

REFOCUS: AN iPhone APPLICATION TO ENHANCE  
COGNITIVE BEHAVIOR THERAPY  
FOR DEPRESSION

by

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## CHAPTER I

### Introduction

The debilitating condition that is today known as depression has been clinically recognized for over 2,000 years, yet it is still not fully understood (Beck, 1970). Referred to in the past by many other names, including “melancholia,” or “the blues,” depression is currently one of the major health problems facing the world. Nearly half of those suffering from depression do not seek treatment, likely because they do not understand they have an illness, they fear judgment, or they do not have adequate financial resources or health insurance (World Health Organization, [WHO], 2012).

It is widely argued that the American health care system’s treatment of mental illness could be improved. On June 3<sup>rd</sup>, 2013, The White House held its first Conference on Mental Health in fourteen years, where President Barack Obama described how the Affordable Care Act would expand mental health care to sixty million Americans (National Institute for Mental Health [NIMH], 2013). The director of the NIMH, Thomas Insel feels the conference should merely be a first step in the changes needed for American mental health care, noting that much has changed since the previous conference, including the advances in mobile technology that now give it the potential to change behaviors (NIMH, 2013).

Indeed, today’s technology offers many options for social change according to Jon Kolko, the founder and director of the Austin Center for Design and author of *Thoughts on Interaction Design* (2011), who asserts that designers are the people uniquely suited to combine the creativity and engineering needed to make the changes happen (Kolko, 2011). By employing a specific area of design, referred to as interaction

design (ID), which draws heavily from psychology and focuses on human behavior, new and improved tools can be developed for the rapidly growing number of people who experience depression.

### **Thesis Organization**

This thesis is organized into six chapters. This chapter provides the description, diagnostic criteria, treatments, and global impact of depression as a mental illness. Cognitive behavior therapy (CBT) is suggested as the leading form of psychotherapeutic treatment for depression and its process is explained. Additionally, the various design terms that will apply throughout the thesis are presented and defined, including interaction design, user experience design, user interface design and gamification. The second chapter focuses on preliminary research into CBT's ability to treat specific aspects of depression when presented in various formats, such as the traditional written format versus computerized, web-based, or mobile versions. Chapter three presents the statement of the problem being suggested in this thesis as well as the hypothesis proposed. In chapter four, a detailed account of the methods used to solve the research problem will be documented with a thorough explanation of design possibilities being explored and techniques employed to create a design solution. Chapter five offers the results of user testing in the design artifact and chapter six presents conclusions and future research.

### **What is Depression?**

Depression is a serious mental illness that affects people of all ages, races, genders, and socioeconomic statuses around the world. According to the World Health Organization (2012), an estimated 350 million people worldwide are currently affected,

with approximately one in 20 people experiencing an episode in the last year. In the United States, the prevalence of major depressive disorder among 18-29 year olds is three times higher than people aged 60 years and older (American Psychiatric Association [APA], 2013). Females experience depression at a rate 1.5-to-3 times higher than males (APA, 2013).

Depression is known to interfere with physical and mental functioning, with episodes that are often long-lasting and recurring. These issues make depression the leading cause of disability for men and women worldwide and the leading source of disease burden for women across all income levels, according to a 2008 study on global disease burden by the World Health Organization (WHO, 2008).

Perhaps the gravest health risk associated with depression is suicide. Each year, nearly 1 million people worldwide commit suicide, meaning that each day, about 3,000 people take their own lives while 60,000 more attempt to do so (WHO, 2012).

Depression is more than sadness. It is normal for people to feel sad from time to time. Sadness is a negative, but healthy, emotion. However, feeling sad most of the day for a period of several weeks is more than an emotion, it is a long-lasting *mood* that is neither healthy, nor productive. In *The Feeling Good Handbook* (1999), psychologist David D. Burns, M.D. points out some ways to differentiate depression from healthy sadness:

- “Depression involves a loss of self-esteem.
- Depression goes on and on.
- People who are depressed may not function productively.
- Depression is not realistic, and always results from distorted thoughts.



- Depression is an illness.
- Depression feels hopeless, even though the prognosis is excellent.” (p. 39).

It is still unknown if there are definitive causes of depression, but there are multiple factors that play a role, including genetics, biology, environment, and psychology (National Alliance on Mental Illness [NAMI], n.d.). A chemical imbalance may be to blame, but this has not yet been proven (NAMI, n.d.). Regardless, the illness is one of the brain, and therefore it is often labeled an “invisible illness” since depressed individuals may not “look sick” to those around them. As with seizure disorders, chronic pain, fibromyalgia, posttraumatic stress disorder (PTSD), and other “invisible illnesses,” the lack of visual indications of disease make the condition no less disabling (Davis, 2005).

### **Diagnostic Criteria**

According to the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> Edition (DSM-5), regarded as the authority on diagnostic criteria for mental health, the condition typically referred to as depression could actually be one of several mood disorders, including major depressive disorder, dysthymia, premenstrual dysphoric disorder, and substance/medication-induced depressive disorder among others. For the purposes of this thesis, “depression” will refer to major depressive disorder because it represents the classic characteristics of this group of conditions (APA, 2013).

The DSM-5 (APA, 2013, pp. 160-161) provides the following diagnostic criteria for major depressive disorder:

- A. Five or more of the following symptoms must have been present during a two-week period and represent a change from previous functioning; at

least one of the symptoms is either (1) depressed mood, or (2) loss of interest or pleasure.

1. Depressed mood most of the day, nearly every day, as indicated by either subjective report or observation made by others.
2. Marked diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day.
3. Significant weight loss when not dieting or weight gain, or decrease or increase in appetite nearly every day.
4. Insomnia or hypersomnia nearly every day.
5. Psychomotor agitation or retardation nearly every day
6. Fatigue or loss of energy nearly every day.
7. Feelings of worthlessness or excessive or inappropriate guilt nearly every day.
8. Diminished ability to think or concentrate, or indecisiveness, nearly every day.
9. Recurrent thoughts of death, recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

C. The episode is not attributable to the physiological effects of a substance or to another medical condition.

D. The occurrence of the major depressive episode is not better explained by schizoaffective disorder, schizophrenia, schizophreniform disorder, delusional disorder, or other specified and unspecified schizophrenia spectrum and other psychotic disorders.

E. There has never been a manic episode or a hypomanic episode

This research will be primarily concerned with the symptoms associated with diagnostic criterion A-8, as they are the most suitable to the incorporation of interaction design principles, including gamification for enhancement of existing treatment methods. Rooted in the psychology of memory and the brain's capacity for focusing on and retaining information, this type of design lends itself well to these particular problems (Johnson, 2010).

### **Current Treatments**

Just as there are many ways that depression presents itself, there are also many ways to treat it. Currently, the preferred treatment method consists of a combination of psychotherapy and antidepressant medication, as these have provided the most consistently successful results (WHO, 2012). The National Alliance on Mental Illness (NAMI, n.d.) names two main types of psychotherapy for treating depression. These are cognitive behavioral therapy (CBT) and interpersonal therapy (IPT). Patients undergoing CBT therapy learn to counteract their negative thoughts through the use of written exercises completed in and out of therapy sessions, in order to interpret personal and environmental interactions more positively. IPT patients work one-on-one with a therapist to understand troubling events and relationships that may be worsening their depression, typically through conversational techniques (NAMI, n.d.). For the purposes

of this research, CBT will be the focus due to its standardized methods and step-by-step process for thought restructuring that are amenable to graphic and interactive design applications.

As noted earlier by Burns (1999), and supported by many experts in the medical and mental health fields, the prognosis for depression is excellent if treatment is sought (Burns, 1999; NIMH, n.d.). Theoretically, anyone can fight depression with the proper treatment, however this typically means seeking help while a person is mentally and emotionally strong enough to do so (Solomon, 2001). More efficient methods that make seeking help as easy as possible for depressed individuals are needed.

### **Societal Implications**

It is possible that a number as high as 16.6% of American adults alive today will experience depression at some point in their lifetimes (Kessler et al., 2005). While there are many effective treatments for depression, most of the people in need never receive it. According to the World Health Organization (2012), the number of people seeking treatment for depression is less than 50% worldwide, fewer than 30% in most regions, and less than 10% in some countries. Barriers to care include a lack of resources, a lack of providers, and the social stigma associated with mental illness (WHO, 2012). As more diagnostic tools become available, awareness grows and stigma declines, we are likely to see the prevalence of depression rise, rather than decrease.

Most of the currently available treatment options for depression rely on the depressed person to seek them out, which can be problematic for someone who has difficulty functioning productively. New delivery systems should be designed that remove as many obstacles to attainment as possible. Ideally, a tool that is readily

available in everyday life would eliminate a person's need to search for it. Therefore, because mobile phones are now commonplace in Western society, this research will include the design of a mobile application that aims to enhance an existing treatment method for depression.

### **CBT as Treatment for Depression**

Studies have found that CBT is as effective, or is more effective, at treating depression than antidepressants alone in the context of self-reporting by patients (Antonuccio, 1995) and there are distinct reasons why this method of psychotherapy is a popular and successful one. For instance, the word "cognitive" comes from "cognition," meaning thought. CBT is based on the idea, pioneered by psychologist Aaron T. Beck in the 1960s, that it is your own thoughts that create your negative moods, rather than external events (Beck, 1967). Such an idea can be very empowering to a depressed person who may be feeling helpless and/or hopeless. In addition, many of the principles of CBT are practical, rooted in common sense, so they are amenable to the therapist and patient. A further attractive feature of this method is how quickly and successfully the treatment tends to work (Burns, 1999).

Patients tend to believe they do not have control over their own moods; rather, they tend to see their moods as due to external factors. CBT can help the patient to see this is not the case (Burns, 1999). As previously discussed, moods result from thoughts (cognitions) and sometimes thoughts may be distorted, particularly for those suffering depression. Depressed individuals tend to view and remember experiences with a negative outlook in contrast to non-depressed individuals who tend toward a positive outlook (Greenberger, 1995). For example, if a depressed person completed three out of

five items on a daily to-do list, he or she may think, “I didn’t get anything done today. I never do anything right. I am a total failure!” CBT can help to restructure this type of negative, distorted thinking to a more realistic and functional way of thinking.

### **The CBT Process**

This thesis will refer to the CBT exercises explained in Burns’ *The Feeling Good Handbook* (1999). Burns provides lists of ten common forms of distorted thinking and ten ways to rationally respond to your distorted thinking, as well as four steps to analyze negative thoughts and/or moods. This process, which will be the basis for the design portion of this research, is outlined as follows:

### **Ten Forms of Twisted Thinking (Distorted Thoughts)**

The first step in changing your negative thinking patterns, according to Burns, is to understand the common ways that the depressed mind distorts thoughts. He offers ten types of “twisted thinking” (Table A1) with a description and examples of each. Some examples from this list include: Overgeneralization, Jumping to Conclusions, and Emotional Reasoning. If an individual is “overgeneralizing” an upsetting event or situation according to Burns, it means he tends to view things as an unending pattern of defeat. This outlook only produces more negative thoughts. If a person is upset about something and pauses to think about why they are truly upset, s/he may find that s/he is “jumping to conclusions” if s/he is making assumptions about that which is upsetting her or him. Similarly, in the case of Emotional Reasoning, a depressed person often convinces herself/himself that if things *feel* bad, then they must actually be bad (1999). It is important for the CBT patient to read and comprehend this list before and during the

thought-restructuring exercises that follow. The hope is that with practice, s/he will commit them to memory and draw from them as needed when upsetting situations arise.

#### **Four Steps to Change the Way You Feel**

The first step to changing the way you feel when upset, according to Burns' process is to write down the upsetting event (Table A3). It helps to be specific, noting times, places, and people involved, rather than just writing something vague or general such as "I feel sad." The second step asks the patient to record negative feelings and give each one an intensity rating on a scale from zero (least) to 100 (most). Feelings can be recorded using one word, such as "sad," "anxious," or "hopeless" (1999). In Step 3, the patient is asked to record any negative thoughts that come to mind when recalling this negative event, and to write them down in an unfiltered fashion. Step 4 asks the patient to refer to the list of Ten Types of Twisted Thinking (Table A1) in order to identify the distortions in those negative thoughts s/he has just recorded. Once the distortions have identified, s/he can view the list of Ten Ways to Untwist Thinking (Table A2) provided by Burns, and try to find some rational responses to those negative thoughts. Finally, in Step 4, the patient can now review everything s/he has recorded about this particular upsetting event, and re-rate her or his thoughts and feelings (Table A3). The exercise ends with the patient checking off a box to determine how much, if at all, her or his mood has changed since s/he began the exercise (1999).

#### **Homework**

The standard method for learning CBT techniques in psychotherapy is through assignments given to the patient by the therapist, usually in a written format to be completed between sessions. As in a typical educational setting, these assignments are

collectively referred to as “homework.” Beck stressed the necessity of homework in CBT because it helps make the principles more concrete while augmenting the communication between patient and therapist (Beck, 1979).

While homework is an easily completed task for some patients, it is more problematic for others, particularly depressed individuals experiencing limited motivation, low-self esteem, and decreased cognitive and physical functioning. There are some things therapists can do to safeguard against these symptoms when assigning homework, such as:

- “Err on the side of devising assignments that are too easy rather than too hard.
- Provide a rationale as to how and why the assignment might help.
- Set homework collaboratively; seek the patient’s input and agreement.
- Make homework a no-lose proposition.
- Begin the assignment (when possible) in session.
- Help set up systems for remembering to do the assignment.
- Anticipate possible problems; do covert rehearsal when indicated.
- Prepare for a possible negative outcome (when applicable)” (J. S. Beck, 2011, p. 299).

The importance of CBT homework cannot be dismissed, as it serves to reinforce the more realistic and effective ways of thinking and behaving that patients are learning. Beck’s (1979) research found that those who carried out their homework assignments were more successful in their treatment of depression than those who did not (Beck, 1979). Kazantzis and colleagues supported his findings over thirty years later in a meta-



analysis of CBT studies, which concluded that CBT that includes homework produces better therapeutic results than CBT without homework (2010).

### **Mobile Self-Management**

Beck's homework strategies and Burns' CBT process are reading and writing intensive and they assume regular face-to-face feedback and direction from a clinician. By incorporating the same techniques and language, but shifting to a perspective of self-managed care, depressed individuals could make use of mobile technology and empower themselves to create meaningful change (Dubberly, et al., 2010). With an estimated 1.75-billion smartphone users worldwide in 2014 (eMarketer, 2014), the application of mobile interactivity to CBT homework makes sense economically and as a way to reach more people. There are several characteristics of a mobile phone that make it a suitable delivery method for self-managed CBT, some of which are:

- Portability
- Widespread acceptability
- Low maintenance cost
- Always on
- Internet connectivity
- Programmability
- Audio and video output
- Keypad and audio input
- User-friendliness and ease of use (Boschen & Casey, 2008)

If a patient were able to keep their CBT homework on their phone, rather than having to carry a book with them at all times, it would open up more possibilities for

recording thoughts and feelings as they arise. Further, the ability to document with images and videos, instead of just text may help the user learn and retain content better (Weinschenk, 2011).

### **Design Terminology**

The creation of an interactive delivery method for CBT would incorporate many areas of the discipline referred to broadly as “design,” particularly those that hold value for a product intended to change behavior and engage its user on an intimately personal level. The primary areas of design employed in this research are included here, and share a common foundation in cognitive psychology (Kolko, 2011), making them uniquely suited to a mobile application of CBT.

### **Interaction Design**

Jon Kolko (2011) calls interaction design “the creation of a dialogue between a person and a product, service, or system” (Kolko, 2011, p.13). It is often thought of in terms of electronic objects that display information in a digital screen. ID is concerned with what an interface (digital information) does after a user interacts with (touches) it (Ming, 2014). For instance, when a user taps an icon on a touchscreen menu, does it move, and how?

### **User Experience Design**

User Experience (UX) designers are interested in how easy a system is to use, how the user values the application, how the user feels about it, and how efficiently the system allows the user to perform tasks, as well as the flow from one step to the next (Gube, 2010). UX designers collect this information on usability through a process called user testing.

## **User Interface Design**

An interface is simply that which connects a system and its user. Therefore, a user interface designer is interested in visual language that allows the two parties to communicate. For instance, the mobile operating system, Android incorporates design standards such as using the system font Robot, specific colors, and visual elements that make its applications recognizable as being Android products (Banga & Weinhold, 2014).

## **Gamification**

Gamification is the process of applying aspects traditionally used in games, such as story, challenges, feedback, rewards, points and badges in order to encourage learning and increase motivation (Kapp, 2012).

Psychotherapeutic treatment for depression, including CBT, has been combined with interactive technology in the past, including computerized diagnostic tools and homework exercises, for example. More recently, a wide variety of personal health applications have become popular on mobile devices, including those for practicing CBT techniques or for coping with depression. These will be explored in the following chapter.

