

ECE1778 – Winter 2014



Ilona Wong | Mario Badr | Sharon To

Document: 1998 words

Apper Context: 496 words

Source: MyAlly_impl.zip

Repository: <https://code.google.com/p/my-ally/>

Video Permission: Yes

myAlly Final Report

myAlly is an android application that allows adolescents to practice skills from Dialectical Behaviour Therapy (DBT). This document introduces DBT, demonstrates how myAlly uses DBT to help adolescents, and provides a description of how the app was implemented. The document concludes with a discussion on what we learned when implementing the app, as well as future work to be completed.

1 Dialectical Behaviour Therapy

Dialectical Behaviour Therapy (DBT) is a well-established treatment method that combines traditional cognitive-behavioural techniques with mindfulness techniques derived from Zen meditation practice. The premise of this therapy is that, while we cannot control the suffering in our lives, we can control our response and tolerance. DBT provides the tools to help achieve this goal. It was originally developed for chronically parasuicidal adult women diagnosed with borderline personality disorder [1]. Recently, however, emerging research has demonstrated the efficacy of adapting DBT to treat adolescents engaging in self-injurious or suicidal behaviours [2][3].

Dialectical Behaviour Therapy targets emotional dysregulation by teaching DBT skills to alleviate adolescents from performing maladaptive problem behaviours. For example, suicidal adolescents often experience a spike of intense, overwhelming emotions that lead to urges for ineffective, destructive behaviours (e.g. self-harm or attempted suicide). DBT teaches four critically important skills (mindfulness, distress tolerance, emotion regulation, and interpersonal effectiveness) to decrease emotional reactivity to overwhelming emotions and to regulate emotional response.

myAlly adapts some DBT skills so that they meet the developmental needs of adolescents. The goal is to provide activities that are easily accessible and fun, so that users of the app are more inclined to practice DBT skills daily. This way, in times of a crisis, the user is well versed in activities that can help deescalate their intense emotions, avoiding destructive behaviours.

2 How myAlly Works

The myAlly home screen presents users with a picture of a park, where a young girl is studying near a tire swing (Figure 2); we want users to associate myAlly with the feelings of calmness and serenity. This is further emphasized with motivational/inspirational quotes fading in and out at the top of the home screen.

Two buttons are prominently displayed on the home screen: **Crisis** and **Diary Card**. Other features of the app, such as a list of activities that can be performed, are made accessible via a navigation drawer on the left. Currently, myAlly provides five different activities adapted from DBT skills that the user can practice or use in times of a crisis (Figure 2). The user can favourite a certain activity by enabling the tire next to it. In this section, we will discuss the different components and activities available in myAlly, as well as incomplete components that will be addressed in future work.

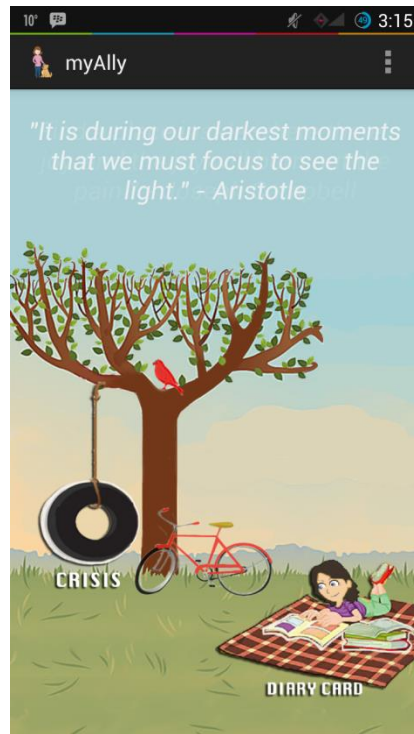


Figure 2 – myAlly homescreen

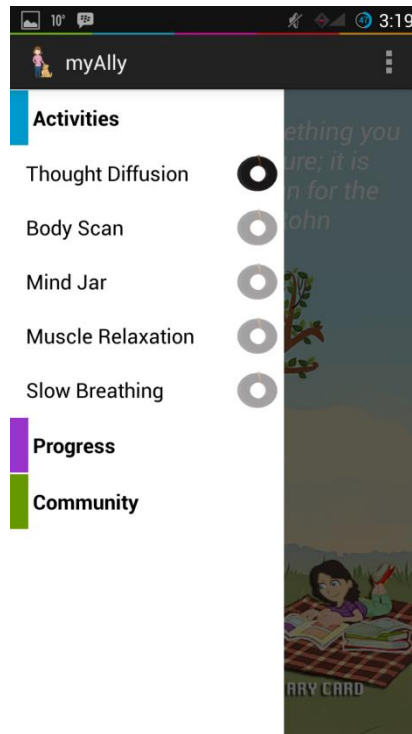


Figure 2 – Navigation drawer showing other activities available.

