Having said that, there were modifications made which resulted in loss of time which meant that the project was not under way till quite far into the allocated time frame. As a result, a fully functioning implementation of the app was not possible. To improve upon this, a project plan should have been introduced so that interim deadlines and milestones could be better visualised which ensured better productivity and progress. The GitHub repository benefited the project management greatly with it being used throughout for back up and coordination of the main project files and this report itself.

7.2 Future Considerations

Further research into the benefits of this digitised adaptation of the *cognitive behavioural therapy* process over the written method would be beneficial, as this would convince therapists and other physicians to trial the product for their own research and endorse it to their patients. This would eventually be more widely accepted as a trusted method of therapy and so more sufferers of mental health conditions will be likely to use it, potentially enabling them to take better charge of their mental health as the therapy is so easily available.

7.3 Personal Development

The author has improved technically by learning how to use namely the Adobe XD prototyping software, which will definitely be a top consideration for future projects. As well as this learning to write documents in LaTeX has been enjoyable and is a highly beneficial skill to have. The author's ability to design has been enhanced greatly which is useful for all types of projects. Knowledge has been gained in *cognitive behavioural therapy* and mental health in general which has been enjoyable as it was a subject of high interest prior to starting the project. Most notably however, it has taught me how to push through adverse circumstances and break tasks down into smaller chunks to achieve the overall goal.

7.4 Conclusion

Recording Thoughts for Mental Health Therapy has all in all been a successful project. Although the final prototype of the mobile application did not meet all of the requirements specification, it demonstrates all of the functionality to a high quality standard.

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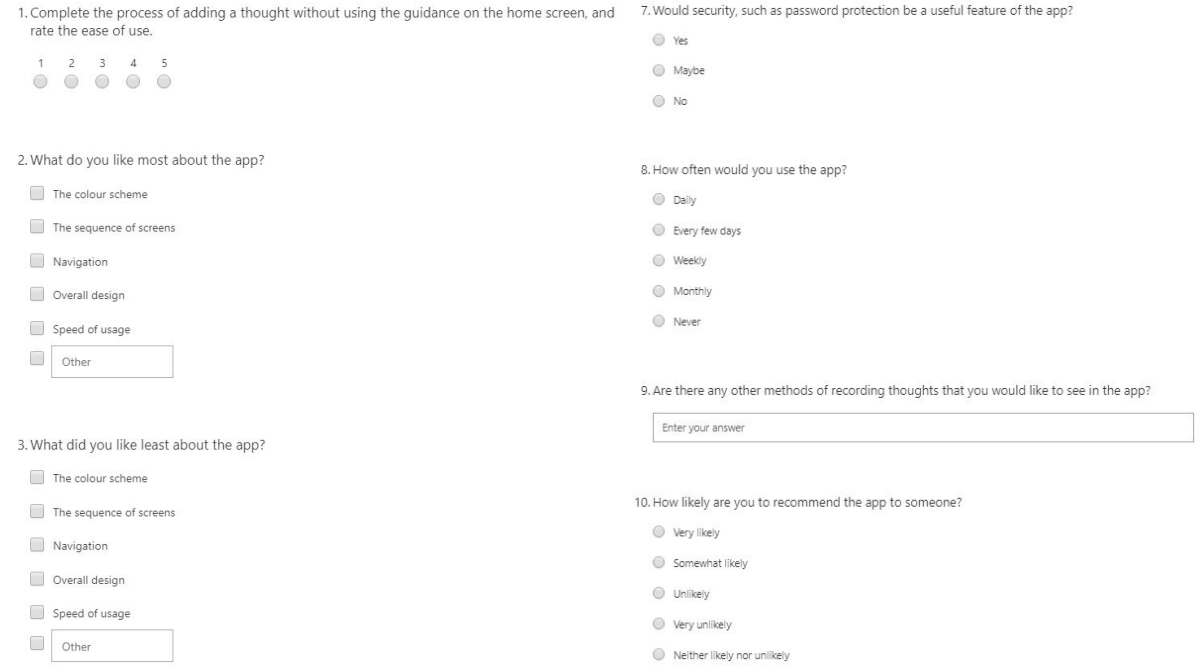
A Usability Questionnaire



1. Complete the process of adding a thought without using the guidance on the home screen, and rate the ease of use.

1 2 3 4 5

2. What do you like most about the app?

- The colour scheme
- The sequence of screens
- Navigation
- Overall design
- Speed of usage
- Other

3. What did you like least about the app?

- The colour scheme
- The sequence of screens
- Navigation
- Overall design
- Speed of usage
- Other

4. How intuitive was the app?

1 2 3 4 5

5. How do you feel emotionally when using the app?

- Positive
- Negative
- Frustrated
- Stressed
- Anxious
- Calm
- Other

6. Are the text and icons used clear and understandable?

- Yes
- In the middle
- No

7. Would security, such as password protection be a useful feature of the app?

- Yes
- Maybe
- No

8. How often would you use the app?

- Daily
- Every few days
- Weekly
- Monthly
- Never

9. Are there any other methods of recording thoughts that you would like to see in the app?

Enter your answer

10. How likely are you to recommend the app to someone?

- Very likely
- Somewhat likely
- Unlikely
- Very unlikely
- Neither likely nor unlikely

B GitHub Project Repository

https://github.com/Umaarr/g53ids_dissertation.git