## CHAPTER II

### Preliminary Research

In CBT, the homework assignments given to a patient by the therapist are a critical component of the treatment process and should be treated as such. Psychologist Aaron T. Beck (1979), in his book, *Cognitive Therapy of Depression* writes, “Educators have long noted that homework reinforces the learning process. In cognitive therapy, patients are learning more realistic and effective ways of thinking and acting” (p. 273). When the patient routinely completes the homework exercises, s/he tends to see longer-lasting improvements that carry with her or him outside of the therapist’s office. It is crucial for building skills that can be applied to situations once treatment is completed, as well (Beck, 1979). Kazantzis et al. (2010) supported this by analyzing several such studies and finding that CBT treatments that were focused on homework assignments resulted in greater positive effects than those that did not, supporting the theory that CBT patient therapy with homework is better than therapy without homework (Kazantzis et al., 2010).

While some patients easily complete homework, for others it is problematic and may become an obstacle to successful CBT treatment. As was noted in the diagnostic criteria for major depressive disorder (APA, 2013), there are some symptoms that may make it difficult to complete tasks. According to the DSM-5, it is not uncommon for a depressed person to experience reduced efficiency completing even small, daily chores like getting dressed in the morning, or to report that such a task is exhausting or requires more effort than usual. In addition, “many individuals report impaired ability to think, concentrate, or make even minor decisions. They may appear easily distracted or

complain of memory difficulties. Those engaged in cognitively demanding pursuits are often unable to function” (APA, 2013). It is these cognitive and behavioral symptoms of depression that will be focused on as possible barriers to the completion of CBT homework, focusing on the following four barriers: Memory, Attention, Indecisiveness, and Motivation.

### **Memory as a Barrier to Treatment**

Impairments in short-term and long-term memory as symptoms of depression can pose problems for patients in terms of routine homework completion if they forget to do their assignments or if they have trouble recalling information that they have studied or learned in the CBT process. According to Beck (1979), the difficulty in information recall is often due to poor concentration, asserting that the two issues are interconnected (Beck, 1979).

### **Attention as a Barrier to Treatment**

For patients with depression, attention and focusing capabilities are already impaired, making regular learning tasks sometimes seem insurmountable. A homework assignment with multiple steps can be overwhelming to a person with reduced attention capabilities.

Beck’s (1979) suggestion for dealing with “overwhelming problems” involves asking the patient to narrow down a specific problem that he or she wants to work on, and then making a list of constructive steps toward solving it. It may help the patient to be told not to focus their attention on more than one thing at a time. If prioritizing is problematic for the depressed individual, it is often useful to create an activity schedule that includes specific start times (Beck, 1979).

### **Indecisiveness as a Barrier to Treatment**

Indecisiveness, or difficulty making a decision, is an aspect of depression that appears to be partly cognitive, and partly motivational. Cognitively, the individual worries about making a wrong choice and most likely feels anxious about the regret that may follow, therefore choosing between two or more alternatives becomes stressful and nearly impossible. Additionally, the individual may avoid making a decision simply because he or she does not have the energy or motivation required to complete the mental processes necessary for deduction (Beck, 1967).

### **Motivation as a Barrier to Treatment**

Possibly the most disruptive barrier to CBT homework is the lack of motivation that depressed individuals experience. This is a major symptom of depression and it affects even the simplest of tasks. Beck (1979) addresses the motivational dilemma, pointing out that even if a depressed individual has a task in mind and is aware of what needs to be done to accomplish it, he or she lacks the momentum to follow through, often believing that no satisfaction will be attained. This leaves the individual immobilized and avoidant of productive activity, including homework assignments (Beck, 1979).

### **Literature Review**

In a 2010 meta-analysis of twenty-one studies, Cuijpers et al. found that guided self-help in CBT was just as effective as face-to-face CBT with a therapist for treating anxiety and depression. Guided self-help refers to any treatment method that a patient can work on independently, outside the therapist's office (i.e., homework). This can be delivered by book, over the Internet, on a personal computer, CD/DVD, telephone, or mobile phone.

A 2008 study by Carroll et al. compared two groups of participants at an outpatient clinic for substance abuse in Bridgeport, Connecticut. One group participated in standardized CBT and the other participated in a computerized CBT program called *CBT4CBT*, each for eight weeks. *CBT4CBT* featured simple learning games, videos, interactive assessments, verbal instructions, and practice exercises. Results showed that the *CBT4CBT* patients benefited significantly more from treatment than the standard CBT group, and avoided relapse longer as shown by both self-reporting and urine specimens. The computerized CBT group reported 102 consecutive drug-free days during a follow-up period, as opposed to the standardized group who reported only 74 consecutive days. At a one-month follow-up urine test, the *CBT4CBT* group had 74% drug-free samples versus 48% from the standardized CBT group (Carroll et al., 2008).

Several Internet CBT programs have been developed, but as Swedish researchers Kuhn and colleagues pointed out in 2007 (before internet access on mobile phones was commonplace), being constricted to a computer requires one to recall information for CBT exercises after an unpleasant event or the thoughts associated with it have occurred. Since one of the key principles of CBT is learning to use its techniques in context, as negative thoughts and feelings arise, it is essential that the ability to input those thoughts and feelings be implemented on a portable device (Kuhn et al., 2007). For this and other reasons, Watts et al. (2013) compared the delivery of CBT for depression via fixed computer vs. mobile phone/tablet on participants with major depressive disorder, and hypothesized that the mobile group of users would fare better in testing. Instead, they found them less satisfied with the treatment than the computer users. However, the researchers admit that they did not take advantage of the mobile platform's functionality,

such as automated reminders to do homework, or the ability to complete assignments within the application (Watts et al., 2013).

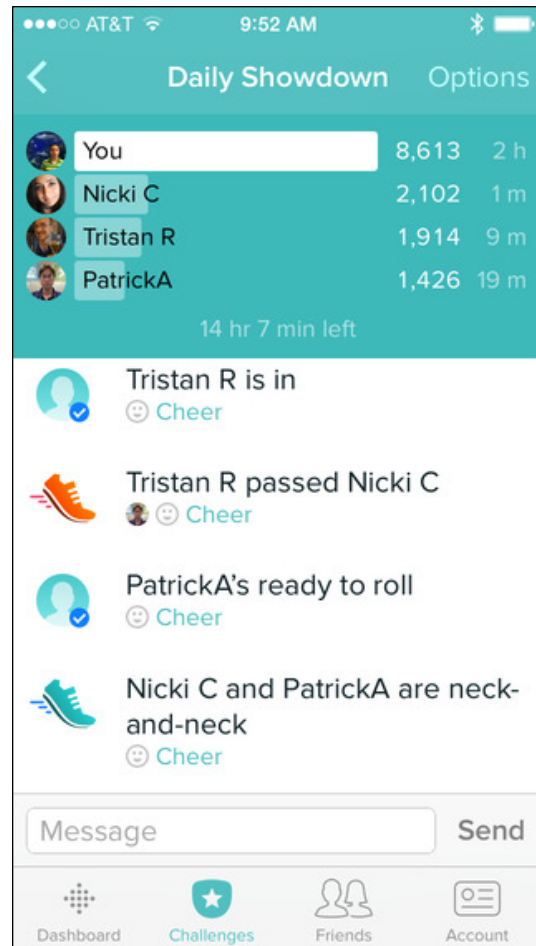
### **A Mobile Application as a Solution to Treatment Barriers**

To date, there are several mobile applications (apps) for the iPhone that are based on CBT techniques, yet not all of them are for depression since CBT can be applied to a wide range of issues. The CBT-iCoach app for instance, is designed for people with insomnia who would like to acquire better sleep habits, created by the Veterans Administration's National Center for PTSD in partnership with the DoD's National Center for Telehealth and Technology (U.S. Department of Veterans Affairs, 2014). Some apps neglect the importance of design aesthetics, in terms of a clean and consistent visual style and consistent use of typography. According to Donald Norman (2004), “we now have evidence that aesthetically pleasing things work better...products and systems that make you feel good are easier to deal with and produce more harmonious results” (Norman, 2004, p. 10). If, on the other hand, an interface features a typeface that is difficult to read, it is possible that the reader may subconsciously transfer that difficulty to the text itself, or the subject matter (Weinschenk, 2011). The iCouch CBT app, for example, features inconsistencies in typefaces and weights between screens, which may cause confusion for the user (iCouchInc.). Some CBT apps ask the user to complete an extensive amount of reading, rather than interacting, which fails to take advantage of mobile technology. Android’s Depression CBT Self-Help Guide (Excel at Life, LLC, 2014) is one such application.

When CBT homework assignments are presented in a mobile format, specifically on a smartphone, the application may take advantage of user experience (UX) and user



interface (UI) design principles that can make the tasks less daunting—perhaps even more enjoyable—and work to counter the four cognitive barriers to treatment (i.e., memory impairment, difficulty paying attention, indecisiveness, and low motivation). For instance, alerts can be set to remind the user to record their CBT exercises, which helps to counter memory as a barrier to treatment. Breaking a task down into smaller, easily accomplished subtasks can eliminate perceived risk and help with indecisiveness. Consistency and repetition of key elements and functions throughout the application can help focus the user’s attention and keep him or her on task, as can be seen in the popular Fitbit app (figures 1a & b), a health and fitness app for smartphones that connects to a wireless activity tracker worn like a bracelet (Fitbit, Inc., 2014). The Fitbit app for iPhone shows consistency of color palette, icons, and typography between screens. Motivation barriers may be addressed with gamification features, which can be used to deliver achievements and encouragement to keep a user engaged and motivated throughout the application’s use. The Fitbit app uses gamification techniques as well, by displaying user information with activity meters (Figure 1a). This is an effective way of motivating a user, as people tend to focus more on what is left of their goal than on what has been completed (Weinschenk, 2011), and a meter allows them to see both. Additionally, the “Daily Showdown” feature allows users to compete with each other in real time fitness challenges and offer each other encouragement (Figure 1b). By keeping the central guidelines of UI and UX design and gamification in mind, a more engaging and helpful interactive CBT app for depression can be designed, as well.



Figures 1a & b. Fitbit for iPhone. Fitbit for iPhone application screens showing consistency among user interface elements and gamification features (Fitbit, Inc., 2014.).

## **CHAPTER III**

### **Statement Of The Problem**

While the standard methods of CBT homework have tremendous benefits for patients suffering depression, they are not without their limitations. Traditional self-help books, workbooks, and worksheets given to patients by their therapists for completion outside of therapy are often physically cumbersome and may be psychologically daunting. In recent years, studies have shown that computerized or computer-assisted CBT have had a positive effect on treatment outcomes for a variety of mental illnesses, including depression, yet there are drawbacks to using a computer as well. These include being confined to one location, which limits the ability to record thoughts and feelings in real time and requires the recall of past information, which may be problematic (Kuhn et al., 2007; Boschen et al., 2008).

In addition, the cognitive symptoms reported by many depressed people could create obstacles to homework adherence: memory impairment, difficulty paying attention, indecisiveness and low motivation. These barriers to treatment, combined with the known limitations of standard CBT homework methods, make the currently preferred treatment method for depression less successful than it could be. In order to enhance patient productivity, a new method of homework delivery via a portable device should be created which helps to alleviate the cognitive difficulties that depressed individuals face.

### **Hypothesis**

An original mobile application for the iPhone will be designed that guides users through the process of a thought-restructuring exercise modeled after the techniques developed by David D. Burns in *The Feeling Good Handbook* (1999). Using design

principles rooted in psychology, the app will show that specific design features are well suited to the treatment of depression. Time based reminders, on-screen notifications, compartmentalization of information and availability of previously recorded information are some of the features that will help with memory impairment. Instructions will be kept simple and readily available to avoid placing burden on a depressed user's already limited memory capacity. To help keep attention focused, mechanisms such as checklists and numbering devices will be incorporated so that the user may focus on the task being performed, rather than the tools being used to perform it (Johnson, 2010). To assist a user experiencing indecisiveness, gamification features will be employed, including the option to walk through an example exercise before starting the CBT process, which may eliminate a user's fear of making mistakes (Kapp, 2012). Finally, for the problem of low motivation, the game-based practice of providing rewards and achievements helps keep a user encouraged while using the app. Combining UX and UI design and gamification with the CBT process in a mobile application will demonstrate how interactive design is an ideal solution to the barriers toward CBT homework posed by cognitive symptoms of depression.

## **CHAPTER IV**

### **Methods**

UX and UI design are part of a larger field known as interaction design (ID). ID encompasses digital objects with a screen displaying informational elements. Interaction design is uniquely poised to combat the barriers to CBT homework adherence created by the cognitive symptoms of depression, as UX and UI design rules are founded on human psychology: The way humans observe, learn, think, remember, and behave. In fact, many of the designers who created the UX and UI design guidelines have a background in psychology (Johnson, 2010).

#### **Interaction Design as a Solution to Memory Problem**

The evolution of computerized technology, the Internet, and mobile storage capacities has lessened the need to remember large quantities of information. The average mobile phone user likely does not have more than one or two phone numbers memorized aside from his or her own because our phones store them for us. Today it is a basic requirement that well-designed user interfaces help the user to remember important information as they move through actions. Rather than requiring the user to recall past steps or current location, s/he should be allowed to focus and progress toward a goal.

The following UX features are typically used to counteract memory insufficiency and could be of benefit to depressed individuals if incorporated into a user interface. A common problem that occurs due to short-term memory's limits is that the user typically forgets the search term they have just typed in as soon as their results appear. Including search terms in displayed results helps with placement tracking and reduces wasted time (Johnson, 2010). Rather than asking users to remember a lengthy set of steps required to

complete a task in short-term memory, interactive systems should display instructions in a place where users can refer to them until the task is completed. Learning and long-term information retention in interactive systems can be improved with user-interface consistency. When objects and functions are consistent throughout an interface, there is less the user has to learn and retain (Johnson, 2010).

Johnson warns that there are also several ways in which designers can inadvertently burden a user's long-term memory with an interactive system. Authentication—verifying a user's identity with a password, for example—demands long-term memory resources each time it is enacted. Some sites or software have requirements for their passwords— a certain number of characters, at least one number, or inclusion of an uppercase letter—which make remembering the password even more difficult. Add to that a site registration requirement, or password security questions, and the user's memory is heavily taxed *before* they have entered the site or program (Johnson, 2010).

In the creation of a CBT iPhone app for depression, authentication will not be a requirement so as not to burden the user's long-term memory, meaning that the user will not be asked to “sign in” in order to use the app. Any instructions for using the app can be easily accessed by the HELP icon, located in the navigation menu at the bottom of every screen. Thus, it is not necessary to memorize instructions. In addition, the information entered in the first step of a CBT exercise will be automatically provided for the user in each of the following steps, removing the need for him or her to recall it from memory.

## **Interaction Design as a Solution to Attention Problem**

By studying user behavior, interaction designers have, over time, observed patterns in their engagement with interactive systems. Part of the designer's job is to support such patterns, including those based on limited attention or short-term memory capacity. Therefore, some design rules have grown out of the human limitations of attention and memory (Kapp, 2012). Interaction designers have observed that users tend to focus on their goals, rather than their tools. That is to say, that since attention is limited to begin with, it makes sense to design interactive systems so that the focus is on the task at hand and remove the distraction of tools being used, be they a computer, tablet, mobile phone or other interactive device (Johnson, 2010). Designers also observe that users have learned not to rely on their limited memories and attention capacities and instead mark up their environment with devices that aid in these obstacles. The same devices can be employed interactively. For instance, we often count objects on our fingers, bookmark pages when reading, do arithmetic calculations on paper, or write checklists (Johnson, 2010).

In the CBT iPhone app for depression, the user will have everything s/he needs to accomplish goals within the app. There should be no need to leave the app in order to search for more information, nor should the user be distracted from the current task. For additional information that users are likely to desire beyond what is presented in the Refocus app, the RESOURCES screen provides several useful web links which allow the user to quickly switch from topic to topic outside of the app (Weinschenk, 2011). Wayfinding mechanisms like checklists will be incorporated for long sets of information,

and “bread crumbs”—a wayfinding mechanism—will help keep track of which step in a process the user is currently working on.

### **Gamification as a Solution to Indecisiveness Problem**

A valuable device to counter indecisiveness used in games is feedback—information given to the player regarding his or her performance. As psychologist Aaron Beck indicated, the depressed person’s indecisiveness typically stems from a fear of making a wrong decision and the regret that will follow (Beck, 1967). With two types of feedback—learning and prompts—games may provide a type of safety net that makes it easier for the player to make a decision. In a learning experience, immediate feedback can tell a player if he or she made a right choice, a wrong choice, or a neutral choice, but may not convey how to proceed. However, another type of feedback, called a “prompt,” can guide the player if he or she makes an error, without explicitly giving away the answer. These two forms of feedback are often used together to inform the player’s experience (Kapp, 2012).

It is also useful to include a practice round at the beginning of a game or task which will allow the user to see how a process can or should unfold, and then try it themselves in a risk-free environment (Kapp, 2012).

In the CBT iPhone app for depression, an optional example exercise will be permanently available on the HELP screen, allowing the user to see how a CBT exercise will work before entering any personal information. Feedback will be given in the form of alerts and notifications to tell the user either that it is time to do a thought exercise, that a long period of time has passed since their last record, or to provide them with an encouraging reward or achievement. For instance, after having completed Thought



Records for five consecutive days, the user will receive a reward notification that says, “You’ve completed 5 consecutive days of thought records! KEEP GOING!” This particular reward is intended to encourage the user to use the Refocus app every day.