2.1 Diary Card

The use of a diary card helps users (and their therapist) determine what needs to be targeted in treatment, increases mindfulness of problem behaviours and patterns, and helps change targeted behaviours. A traditional diary card is shown in Appendix A, which can be quite complex. One of the biggest challenges faced by clinicians is getting their adolescent patients to fill out their diary card daily. To alleviate this issue, myAlly first makes the diary card easily accessible (Figure 3), and second simplifies the diary card to a quick-and-easy way to track emotions and urges. This is done by presenting the user with two screens, one for emotions and the other for urges, and providing simple sliders to rate these emotions/urges on a scale of 0 to 5 (Figure 3).

2.2 Crisis

When a user is in crisis, they can click on the Crisis button from the home screen. myAlly first attempts to help users recognize how they are feeling subjectively and then records an objective measure of their heart rate Figure 4. myAlly will then launch the user's favourite crisis activity. This is similar to the approach used in therapy sessions, where users pre-select their preferred activities for times of crisis. After they complete the activity, myAlly again asks the users for their subjective feeling and records their heart rate. This is a form of biofeedback, which can help a user calm down mentally. They will see that their heart rate has indeed gone down despite whether or not they are telling themselves they are still stressed.

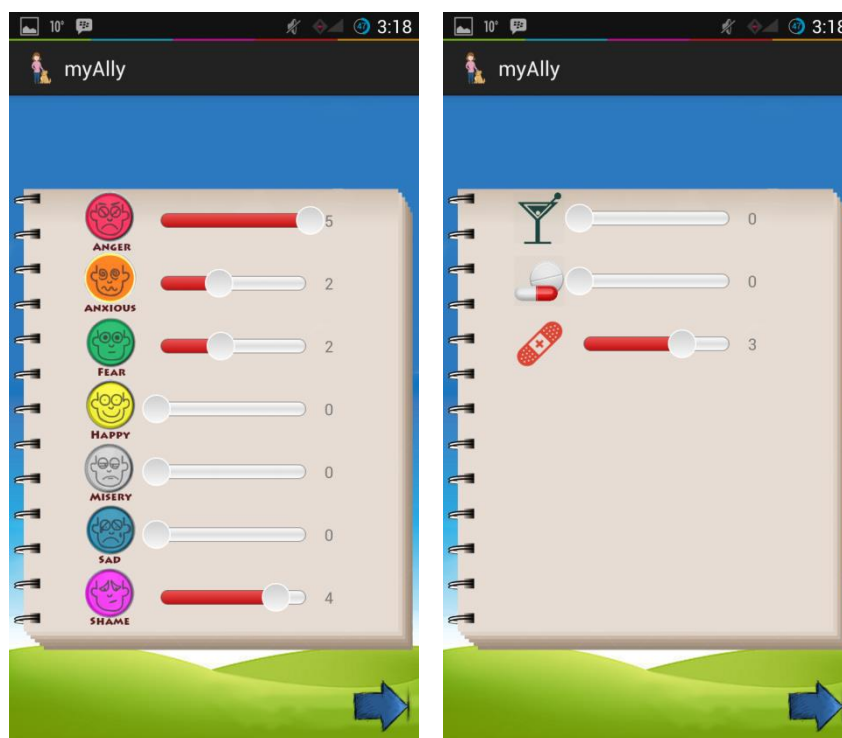


Figure 3 – Emotion tracking (left) and urge tracking (right) for the simplified Diary Card used in myAlly.

