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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:

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Recording Thoughts for Mental Health Therapy

Umar Saghir

Abstract

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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 and compare alternative mental health therapy digital applications
3. Research high fidelity prototyping software/tools
4. Design low and high fidelity prototypes
5. Learn how to implement database within chosen prototyping tool
6. Implement a basic prototype of the application
7. Get real potential users to test the prototype and report the feedback
8. 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.) and IEEE (IEEE 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.

2.3.4.4 The prototype will require a general knowledge and competency in using mobile applications.

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. Additionally, this section will look into alternative mental health/cognitive behavioural therapy apps that are currently out there, analysing how they help the user and discussing inspiration that can be taken from these for this project.

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.

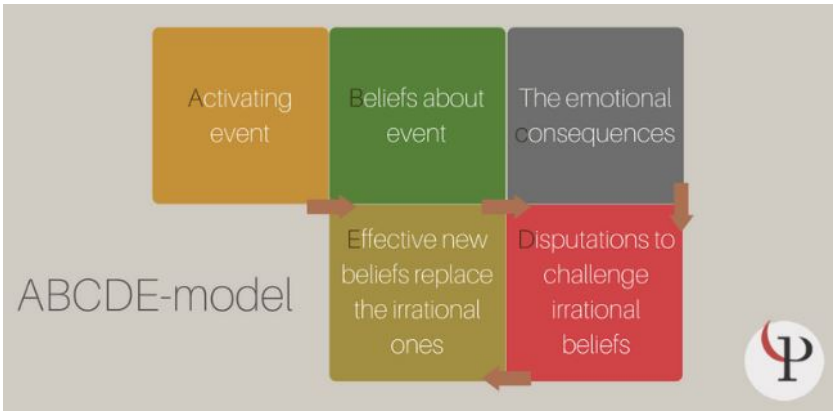

Figure 1: A flow chart for *the ABCDE model* (Selva 2018)

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

4.2 Low Fidelity Prototype

4.3 High Fidelity Prototype

5 Implementation

6 Evaluation

7 Summary and Reflections

8 Bibliography

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A Appendices