### **Gamification as a Solution to Motivation Problem**

As noted earlier, motivation is one of the major struggles for people with depression, and it often creates an obstacle to successful CBT therapy when it comes to completing the homework assignments. Fortunately, gamification is heavily rooted in the concept of motivation (Kapp, 2012), making it an ideal device for promoting CBT homework.

There are two types of motivation to consider when designing with gamification principles: Intrinsic motivation—the motivation comes from within the user, and extrinsic motivation—the user is motivated by an external reward or lack of punishment (Kapp, 2012). For instance, a depressed person’s intrinsic motivation for doing their CBT homework could be that he or she wants to relieve symptoms of depression. An extrinsic motivation could be the approval (or avoidance of disapproval) of his or her therapist. In a game or mobile application, extrinsic motivation can be provoked through the use of rewards such as badges, notifications, levels, points, or other achievements. The desire to earn awards will be used in the CBT iPhone app as a primary source of motivation.

### **Proposed Design Solution**

The proposed design solution is a mobile version of CBT exercises based on the techniques used in *The Feeling Good Handbook* by David D. Burns (1999). The objective is to create a form of CBT homework that is more engaging, more portable, more easily accessible, and that can better assist in combatting a depressed person’s

difficulties with completing homework tasks (memory impairment, attention deficit, indecisiveness, and motivational deficit) to successful completion of the exercises than the standard pen and paper method (typically referred to as “bibliotherapy”). Using psychology-based interaction design principles, along with gamification, a user-interface will be designed that provides information about CBT and the thought-recording task. An example thought record will be included to familiarize users with the format and process, before beginning their own thought record. Additional features include a STATS screen which allows the user to see the progress and achievements he or she has made during use of the application, an option to send or sync the thought record with the user’s doctor or therapist, and additional resources on depression and CBT.

### **Proposed User Testing**

In the first phase of testing, a paper prototype of the app’s primary task will be created with alternative content. A paper prototype is a paper-based version of the app with a line drawing of an iPhone with the user interface elements drawn in the screen area. This method of testing is used in early stages because it is inexpensive and easy to alter designs if needed (Kapp, 2012; Martin & Hanington, 2012). The participants (average citizens) will be shown alternative content in this round so that they are not required to answer questions about their intimate thoughts and feelings, nor are they required to go through the process of learning CBT jargon. In this phase, only the functionality of the task flow will be tested. In the second phase of testing, participants will be testing wireframes of the primary task, again with alternative content in order to test the user interface with additional gamification features. Wireframes are simple, computer-rendered, mockups that outline the content and functions of an app. They

typically do not include stylistic elements like color or graphics. In the final phase of testing, visual elements such as thematic typography, specific colors, icons and background images or colors will be added to wireframes and the actual CBT content will replace the alternative content. The participants in this final phase are clinicians, who will be asked to test the usability of the app from a therapeutic standpoint, as well as the validity of the content. Their responses will be measured using survey questionnaires administered pre and post user-testing.

### **Design Methodology**

The CBT iPhone app for depression was produced through evidence-based design, using traditional research methods and factual evidence to influence the design decisions at each step in the process. Peer-reviewed literature, case studies and evaluations of existing designs were consulted and credited (Martin & Hanington, 2012). The design phase of research began with a tree diagram (Martin & Hanington, 2012) to organize the functions of the mobile app to be created (Figures 2 & 3). The essential functions of a CBT app for depression were written on individual sticky notes. The notes were then moved around to a desirable configuration. The indication of hierarchy through color helped to differentiate the primary functions from the secondary functions.

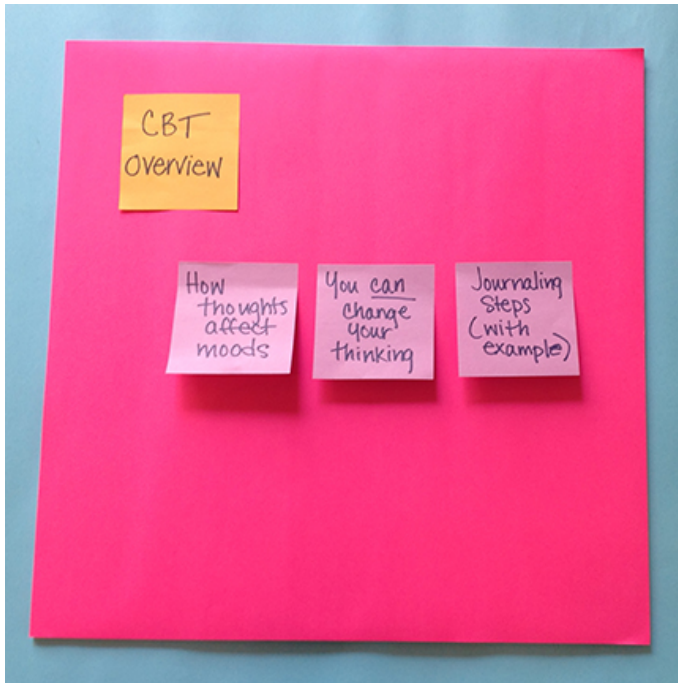


Figure 2. User Interface Outline #1. A tree diagram shows the primary and secondary functions of the Refocus app HELP screen.

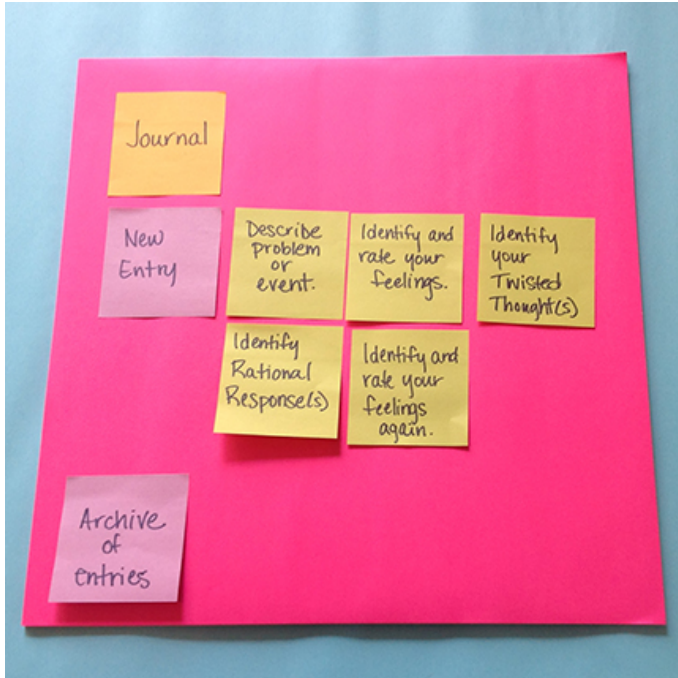


Figure 3. User Interface Outline #2. A second tree diagram shows the primary and secondary functions of the THOUGHT RECORD screen for the Refocus app.

The next phase of design consisted of paper prototypes with a line drawing of a phone and the UI (onscreen) elements handwritten (Figure 4). During user testing, six randomly chosen individual participants used their fingers to tap areas or “buttons” on the prototype as they would on a real phone, while the designer/facilitator swapped out pages (screens) as needed. Sticky tabs were used to denote changed interface elements, such as a checked box or an expanded information field. The information collected during this test determined the clarity of onscreen instructions, the decipherability of UI elements like buttons and sliders, and the overall flow throughout the task.

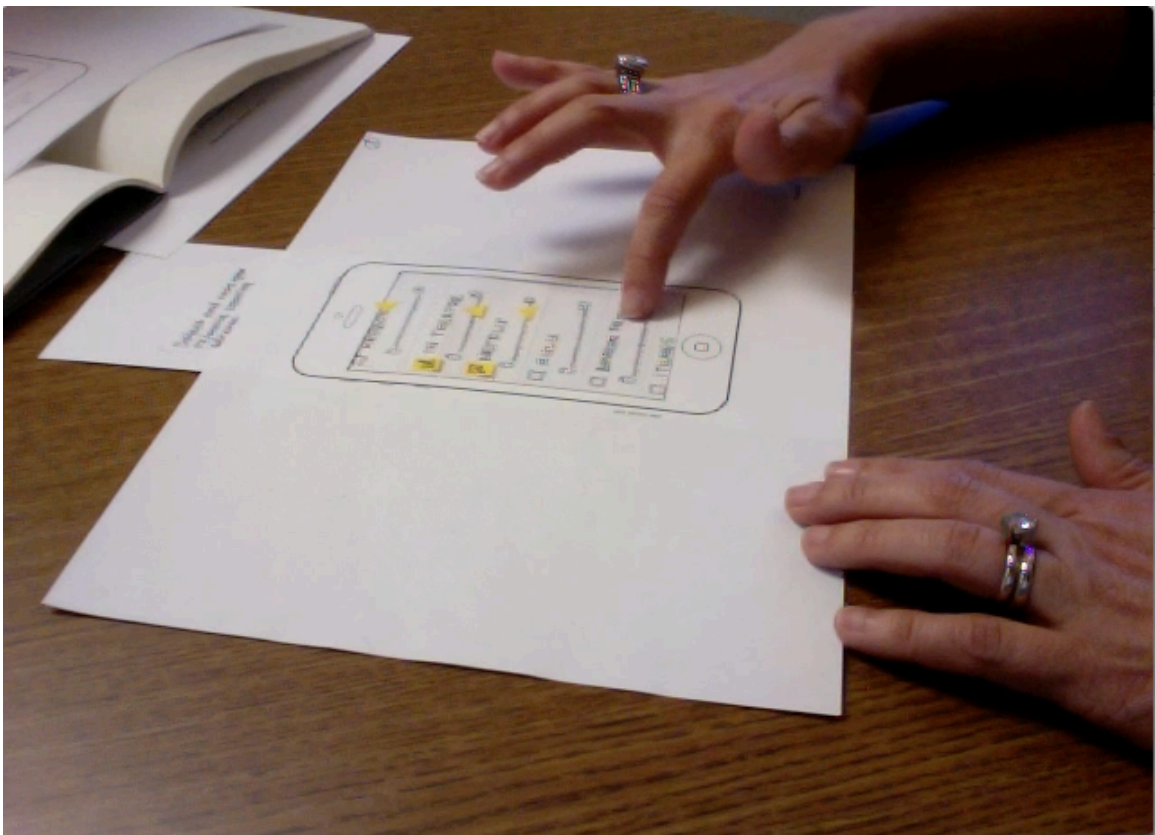


Figure 4. User Testing With Paper Prototype. A user-testing participant mimics the actions of a mobile user interface on a paper prototype.

In the paper prototype phase, no CBT content had yet been included. As only the usability of the interface's functions were being tested, it was decided that questions about mental health and private thoughts and feelings were irrelevant at this point in testing and may distract from the task at hand. Therefore, alternative content was inserted as an interim placeholder. For instance, a CBT question asking the user to rate his negative emotions was replaced with a question asking him to rate his satisfaction with various movie-viewing services.

The feedback from participants in the first round of user testing was used to correct usability issues when creating wireframes, as some buttons were retained and others were eliminated or moved to more intuitive locations. This time the app screens were digitally created to resemble real iPhone interfaces (formatted to fit the iPhone 5s), with the standard apple iOS 7 graphic user interface elements used on a current iPhone (Figures 5a-7b). The alternative content remained in this round, but the task flow was designed with the same types of functions in the same order that the CBT homework task would eventually be designed. These wireframes were created in an online experience prototyping service called InVisionApp, which allows mobile and web designers to interact with digital prototypes of their designs via the Internet. During testing, users moved through the wireframes on an iPhone as if it were a fully functioning mobile app, able to tap buttons and progress through each of the app's screens. The interactive functionality enhanced their user experience and enabled more accurate feedback. Once again, the feedback collected in this round of testing was used to determine the UX and UI design improvements made in the final stage of creation of the mobile app.



Figures 5a and 5b. Wireframe #1 and #2. Digital prototypes of the mobile app show standard apple iOS graphics and functions. In this round, users tested for ease of use among functional elements and task flow.



Figures 6a and 6b. Wireframe #3 and #4. Digital prototypes of the mobile app show standard apple iOS graphics and functions. Alternative content replaced what would ultimately be CBT content, but the actions remained the same.





Figures 7a and 7b. Wireframe #5. A digital prototype of the mobile app shows standard apple iOS graphics and functions, including fake calculated “statistics.”

### The Refocus App

The established design solution is a mobile app for the iPhone called Refocus (Figure 8). The name is inspired by the language used to explain the process of CBT. The negative or automatic thoughts that patients are asked to record during a CBT exercise are often referred to as “distortions” (Burns, 1999). By recording, analyzing, and

restructuring these thoughts, the hope is that a more rational response to the original situation that triggered the negative thoughts will be found. If the analogy of a *distorted* lens were used to explain this process, a *refocused* lens would be the desired outcome. This app is the interactive tool that assists the user in refocusing distorted thoughts.



Figure 8. Refocus Loading Screen. The final design artifact is a mobile application for the iPhone called Refocus that is modeled after the CBT process developed by David D. Burns in *The Feeling Good Handbook* (1999).

Upon first use of the Refocus app, a HELP screen appears after the app has loaded (Figure 9). This gives the user an overview of the app, including an explanation of CBT, a brief summary of the app's functions and the option to view an example CBT exercise. The example moves through the four steps of the Thought Record—a journal-like process of recording thoughts and feelings—explicitly instructing the user where to tap or swipe on each screen through the use of graphic icons (Figure 10). Practicing a procedure from start to finish with the knowledge of how and why they are doing so helps users learn and understand concepts—in this case, CBT—rather than simply memorizing and forgetting actions (Kapp, 2012). On subsequent uses, the app will open to the LOG LIST screen (Figure 11) from which the user can create a new thought record or select a previous one from an archived list organized chronologically. The HELP screen, however, will always be available for later recall via the navigation menu.

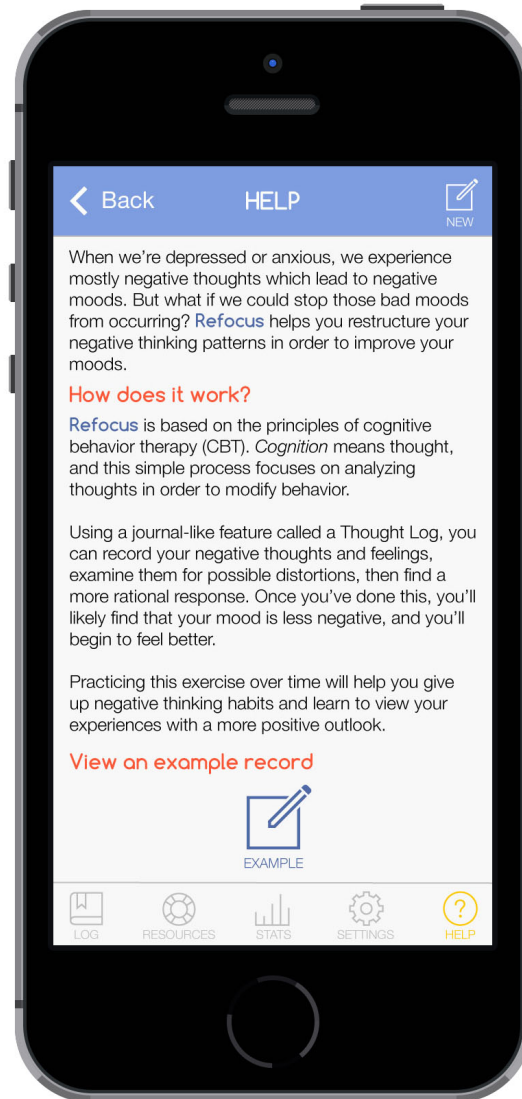


Figure 9. Refocus Help Screen. The first time the app is used, it opens on the Help screen, guiding the user to read background information and perform a practice round of the main task to learn its functions.