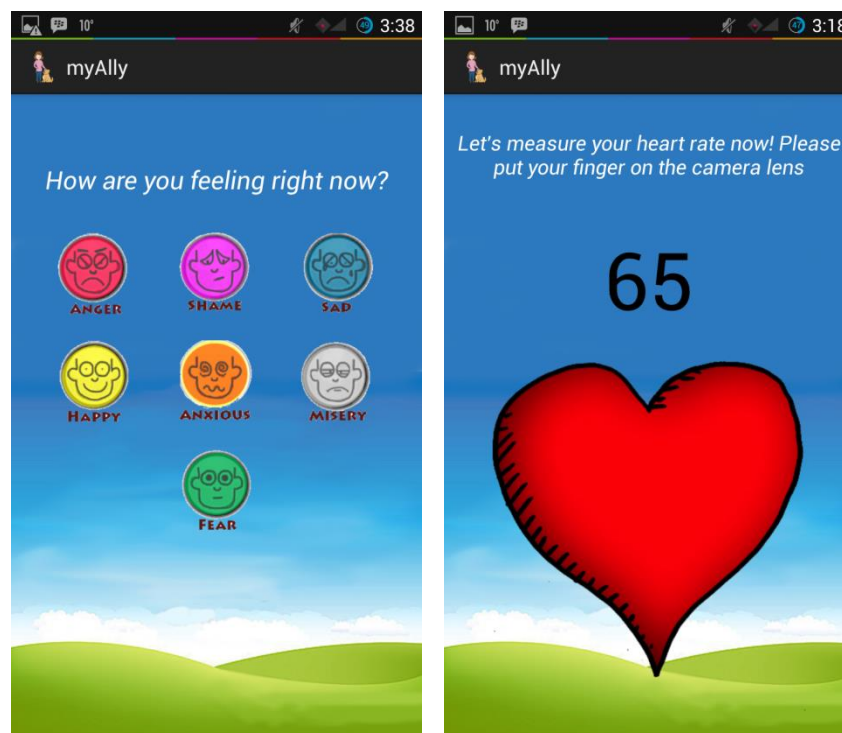


Figure 4 – Subjective measure of the user's feeling (left) and objective measure of their heart rate (right) before and after a crisis activity.

2.3 Thought Diffusion

This exercise helps the user mindfully observe thoughts come and go (Figure 5). With practice, this skill will give one the freedom to choose the thoughts one wants instead of getting stuck on unwanted thoughts that often lead to overwhelming emotions. If the user attempts to push thoughts away (by swiping it away from the screen), they will bounce back. This is analogous to what happens in your mind – the more you try to push away certain thoughts, the more they may cause distress.

2.4 Mind Jar

In this activity, each snowflake represents a thought as it flurries around in your mind (Figure 5). A hectic life and distressing situations are analogous to shaking the phone, which keeps the snowflakes from settling down at the bottom. Instead of getting into the “auto-pilot” mode of reacting to a stressful situation, the activity teaches the users to slow down and allow one’s thoughts to settle before reacting to the distress.