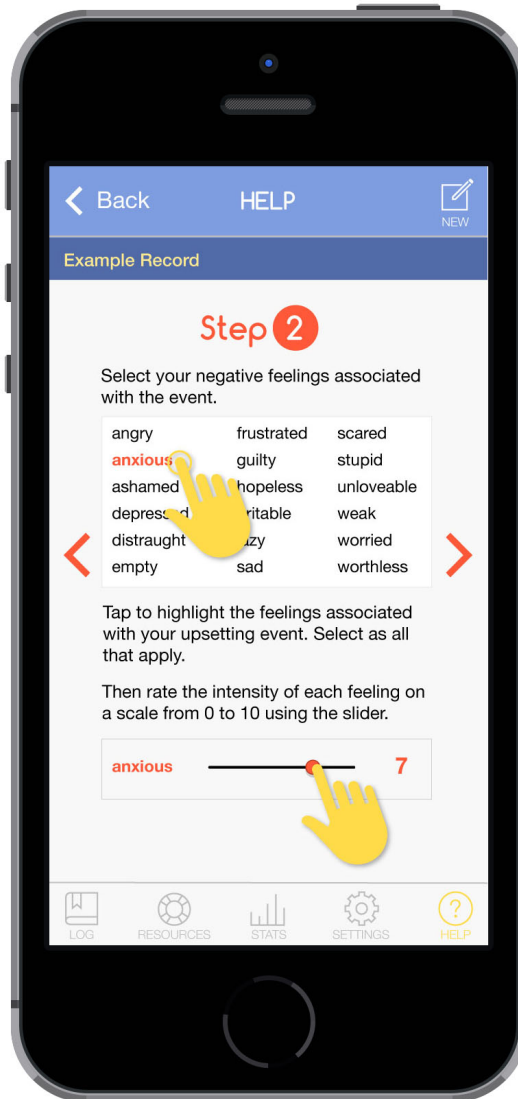


Figure 10. Example Exercise Screen. The example moves through the four steps of the thought record, explicitly showing with graphic icons where to tap or swipe on each screen.

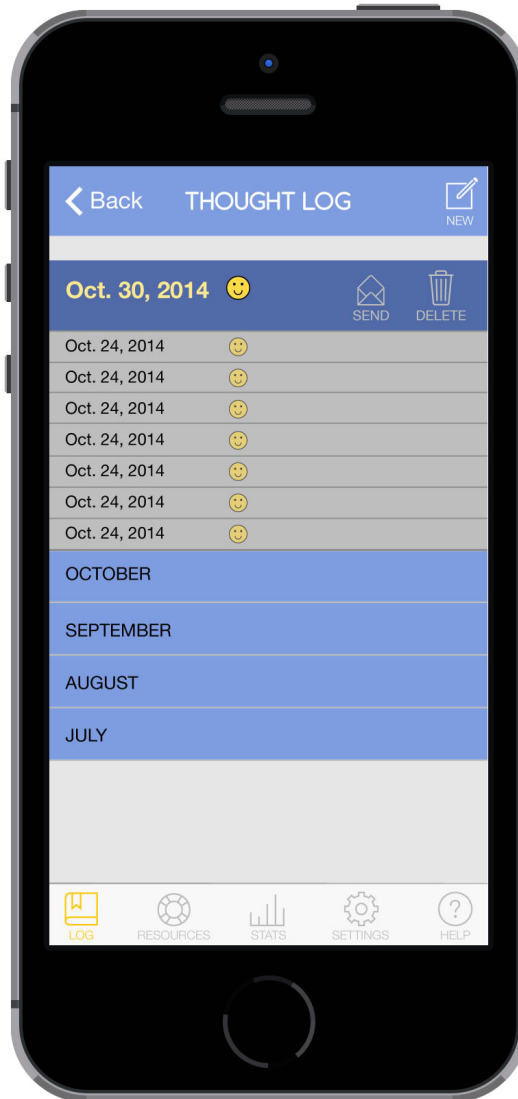


Figure 11. Log List Screen. Thought records are saved in an archived list and each one can be sent or deleted by tapping the corresponding icon.

When a new thought record has begun, Step 1 prompts the user to enter an upsetting event in the text field provided. There is an additional option to use the voice-to-text feature by tapping the microphone icon on the keypad (Figure 12), a technology that is one of the advantages of doing CBT homework on a mobile device, as opposed to a stationary computer or pen and paper. In Step 2, the user is asked to select the negative feelings he or she associates with the event they have entered. The event text is still

visible onscreen so that user short-term memory is not burdened. To aid in the possible occurrence of indecisiveness, a list of negative emotions is provided, rather than forcing the user to produce them spontaneously. Each emotion word selected appears below the list with a slider, prompting the user to rate its intensity on a scale from 0 to 100 (Figure 13).

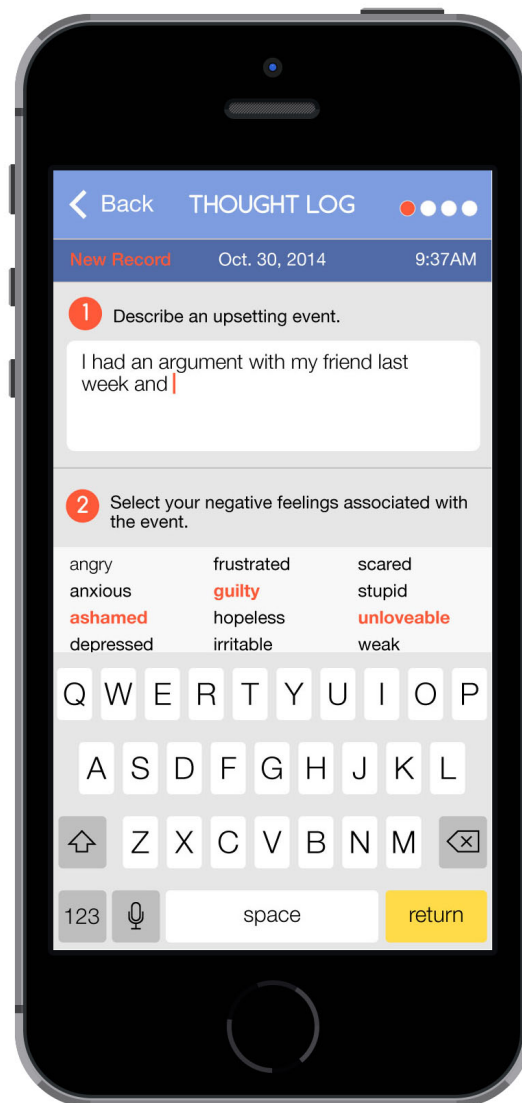


Figure 12. Step 1 Screen. The user is prompted to enter an upsetting event by typing in the text field or by using the voice-to-text option available by tapping on the microphone icon on the keypad.

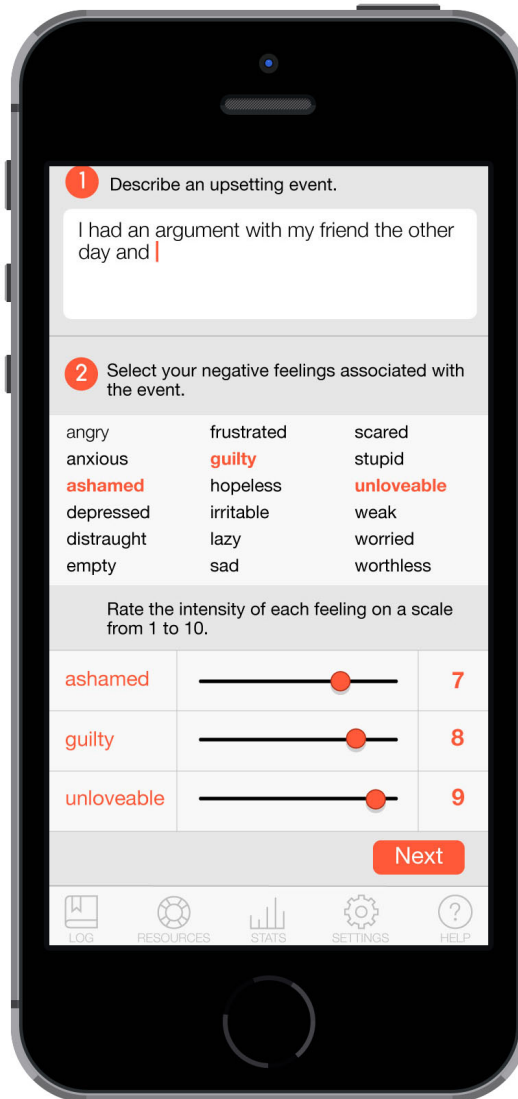


Figure 13. Step 2 Screen. Once a user has selected words from the negative emotion list, they are prompted to rate them using the corresponding slider.

In Step 3, the user enters any negative (distorted) thoughts that come to mind when recalling the unpleasant event. By swiping to the right or left, additional text fields can be accessed without leaving the current screen (Figure 14). Next, he or she rates the belief in each thought by typing a percentage. Beneath the thought entry and rating fields is the list of ten types of twisted thinking (thought distortions) (Burns, 1999). Instructions



direct the user to identify whichever items from the list apply to their negative thoughts by tapping the button next to each item name. An information icon can be tapped to expand the item bar for a definition of each item (Figure 15). Next, the user scrolls down to find a similar list, but this time they are asked to choose rational responses to their negative thoughts. Keeping these expandable lists available while performing the tasks reduces the burden on memory (Johnson, 2010) and prevents the user from having to navigate to a different screen within the app, which puts him or her at risk of getting lost, becoming confused or frustrated, and losing focus.

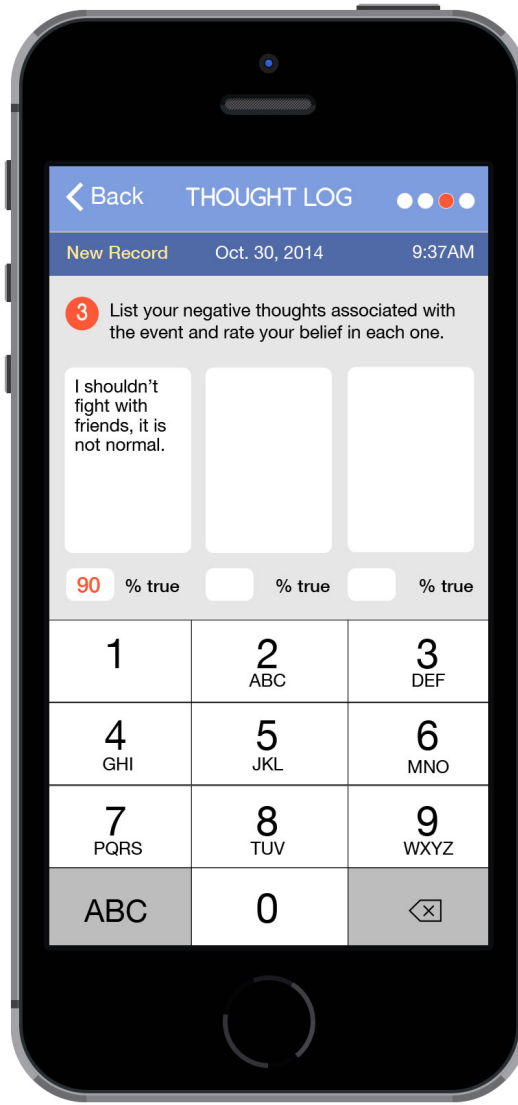


Figure 14. Step 3 Screen. The user enters any negative thoughts in the fields provided and rates the belief in each by typing in a percentage.

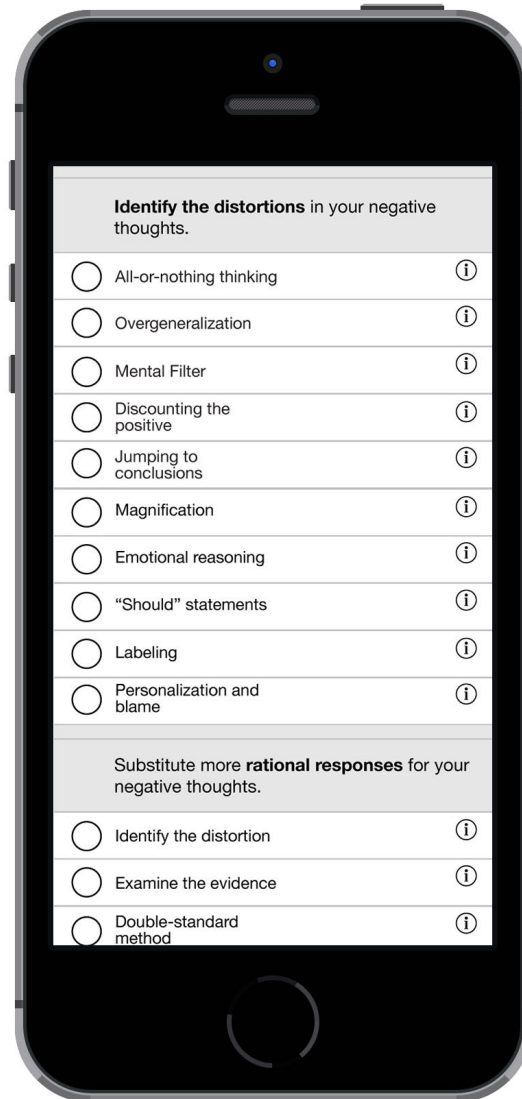


Figure 15. Step 3 Screen Continued. The expandable lists remain onscreen while the user performs tasks, reducing memory burden preventing the need to decipher navigation.

In Step 4 of the Thought Record, the previously entered information (upsetting event, feelings and ratings, thoughts and ratings) appears in a format similar to how it was originally entered (Figure 16), and the user is now asked to re-rate those thoughts and feelings after having identified the distortions and rational responses. The app's ability to automatically recall information for the user in a consistent style and layout will

ideally remove a large cognitive burden from the user, freeing up their attention for task completion—in this case, self-evaluation. The final part of Step 4 is to identify the current mood by tapping one of the four mood icons.

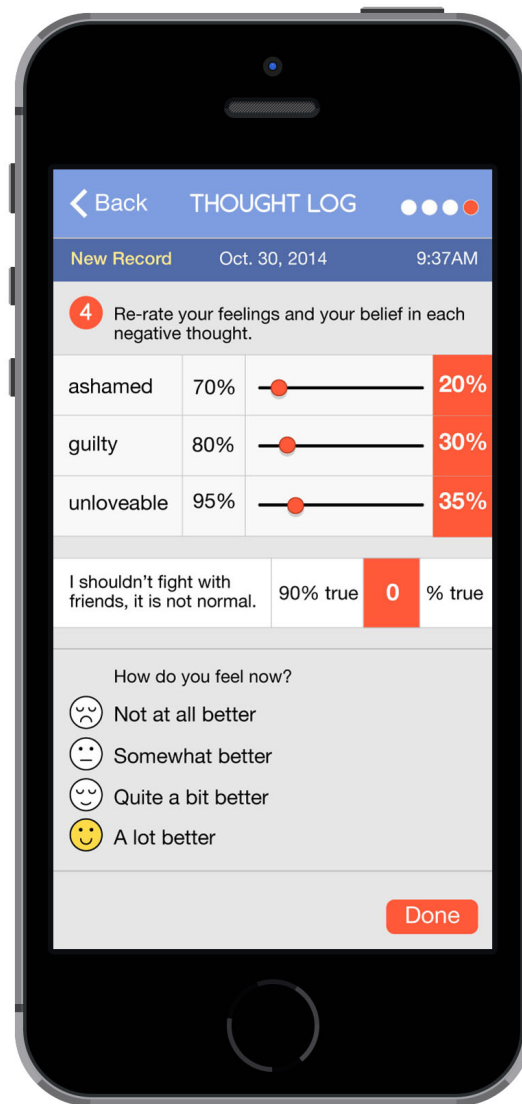


Figure 16. Step 4 Screen. The app's automatic recall of previously entered information presented in a consistent style and layout removes a large cognitive burden from the user, freeing up their attention for task completion.

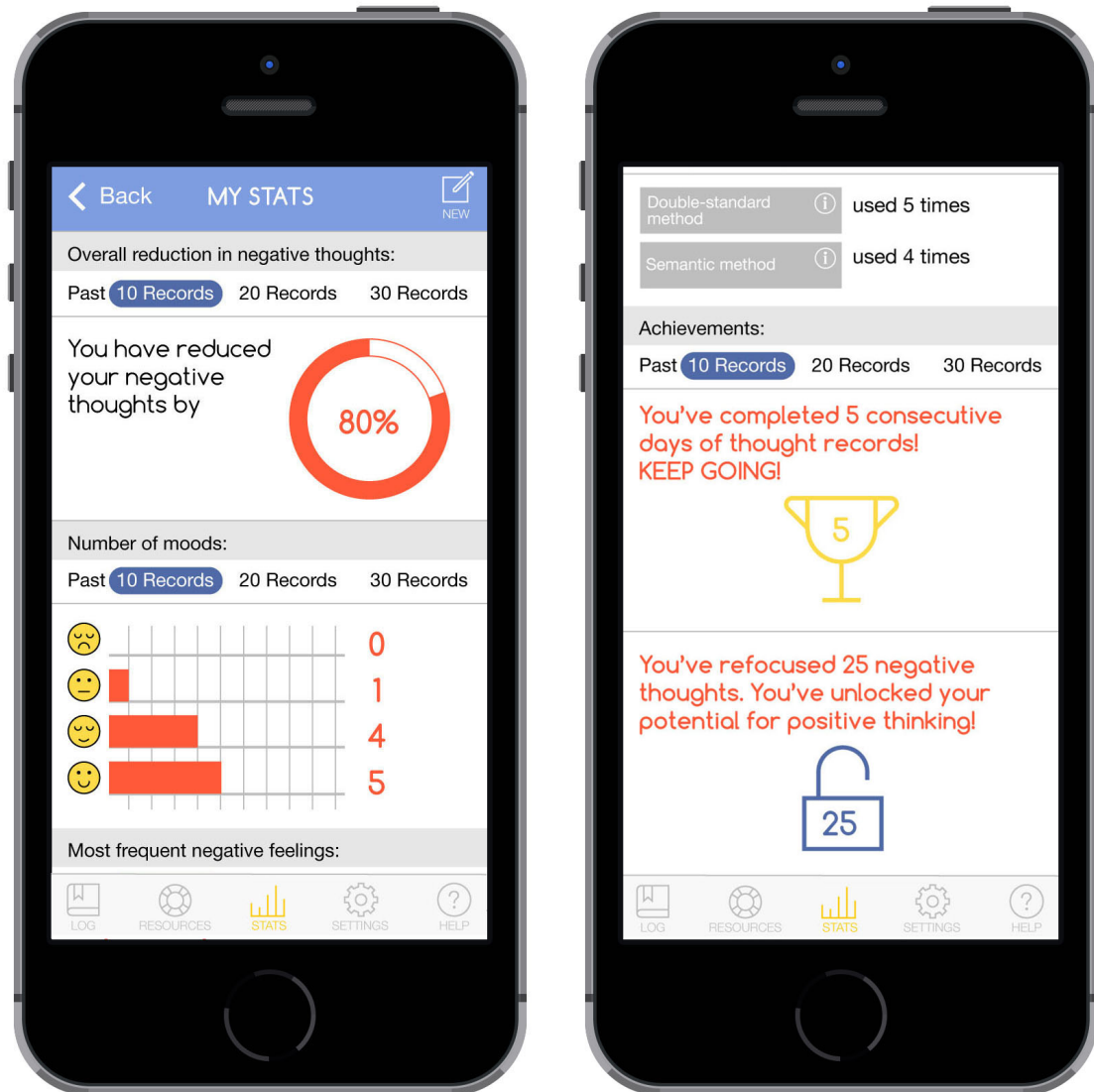
Once a thought record is complete, it is automatically saved in the THOUGHT LOG, where the user has options to SEND and DELETE. The SEND function may be ideal for users undergoing CBT treatment that would like to share their thought records with their therapist (must be HIPAA compliant) as social approval plays a large role in why people play video games and the ability to share successes encourages them (Kapp, 2012). By this line of reasoning, if patients see progress in their modification of thoughts and behaviors while using the Refocus app, they may want to share it with their therapist and be encouraged to continue, especially if they receive positive feedback.

Feedback within a game or app is highly valuable because it lets the user view progress toward achieving his or her goals, which can elevate confidence and boost motivation (Kapp, 2012), both of which would be advantageous to depressed users. In the Refocus app, feedback is given in multiple ways: Periodically, the user will reach pre-programmed milestones such as completing thought records for a consecutive number of days, or completing a certain number of thought records overall (Figures 17a and 17b). These achievements will be delivered as award notifications. The achievements are designed with corresponding graphic icons and encouraging language such as “GOOD WORK!” and “KEEP GOING!” Achievements are saved and can be viewed at any time on the user’s STATS screen (fig. 18a and 18b), which also includes informational graphics illustrating the progress that has been made since the app has been in use. The app calculates the changes in thought and feeling ratings and the final mood rating of each thought record, and lets the user know by what percentage they have decreased negative thoughts. The number of moods rated is charted on a bar graph and the top three most frequently selected negative feelings are listed in descending order. The most

frequently identified distorted thoughts and rational responses used are also listed, and each of these features can be viewed for the past thirty records. These statistics are not only meant to provide motivational feedback, encouraging the user to continue use of the app, but also to help the user see patterns in their thought records over time, promoting self-awareness and a deeper learning of CBT's principles.



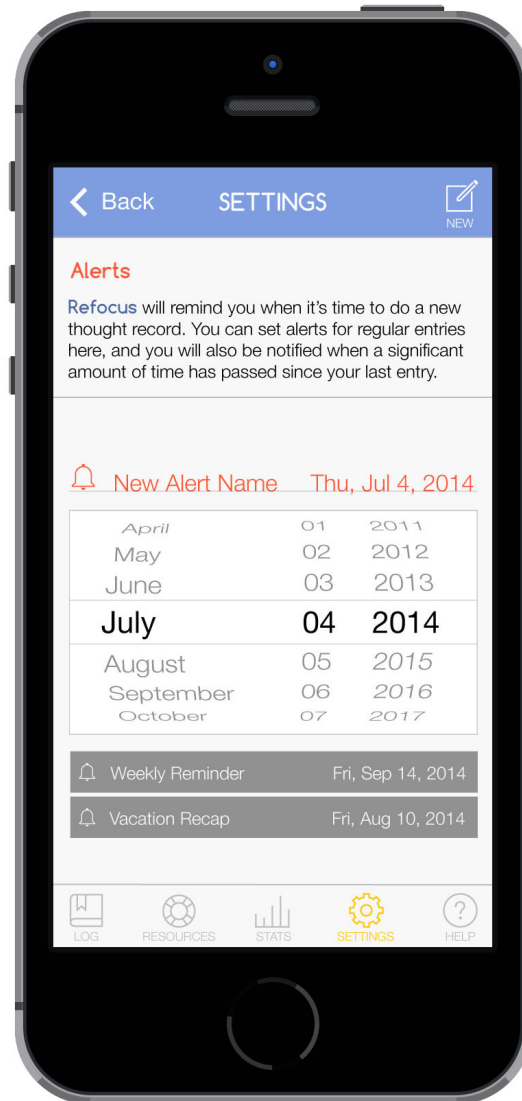
Figures 17a and 17b. Award Notifications. Achievements will be delivered as award notifications and designed with corresponding graphic icons and encouraging language.



Figures 18a and 18b. Stats Screen. Informational graphics display the user's progress, providing motivational feedback, encouragement, and patterns that may promote self-awareness.

The Refocus app includes an alert function, found on the SETTINGS screen (Figure 19), where users may schedule their phone to remind them to complete a thought record, either one time or regularly. For instance, a reminder could be set for every day at 12:00PM if a user finds it convenient to complete thought records on his or her lunch break. In addition, the app will send a push notification if no thought records have been

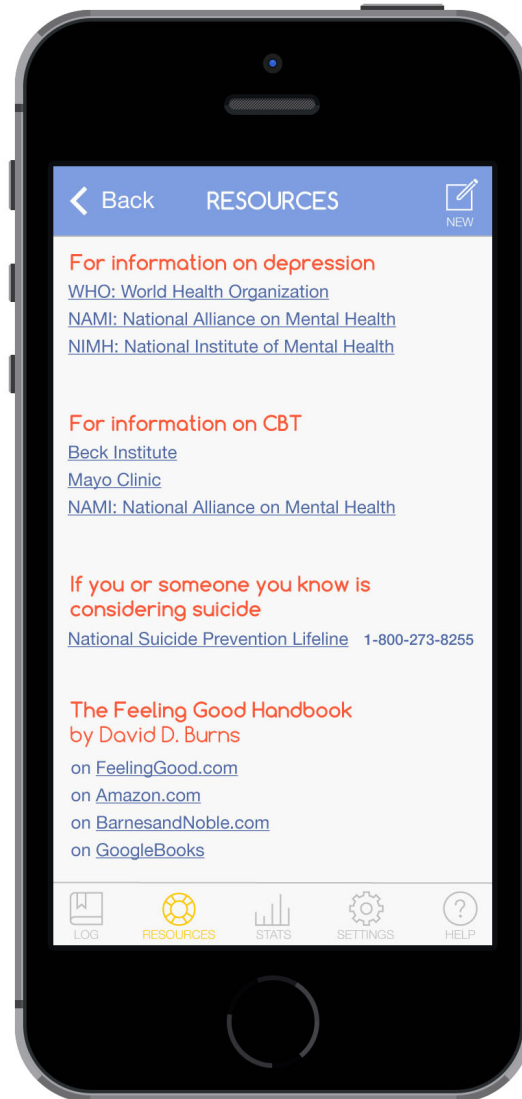
completed for a certain number of days. Alerts and notifications can be turned on and off in SETTINGS at any time. Their purpose is to rectify the problem of remembering to complete a thought record (homework exercise), which often hinders the success of CBT.



Figures 19. Settings Screen. Alerts can be scheduled by the user as a reminder to complete a thought record.

Additionally, a RESOURCES screen (Figure 20) is provided that features helpful links to information on depression, CBT, a national suicide prevention hotline, and *The Feeling Good Handbook* by David D. Burns (1999) that the app's content is based on.





Figures 20. Resources Screen. Helpful links to information about depression, CBT, a suicide hotline, and *The Feeling Good Handbook* (1999) can be found on the resources screen.

### User Testing With Clinicians

In order to test the Refocus mobile app, four licensed psychotherapists—here referred to as “clinicians”—were asked to view the app for the validity of its CBT content and its usability in a therapeutic setting. Usability expert Steve Krug recommends keeping the number of testing participants down to three or four for initial user testing

because these first few users are most likely to encounter most of the important issues, and they can be tested in a short period of time (Krug, 2006). The clinicians were given a brief survey asking about their experiences with CBT and how they felt the traditional methods of CBT homework are able to combat the four cognitive symptoms of depression that pose obstacles to treatment (memory impairment, difficulty paying attention, indecisiveness, and low motivation). The clinicians then viewed the Refocus app on an iPhone 5s device, using the InVisionApp interactive prototyping service. They progressed through every screen and function available in order to gain a thorough understanding of the app's functions and capabilities. Once they were finished, each clinician completed a second survey regarding their opinions on the Refocus app's perceived ability to combat the four cognitive symptoms of depression that pose obstacles to treatment (memory impairment, attention deficit, indecisiveness, and motivational deficit). Additionally, they reported on whether or not they would feel comfortable using the app in a therapeutic setting, and provided feedback regarding benefits over traditional bibliotherapy and any other information they felt could be useful.

## **CHAPTER V**

### **Results**

Clinicians in the final round of usability testing answered two separate surveys, one administered before viewing the Refocus mobile app, and one after. Each of the four participants provided their answers individually, with only the designer/administrator present. The results of each survey are presented in Tables A4 and A5 (see Appendix A). In the first survey, participants were asked if they used CBT techniques in their psychotherapeutic practice, with 100% reporting they did. When asked what form of CBT homework they assigned, answers varied, with one participant giving no homework, one using workbooks, one using handouts and books, and one using workbooks, handouts, and books.

The next questions in the first survey focused on standardized CBT's ability to counteract the cognitive barriers to homework completion that many patients with depression face. The clinicians rated the standardized CBT method less than adequate overall on each of the four barriers: memory impairment, difficult paying attention, indecisiveness, and low motivation.

The post-test survey asked the clinicians if they felt the Refocus app would be beneficial to depressed individuals and if they would recommend it to their own patients. The majority (75%) answered favorably on both questions, with one participant (25%) declining to answer. Similar to the first survey, the second survey asked the participants to rate the Refocus app's ability to counteract the cognitive barriers to homework completion that are common to people with depression. In this case, the clinicians

perceived the app to be more effective than traditional bibliotherapy on three of the four barriers (Table A2): 75% rated it more effective for motivation, 50% rated it more effective for attention, and 50% rated it more effective for indecisiveness. Only 25% rated it more effective for memory, and while this is a complicated and multi-factored obstacle, it bears further investigation in future design iterations and testing.

Clinicians were asked to list any additional benefits to depressed patients of using the Refocus app versus traditional bibliotherapy, beyond the four cognitive obstacles being researched. Some of the responses given include: “content is more accessible—more people would find it appealing”; “phone interface lowers the barrier to data entry, less like homework”; “it is convenient and real time. App is more like a game and attractive, simple”; and “the reminders are a benefit of the app. Clients are also unlikely to carry the materials everywhere, but are likely to have their phone with them. I also think an advantage of the app over the book is that it provides positive reinforcement.”

Finally, the clinicians were given the opportunity to provide comments or suggestions about the app and their experience using the app. Some valuable insights were gained from this feedback, including the suggestion to highlight or enhance the SEND feature in the Thought Log so that the user can transmit thought records to a therapist. Instead of an email method, which the current icon signifies, some participants suggested a “sync” function, implying that the therapist would also have the Refocus app and the two users could transmit information between them through the application. If a user is not currently engaged in psychotherapy, it was recommended to include a “find a therapist” link or search feature. Additional suggestions include incorporating mindfulness exercises, including a disclaimer that the app is not meant to take the place

of professional psychotherapy, and adding links in the RESOURCES screen to social forums for depression or CBT.

Based on results of the clinicians' testing, a final iteration of the Refocus app was produced (Appendix B) that accounted for their suggestions regarding CBT content and resolved remaining user interface issues. On the iPhone's home screen and the Refocus loading screen (Figures B1a & b), the logo was altered to look more like a thought bubble in the shape of a brain—a conceptual allusion to the subject matter of the app, and the type color was changed to white for better contrast against the background. The information on the HELP screen (Figure B2) was condensed to graphic icons and bulleted text explaining how the app works in simple terms. The secondary information about CBT, which a user may read if interested, was moved to a sub-screen accessed by the INFO bar on the top right of the screen. On this INFO screen (Figure B3), a disclaimer regarding liability was included at the suggestion of one of the clinicians during user testing. The LOG screen (Figure B4) underwent several design changes in order to improve its hierarchy and organization for ease of use. Color and tone was used more effectively to denote selected fields. The thought record archive can now be sorted by day, week, or month. The most recent thought record is at the top of the queue with bold, colored type to set it apart from the others. Additionally, as suggested by the clinicians, the “send” feature has been given better contrast and is included on each record entry for better visibility. Many alterations were made to the CBT exercise portion of the app to ensure that each step is simple and straightforward. For instance, STEP 1 and STEP 2 were split onto multiple screens (Figures B5-7) with one task per screen in order to avoid an overwhelming amount of information. To aid short-term memory, the

“upsetting event” entered by the user in STEP 1 is carried through the remaining steps so the user does not have to recall it. Similarly, the items chosen in STEP 3 are presented on subsequent screens (Figures B6-11). On many screens, text fields and graphic elements were edited and the layout adjusted for better readability (Figures B6, 8, & 11). On every screen, the navigation icons were darkened for better contrast. The achievements and rewards on the MY STATS screen (Figures B12a & b) were moved to the top for added incentive and the option of viewing by ten, twenty, or thirty records was removed. The SETTINGS screen (Figure B13) was reconfigured so that the user has the option of creating either a “one-time” or “recurring” alert, and then setting the day and time. Finally, the RESOURCES page (Figure B14) shows the addition of a “Find a therapist” link, as well as links to depression and CBT forums. Clinicians suggested the additions to the RESOURCES screen during user testing.

## CHAPTER VI

### **Conclusion**

The results of usability testing for the Refocus iPhone app were favorable for three of the four factors being examined, illustrating that interaction design is valuable for creating workarounds for the cognitive symptoms of depression that pose obstacles to successful completion of CBT homework. Using the psychology-based principles and guidelines of user experience and user interface design as well as incorporating gamification features in the design of a mobile application for the iPhone, CBT homework exercises intended for depression were successfully enhanced.

### **Future Research**

Further exploration of the Refocus app's potential in the treatment of depression includes, but is not limited to, subsequent rounds of user testing with a larger sample size of random participants who are unfamiliar with CBT using the final version of the app containing the features suggested by clinicians during the last round of testing. A final test of the app's effectiveness with a small sample of depressed individuals would be beneficial as well. Collaboration with licensed CBT specialists or psychotherapists would be ideal in order to assure proper psychotherapeutic processes and material. Additionally, it must be determined that the app is compliant with the Health Insurance Portability and Accountability Act (HIPAA) guidelines where necessary before consulting with mobile developers to create a fully interactive version of the Refocus iPhone application.

This application was designed specifically for the iPhone, however alternate versions could be designed for Android and other platforms. Additionally, the iPad and other tablet devices could run the same type of interactive application with design

alterations for size and functionality. An online version of the Refocus app, in the form of a website with a secure login, could reach an even wider audience, making it available to anyone with Internet access, however the portability advantages would be lost if accessing it from a computer. In addition to multi-platform expansion, the Refocus app has the potential to reach a global audience if it were to be translated into other languages, and international graphic standards were taken into account. Finally, before making the app available for sale or public use, a full branding and identity system should be created, including enhancements to the graphic user interface.

While the Refocus app is not meant to be a substitute for professional therapy, it may provide an educational and supportive tool for those who do not have access to therapy, or who are unwilling to see a therapist due to fear or stigma. In this way, the Refocus app has the potential, with further research and development, to provide a portable resource to a large number of people seeking help.



## APPENDIX SECTION

### APPENDIX A

Table A1. Ten Types of Twisted Thinking (distorted thoughts) (Burns, 1999).

1.	All-or-nothing thinking	You look at things in absolute, black-and-white categories.
2.	Overgeneralization	You view a negative event as a never-ending pattern of defeat.
3.	Mental filter	You dwell on the negatives and ignore the positives.
4.	Discounting the positives	You insist that your accomplishments or positive qualities “don’t count.”
5.	Jumping to conclusions	(A) Mind reading—you assume that people are reacting negatively to you when there’s no definite evidence for this; (B) Fortune-telling—you arbitrarily predict that things will turn out badly.
6.	Magnification or minimization	You blow (usually negative) things way up out of proportion or you shrink their importance inappropriately (usually for positive achievements).
7.	Emotional reasoning	You reason from how you feel: “I feel like an idiot, so I really must be one.” Or “I don’t feel like doing this, so I’ll put it off.”
8.	“Should statements”	You criticize yourself or other people with “shoulds” or “shouldn’ts.” “Musts,” “oughts,” and “have tos” are similar offenders.
9.	Labeling	You identify with your shortcomings. Instead of saying “I made a mistake,” you tell yourself, “I’m a jerk,” or “a fool,” or “a loser.”
10.	Personalization and blame	You blame yourself for something you weren’t entirely responsible for, or you blame other people and overlook ways that your own attitudes and behavior might contribute to a problem.

Table A2. Ten Ways to Untwist Your Thinking (Rational Responses) (Burns, 1999).

1.	Identify the distortion	Write down your negative thoughts so you can see which of the ten cognitive distortions you're involved in. This will make it easier to think about the problem in a more positive and realistic way.
2.	Examine the evidence	Instead of assuming that your negative thought is true, examine the actual evidence for it. For example, if you feel that you never do anything right, you could list several things you have done successfully.
3.	The double-standard method	Instead of putting yourself down in a harsh, condemning way, talk to yourself in the same compassionate way you would talk to a friend with a similar problem.
4.	The experimental technique	Do an experiment to test the validity of your negative thought. For example, if, during an episode of panic, you become terrified that you're about to die of a heart attack, you could jog or run up and down several flights of stairs. This will prove that your heart is healthy and strong.
5.	Thinking in shades of gray	Instead of thinking about your problems in all-or-nothing extremes, evaluate things on a range from 0 to 100. When things don't work out as well as you hoped, think about the experience as a partial success rather than a complete failure. See what you can learn from the situation.
6.	The survey method	Ask people questions to find out if your thoughts and attitudes are realistic. For example, if you believe that public speaking anxiety is abnormal and shameful, ask several friends if they ever felt nervous before they gave a talk.
7.	Define terms	When you label yourself "inferior" or "a fool" or "a loser," ask, "What is the definition of 'a fool'?" You will feel better when you see that there is no such thing as "a fool" or "a loser."
8.	The semantic method	Simply substitute language that is less colorful and emotionally loaded. This method is helpful for "should statements." Instead of telling yourself "I shouldn't have made that mistake," you can say, "It would be better if I hadn't made that mistake."

Table A2. (Continued)

9.	Re-attribution	Instead of automatically assuming that you are “bad” and blaming yourself entirely for a problem, think about the many factors that may have contributed to it. Focus on solving the problem instead of using up all your energy blaming yourself and feeling guilty.
10.	Cost-benefit analysis	List the advantages and disadvantages of a feeling (like getting angry when your plane is late), a negative thought (like “No matter how hard I try, I always screw up”), or a behavior pattern (like overeating and lying around in bed when you’re depressed). You can also use the Cost-Benefit Analysis to modify a self-defeating belief such as, “I must always try to be perfect.”

Table A3. Burns' 4 Steps to Change the Way You Feel.

Step 1.	Describe the upsetting event.	(Example) I inadvertently let Luci use her sick brother's toothbrush. Now I feel tormented and can't sleep.			
Step 2.	Record your negative feelings and rate each one from 0 (the least) to 100 (the most). Use words like sad, anxious, angry, guilty, lonely, hopeless, frustrated, etc.				
Emotion	Rating	Emotion	Rating	Emotion	Rating
1. Anxious	90	3.		5.	
2. Guilty	90	4.		6.	
Step 3.	The Triple-Column Technique				
Automatic Thoughts Write your negative thoughts and estimate your belief in each one (0-100).		Distortion Identify the distortions in each Automatic Thought.		Rational Responses Substitute more realistic thoughts and estimate your belief in each one (0-100).	
1. If Luci gets a sore throat it will be my fault. <del>(100%)</del> (20%)		1. personalization; fortune-telling		1. I made an honest mistake. Luci probably won't get a sore throat. It won't be the end of the world if she does. I don't deserve to be punished like this. (100%)	
2. If Bess finds out, she will be angry with me. <del>(100%)</del> (20%)		2. fortune-telling; personalization		2. I don't know for certain that she'll blame me. If she is critical, I can apologize for making a mistake. If she continues to be angry and upset with me, I can tell her that I made an innocent mistake and that I'm uncomfortable with the way she's treating me. (100%)	
Step 4.	Outcome: Re-rate your belief in each Automatic Thought from 0 to 100 and put a check in the box that describes how you now feel.				
<input type="checkbox"/> not at all better		<input type="checkbox"/> somewhat better		<input type="checkbox"/> quite a bit better	
				<input checked="" type="checkbox"/> a lot better	

Table A4. Clinician Survey #1 Results.

### Clinician Survey 1

1.	Have you used cognitive behavior therapy (CBT) techniques in your practice?		YES		NO	
			100%		0%	
2.	What form of homework do you give your patients? (i.e., in-session exercises, workbook, handouts, etc.)					
	25% All of the above	25% Workbook	25% None		25% Handouts, books	
3.	Some patients may experience obstacles to completing their homework, such as low motivation, attention deficit, memory impairment, and indecisiveness. How well would you say the standard written format of CBT homework is effective in counteracting <u>low motivation</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		25%	50%	0%	0%	25%
4.	How well would you say the standard written format of CBT homework is effective in counteracting <u>attention deficit</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		0%	100%	0%	0%	0%
5.	How well would you say the standard written format of CBT homework is effective in counteracting <u>memory impairment</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		25%	50%	25%	0%	0%

Table A4. (Continued)

6.	How well would you say the standard written format of CBT homework is effective in counteracting <u>indecisiveness</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		25%	50%	0%	0%	25%

 = Favorable results

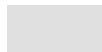
Table A5. Clinician Survey #2 Results.

## Clinician Survey 2

1.*	Do you feel the Refocus app would be beneficial to people suffering depression?	YES			NO	
		75%			0%	
2.*	Would you recommend the Refocus app to your patients?	YES			NO	
		75%			0%	
3.	Some patients may experience obstacles to completing their homework, such as low motivation, attention deficit, memory impairment, and indecisiveness. How well would you say the Refocus app is effective in counteracting <u>low motivation</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		0%	25%	50%	25%	0%
4.*	How well would you say the Refocus app is effective in counteracting <u>attention deficit</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		0%	25%	50%	0%	0%
5.	How well would you say the Refocus app is effective in counteracting <u>memory impairment</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		0%	25%	0%	25%	50%

Table A5. (Continued)

6.	How well would you say the Refocus app is effective in counteracting <u>indecisiveness</u> as an obstacle to CBT homework?	a) Not at all effective	b) Somewhat effective	c) Quite effective	d) Enormously effective	e) Not sure
		0%	25%	50%	0%	25%

 = Favorable results

\* One participant declined to answer, or did not provide an appropriate answer to the question.



## APPENDIX B



Figure B1a & b. Refocus Home screen and Refocus loading screen

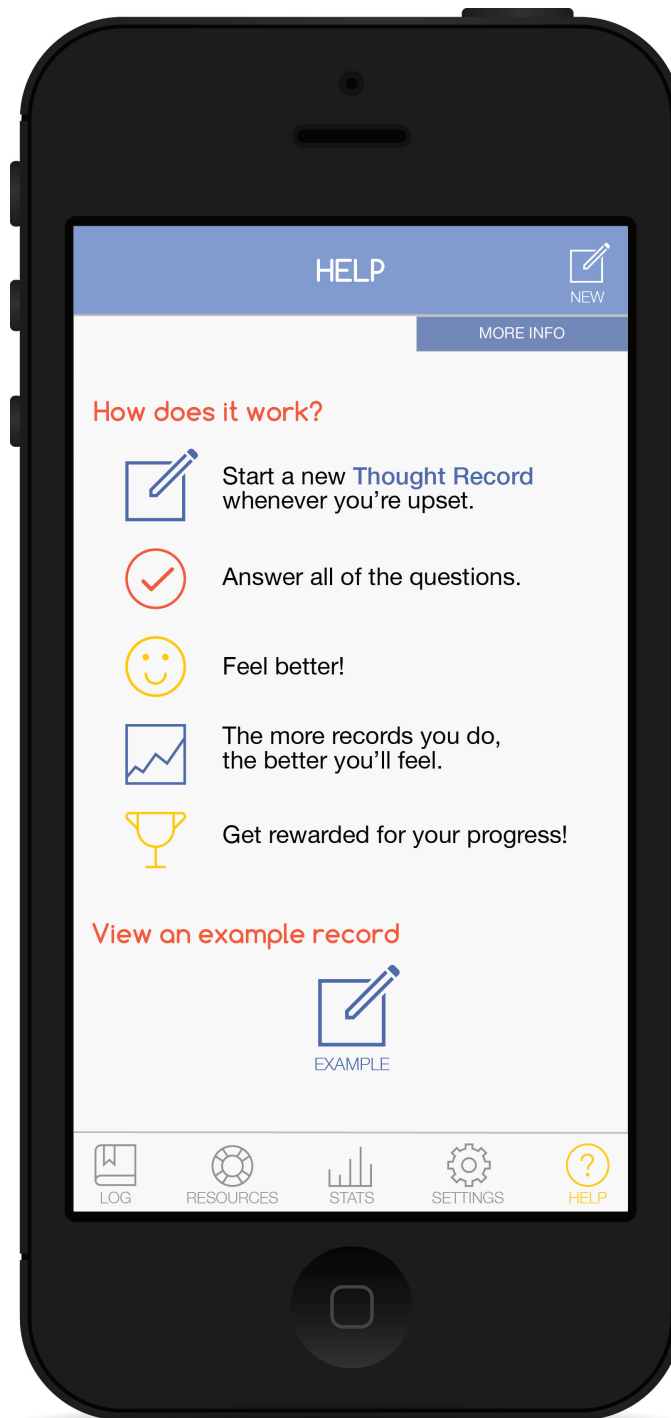


Figure B2. Refocus HELP screen

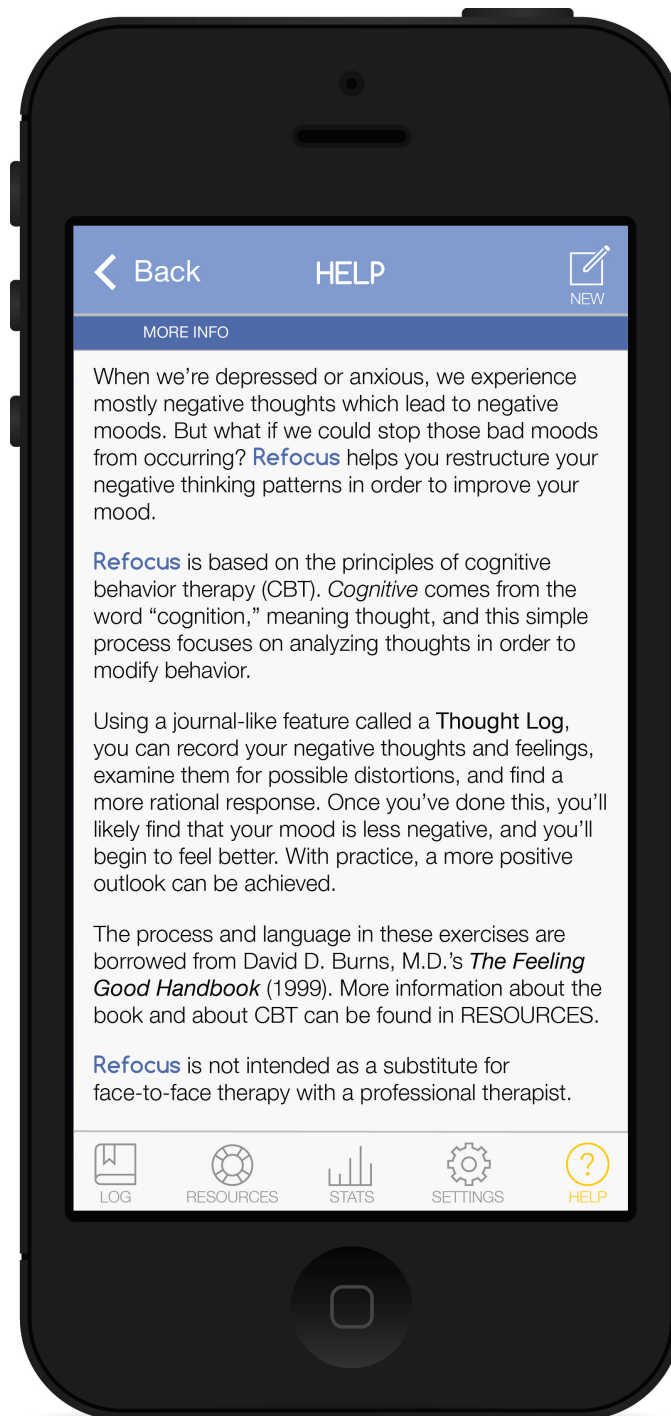


Figure B3. Refocus INFO screen

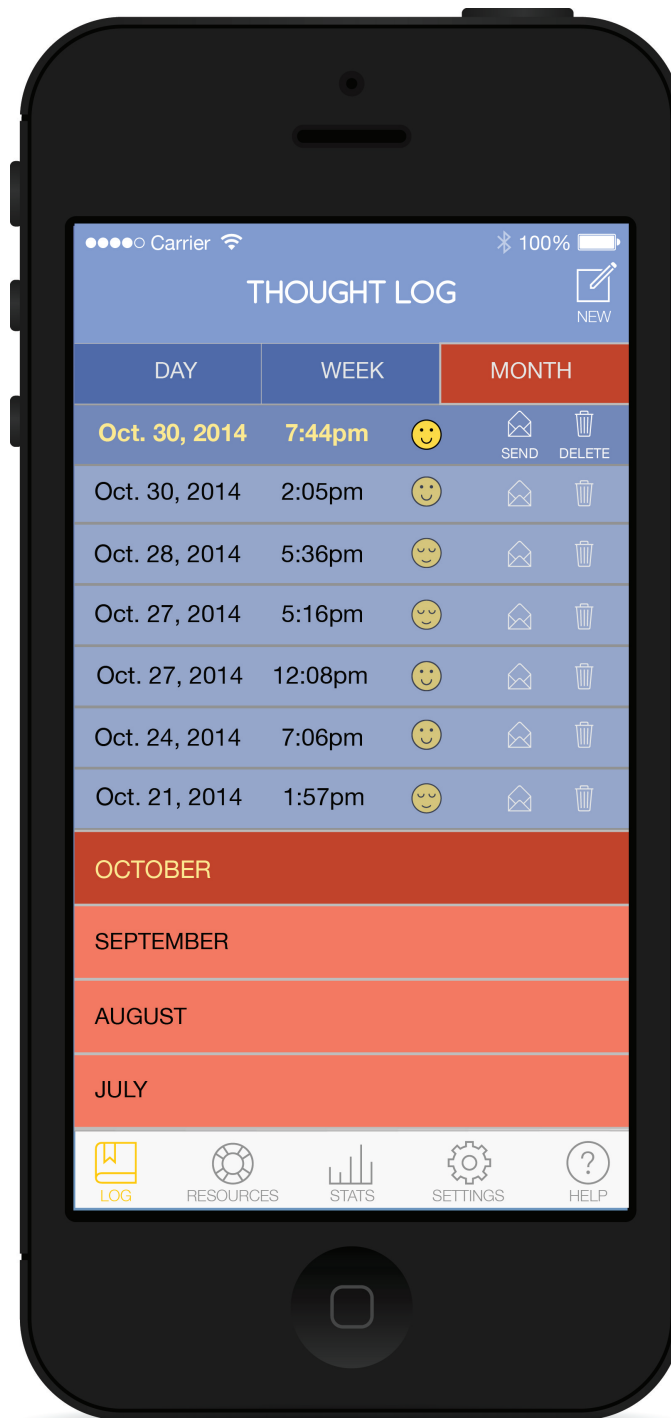


Figure B4. Refocus LOG screen

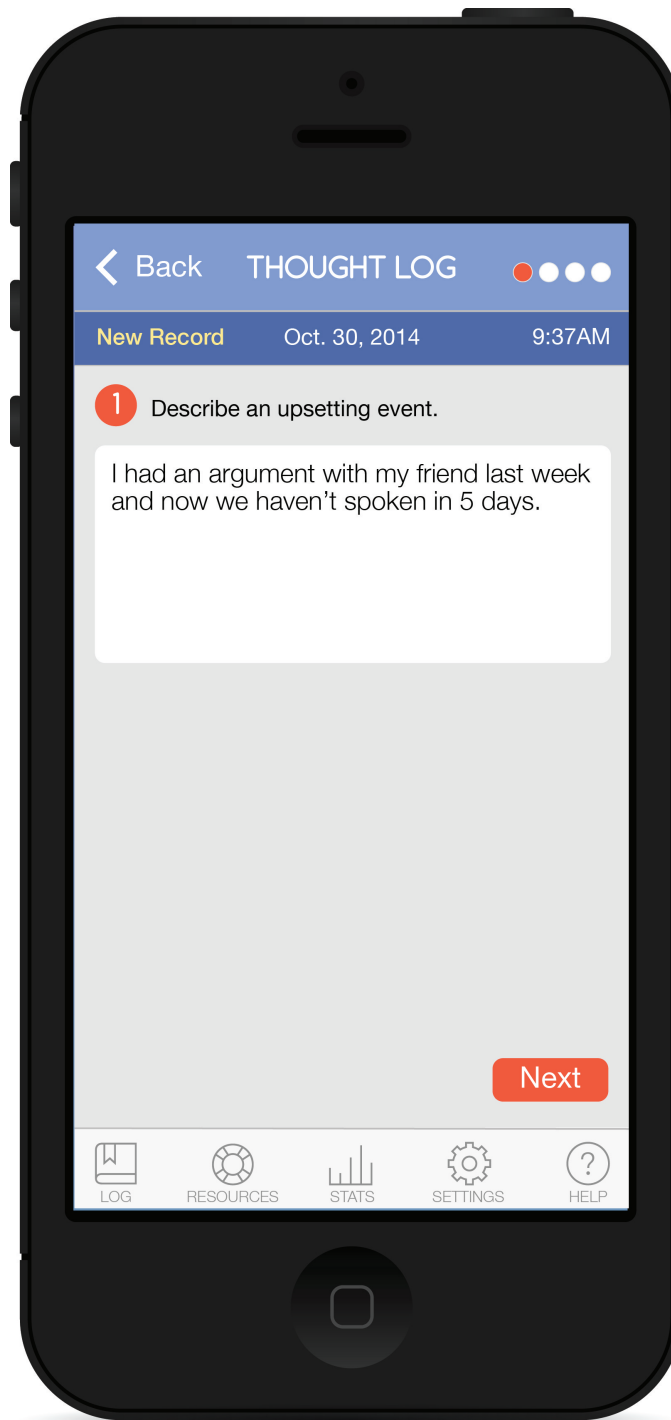


Figure B5. Refocus STEP 1 screen

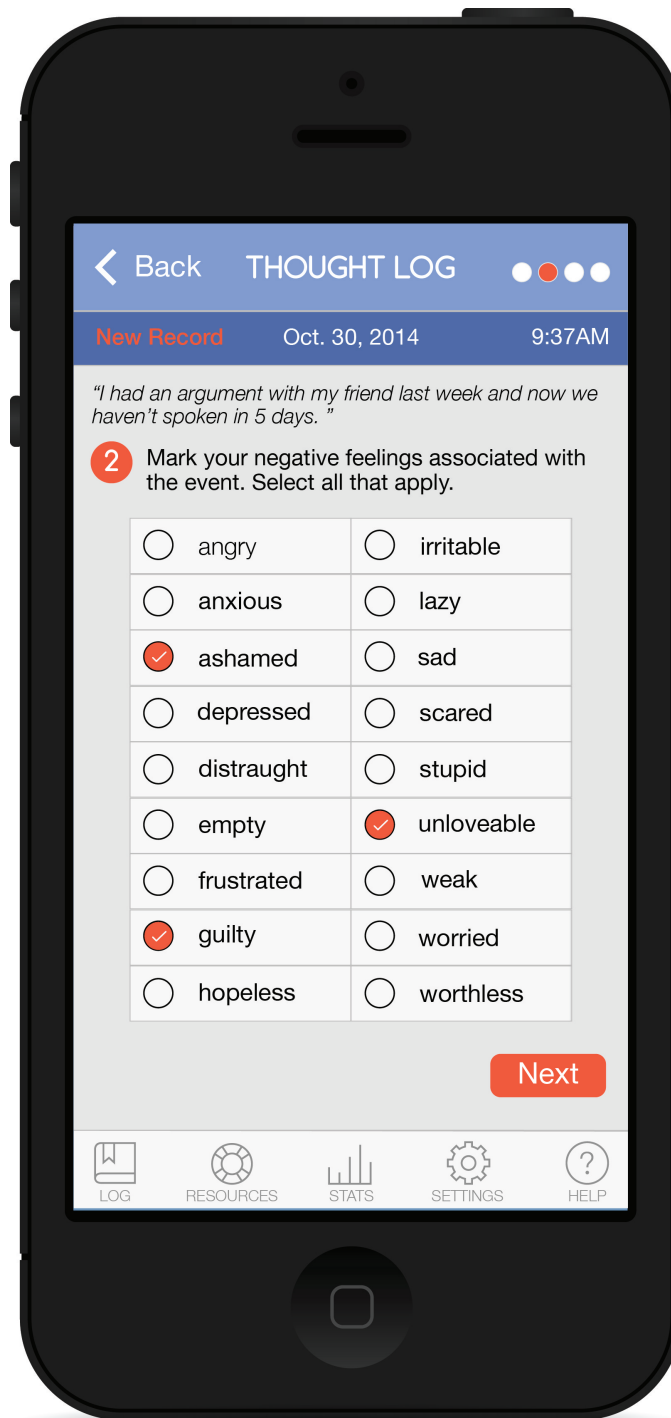


Figure B6. Refocus STEP 2 screen

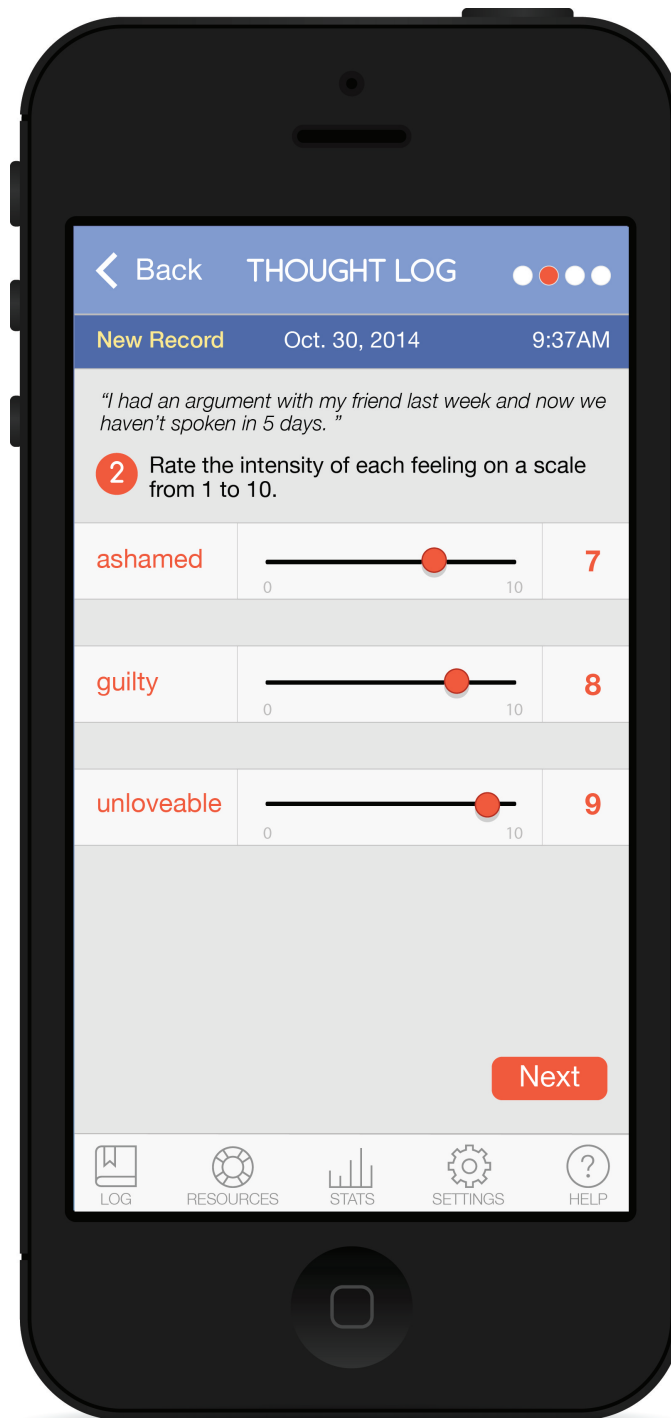


Figure B7. Refocus STEP 2a screen

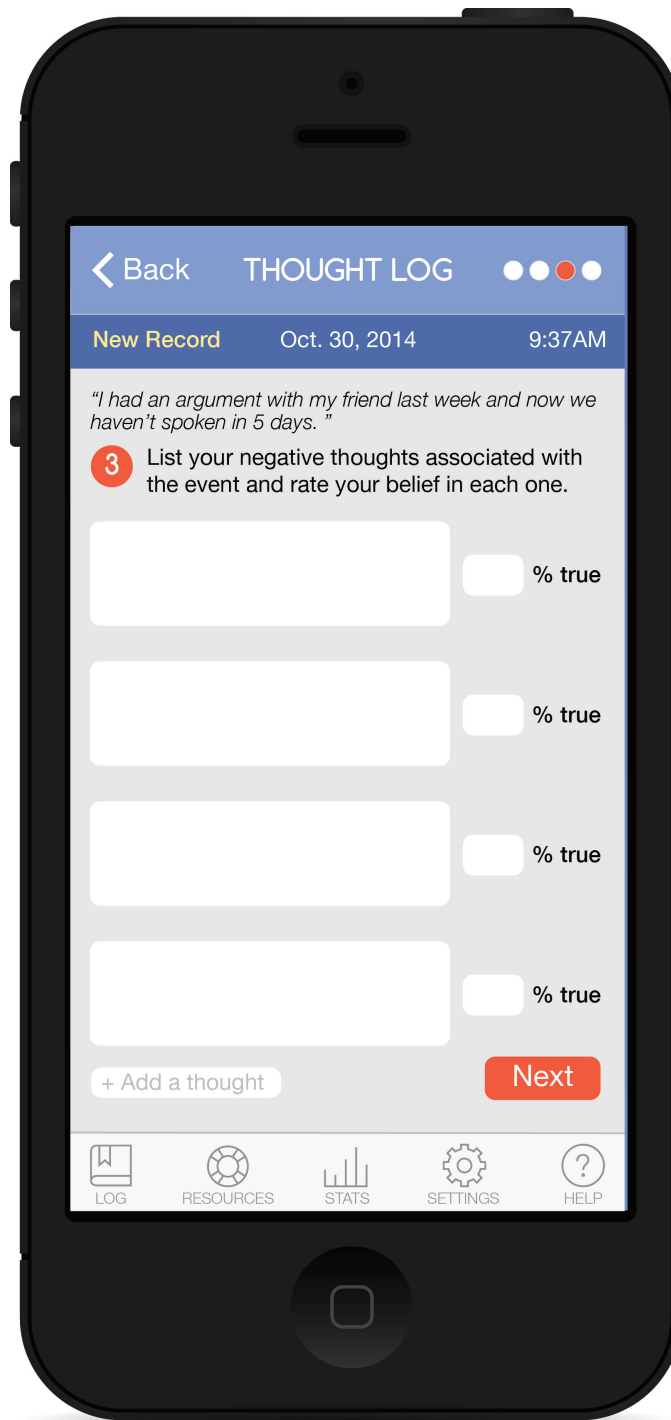


Figure B8. Refocus STEP 3 screen



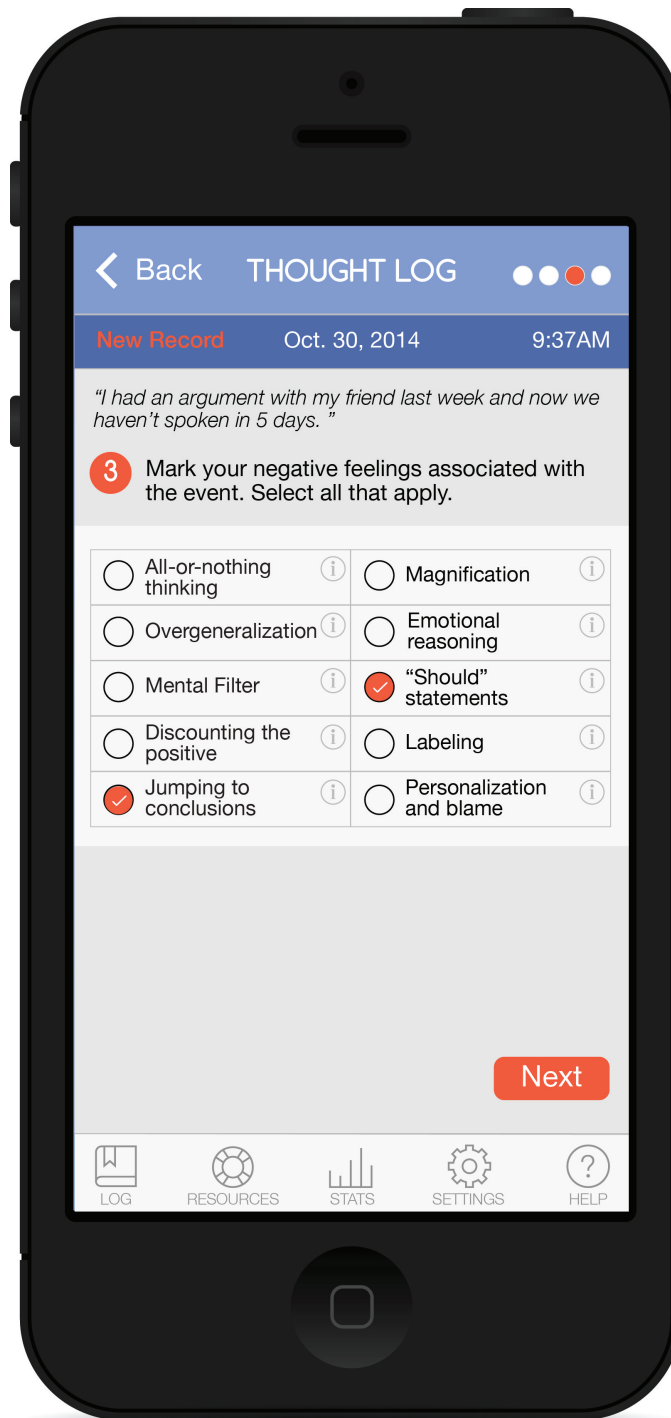


Figure B9. Refocus STEP 3a screen

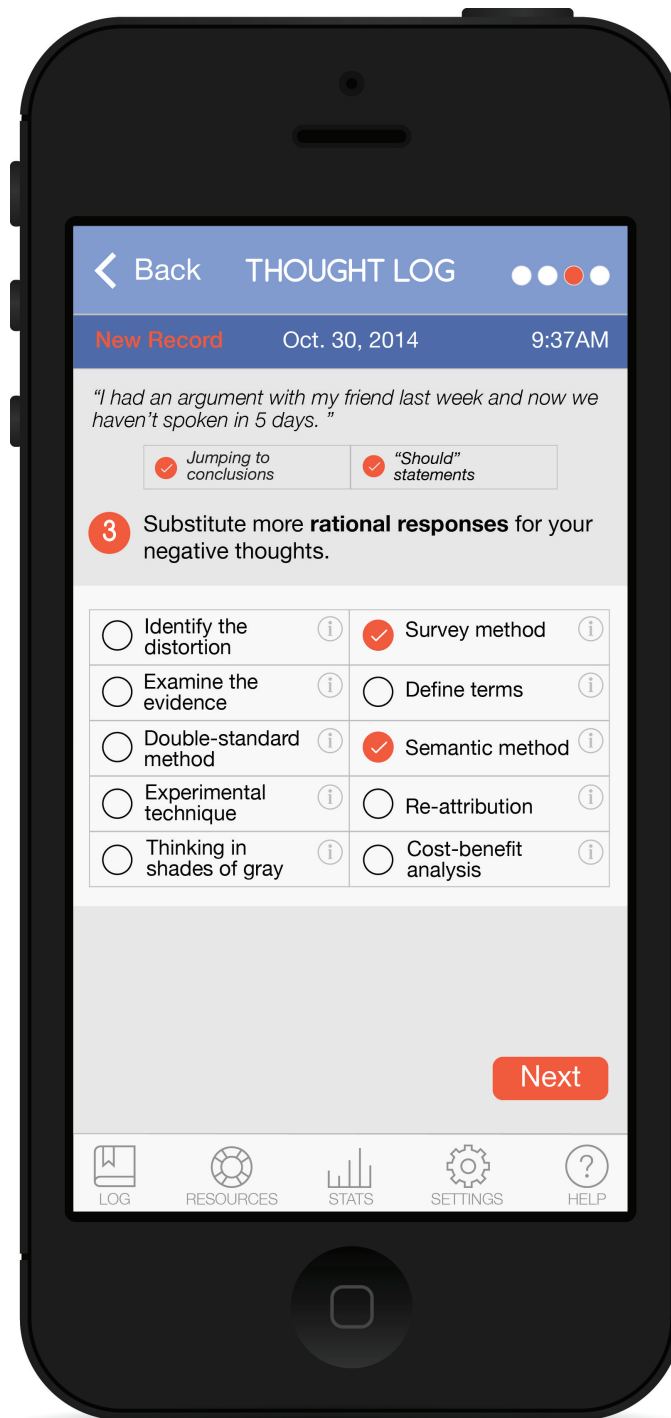


Figure B10. Refocus STEP 3b screen

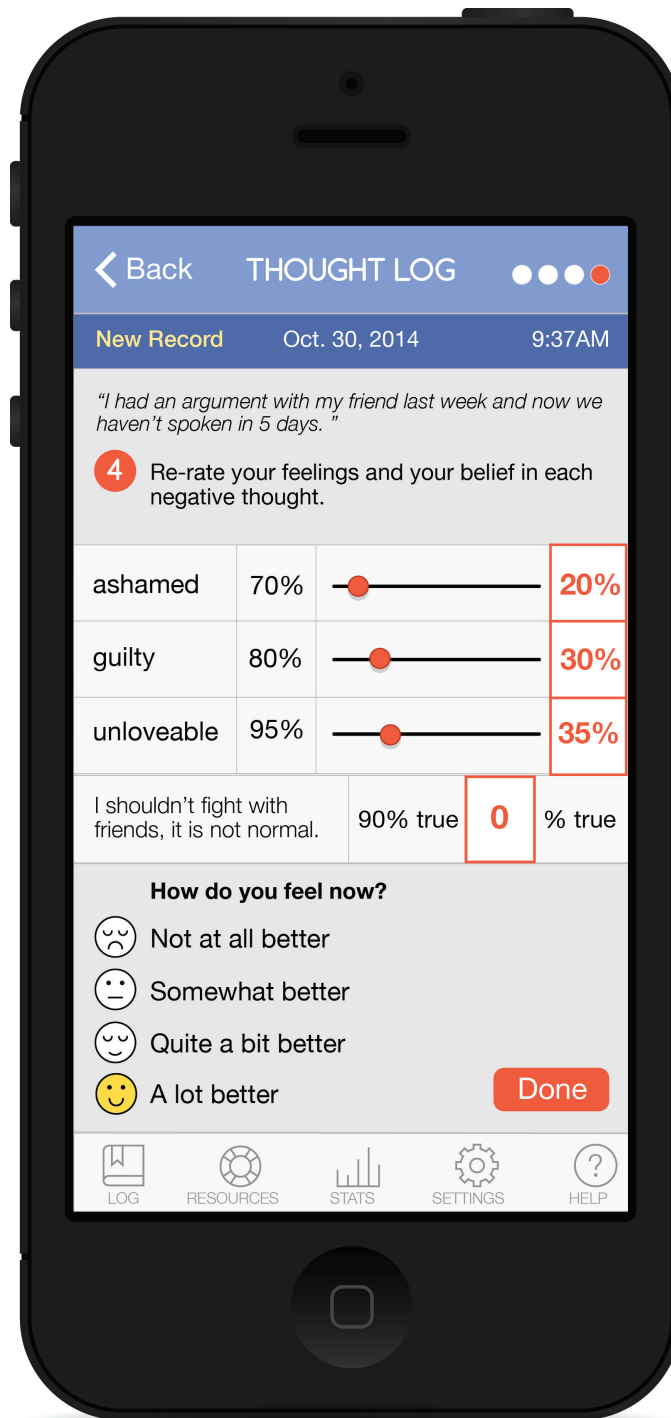


Figure B11. Refocus STEP 4 screen



Figure B12a & b. Partial views of the Refocus MY STATS screen.

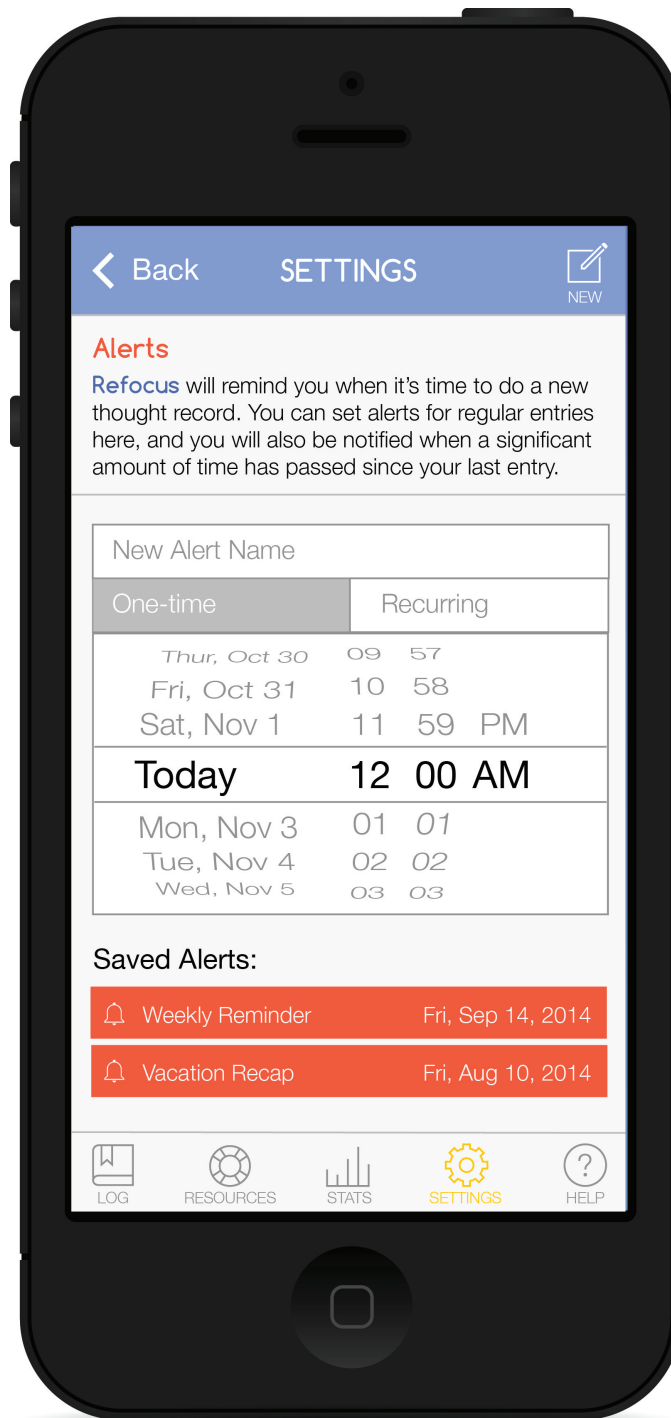


Figure B13. Refocus SETTINGS screen

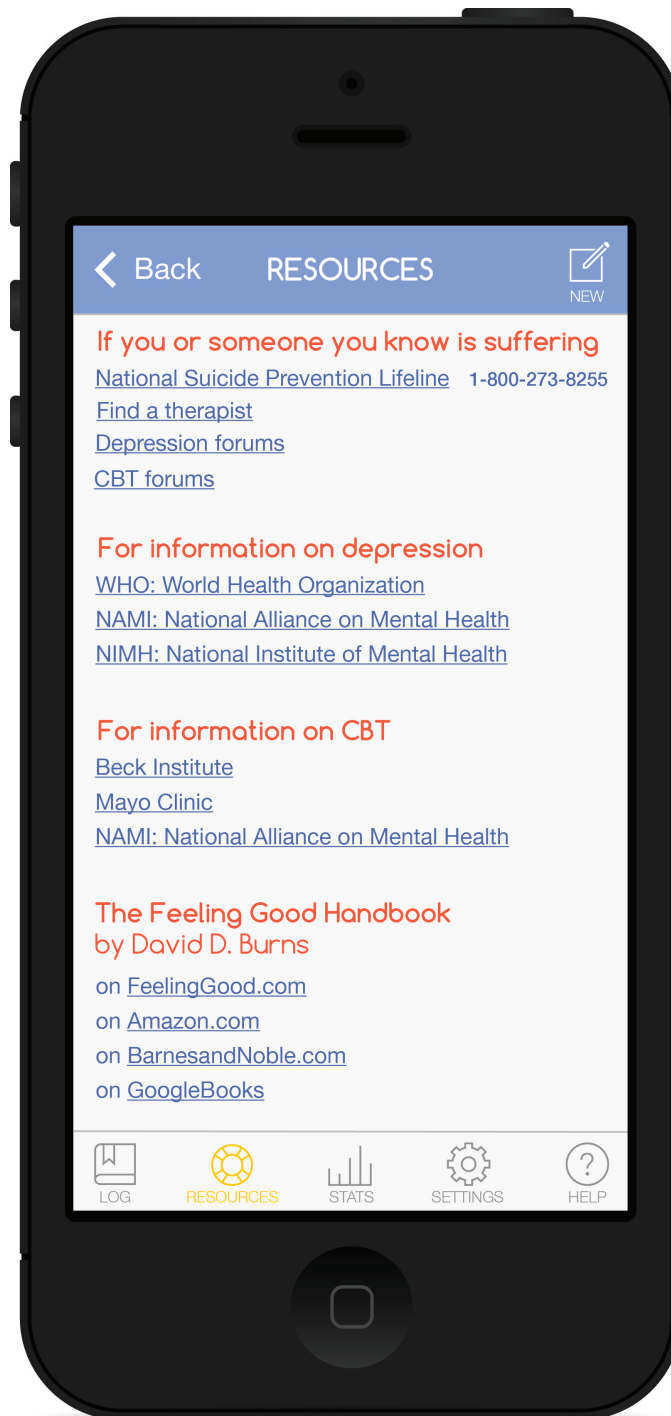


Figure B14. Refocus RESOURCES screen

## REFERENCES

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC.
- Antonuccio, D. (1995). Psychotherapy for depression: No stronger medicine. *American Psychologist*, 50(6), 450-452. doi:10.1037/0003-066X.50.6.450
- Banga, C., & Weinhold, J. (2014). *Essential mobile interaction design: perfecting interface design in mobile apps* [electronic resource]. Upper Saddle River, NJ: Addison-Wesley.
- Beck, A. T. (1967). *Depression: causes and treatment*. Philadelphia: University of Pennsylvania Press.
- Beck, A. T. (1979). *Cognitive Therapy of Depression*. New York: Guilford Press.
- Beck, J. S. (2011). *Cognitive Behavior Therapy: Basics and beyond*. New York: Guilford Press.
- Beckham, E. E., & Leber, W. R. (1995). *Handbook of Depression* (2nd ed.). New York: Guilford Press.
- Boschen, M. J., & Casey, L. M. (2008). The use of mobile telephones as adjuncts to cognitive behavioral psychotherapy. *Professional Psychology: Research and Practice*, 39(5), 546-552. doi:10.1037/0735-7028.39.5.546
- Burns, D. D. (1999). *The Feeling Good Handbook* (Revised ed.). New York: Plume.
- Carroll, K. M., Ball, S. A., Martino, S., Nich, C., Babuscio, T. A., Nuro, K. F., . . . Rounsaville, B. J. (2008). Computer-assisted delivery of cognitive-behavioral therapy for addiction: a randomized trial of CBT4CBT. *American Journal of Psychiatry*, 165(7), 881-888.
- Cuijpers, P., Donker, T., van Straten, A., Li, J., & Andersson, G. (2010). Is guided self-help as effective as face-to-face psychotherapy for depression and anxiety disorders? A systematic review and meta-analysis of comparative outcome studies. *Psychological Medicine*, 40(12), 1943-1957  
doi:10.1017/S0033291710000772
- Davis, A. N. (2005). Invisible Disability. *Ethics*, 116(1), 53-213. doi:0.1086/453151
- Dubberly, H., Evenson, S., Pangaro, P., Mehta, R., (2010, May + June). Reframing Health to Embrace Design of Our Own Well-Being. *Interactions*. XVII(3), 56. Retrieved from <http://interactions.acm.org/archive/view/may-june-2010/reframing-health-to-embrace-design-of-our-own-well-being>

- eMarketer, (2014, January 16). Smartphone Users Worldwide Will Total 1.75 Billion in 2014. Retrieved November 1, 2014 from <http://www.emarketer.com/Article/Smartphone-Users-Worldwide-Will-Total-175-Billion-2014/1010536#sthash.7FjqK1dd.dpuf>
- Excel at Life, LLC. (October 12, 2014). Excel at Life Android Self-Help Apps. Retrieved February 10, 2014, from <http://www.excelatlife.com/>
- Fitbit, Inc., (2014) Fitbit (Version 2.5) [Mobile application software]. Retrieved from <https://itunes.apple.com/us/app/fitbit-activity-calorie-tracker/id462638897?mt=8&ign-mpt=uo%3D4>
- Greenberger, D., & Padesky, C. A. (1995). *Mind Over Mood: Change How You Feel By Changing the Way You Think*. New York: Guilford Press.
- Gube, J. (October 5, 2010). What is User Experience Design? Overview, Tools and Resources. *Smashing Magazine*. From <http://www.smashingmagazine.com/2010/10/05/what-is-user-experience-design-overview-tools-and-resources/>
- iCouchInc. iCouch. Retrieved February 10, 2014, from <http://secure.icouch.me/>
- Insel, T. M.D., (June 3, 2013). Directors Blog: A National Dialogue [blog post]. Retrieved from <http://www.nimh.nih.gov/about/director/2013/a-national-dialogue.shtml>
- Johnson, J. (2010). *Designing With the Mind in Mind: A Simple Guide to Understanding User Interface Design Rules*. Amsterdam: Morgan Kaufmann/Elsevier.
- Kapp, K. M. (2012). *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education* (Kindle ed.). San Francisco, CA: Pfeiffer.
- Kazantzis, N., Whittington, C., & Dattilio, F. (2010). Meta-Analysis of Homework Effects in Cognitive and Behavioral Therapy: A Replication and Extension. *Clinical Psychology: Science and Practice*, 17(2), 144-156. doi:10.1111/j.1468-2850.2010.01204.x
- Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of dsm-iv disorders in the national comorbidity survey replication. *Archives of General Psychiatry*, 62(6), 593-602. doi:10.1001/archpsyc.62.6.593
- Kessler, R. C., Ph.D., (2012). The Costs of Depression. *Psychiatric Clinics of North America*, 35(1), doi:10.1016/j.psc.2011.11.005.



- Kolko, J., (2011). *Thoughts on Interaction Design*. (2nd ed.). Burlington, MA: Morgan Kaufmann/Elsevier.
- Krug, S. (2006). *Don't Make Me Think!: A Common Sense Approach to Web Usability*. (2nd ed.). Berkeley, CA: New Riders.
- Kuhn, K. A., Warren, J. R., Leong, T.-Y., Bang, M., Timpka, T., Eriksson, H., . . . Nordin, C. (2007). Mobile Phone Computing for In-situ Cognitive Behavioral Therapy. *Studies in Health Technology & Informatics*, 129, 1078.
- Marrs, R. W. (1995). A meta-analysis of bibliotherapy studies. *American Journal of Community Psychology*, 23(6), 843.
- Martin, B., & Hanington, B. M. (2012). *Universal Methods of Design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions* [electronic resource] Bella Martin, Bruce Hanington. Beverly, MA: Rockport.
- McCandless, D. (2012) *The Visual Miscellaneum: A Colorful Guide to the World's Most Consequential Trivia*. New York, NY: Collins Design.
- Ming, L. M. (2014). UI, UX: Who Does What? A Designer's Guide To The Tech Industry. *Fast Company*. from <http://www.fastcodesign.com/3032719/ui-ux-who-does-what-a-designers-guide-to-the-tech-industry>
- National Alliance on Mental Illness. Depression: What is Depression? NAMI: National Alliance on Mental Illness- Mental Health Support, Education and Advocacy. Retrieved September 13, 2013, from <http://www.nami.org/template.cfm?section=Depression>
- National Institute of Mental Health. *Depression*. In U.S.D.o.H.H. Services (Ed.), (Vol. 11-3561): NIH Publications.
- Norman, D., (2004). *Emotional Design: Why We Love (or Hate) Everyday Things*. New York, NY: Basic Books.
- Solomon, A. (2001). *The Noonday Demon: An Atlas of Depression* (Kindle ed.). New York, NY: Simon & Schuster.
- U.S. Department of Veterans Affairs (January 28, 2014). Mobile Apps: CBT-i Coach. Retrieved February 10, 2014, from <http://www.ptsd.va.gov/public/materials/apps/cbti-coach-app.asp>

- Watts, S., Mackenzie, A., Thomas, C., Griskaitis, A., Mewton, L., Williams, A., & Andrews, G. (2013). CBT for depression: a pilot RCT comparing mobile phone vs. computer. *BMC Psychiatry*, 13, 49-49. doi:10.1186/1471-244X-13-49
- Weinschenk, S., Ph.D., (2011). *100 Things Every Designer Needs to Know About People* (Kindle ed.). Berkeley, CA: New Riders.
- World Health Organization. (2008). The Global Burden of Disease. In W. H. Organization (Ed.). Switzerland: WHO Press.
- World Health Organization. (2012). *Depression*. Retrieved August 5, 2014, from <http://www.who.int/mediacentre/factsheets/fs369/en/>