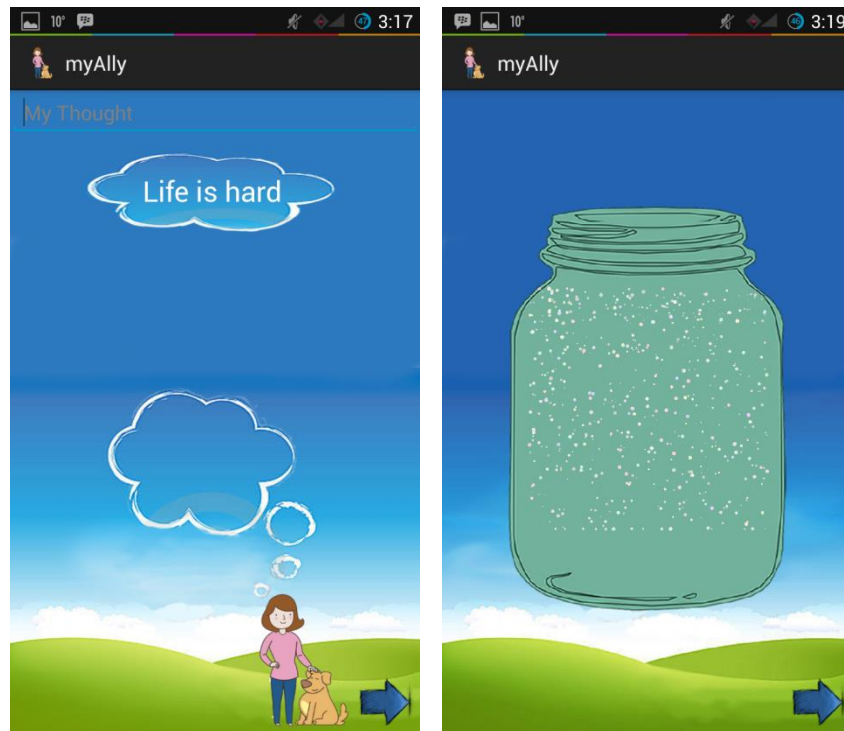


Figure 5 – Thought Diffusion (left) and Mind Jar (right) activities.

2.5 Body Scan

This exercise helps users to restore a connection with the body by becoming aware of its different regions (Figure 6). It involves a thorough and minute focus on the body, noticing any tensions, pain or other sensations. The activity guides users to scan different parts of their body and allows them to highlight in red the parts where they feel tension/discomfort. This information is then fed into the next activity, Muscle Relaxation.

2.6 Muscle Relaxation

This exercise consists of instructing the users to tense and relax various muscle groups in sequence (Figure 6). Attending to this contrast assists users to develop awareness of tense and relaxed states and promote relaxation. In the top right hand corner, there is also a balloon that expands and contracts and helps regulate the user's breathing in conjunction with the tensing and relaxing.

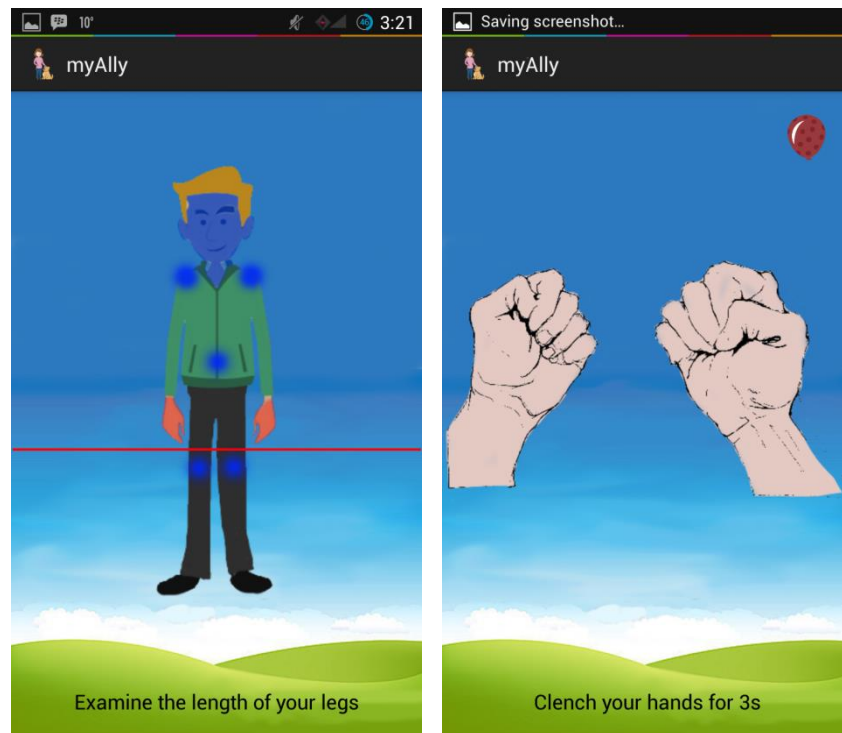


Figure 6 – Body Scan (left) and Muscle Relaxation (right) activities.

2.7 Deep/Diaphragm Breathing

The user is guided to take slow deep breaths following the visual guide of an inflating and deflating balloon. In contrast to the shallow and fast breaths one would experience during stressful times, deep breathing would help the body calm down. The heart rate measured during the breathing exercise provides users with a form of biofeedback, so that they can monitor physiological indices of relaxation or arousal. This information would provide objective data to the user on how they can be in control of their physiological reactions, despite being in a stressful situation.

2.8 Progress

In the drawer on the main screen, there are also two other options other than the activities. One is the progress screen, which displays the user's emotion and behavioural patterns, as well as tracks skills practiced throughout the week. This is not fully implemented in the application yet due to time constraints.

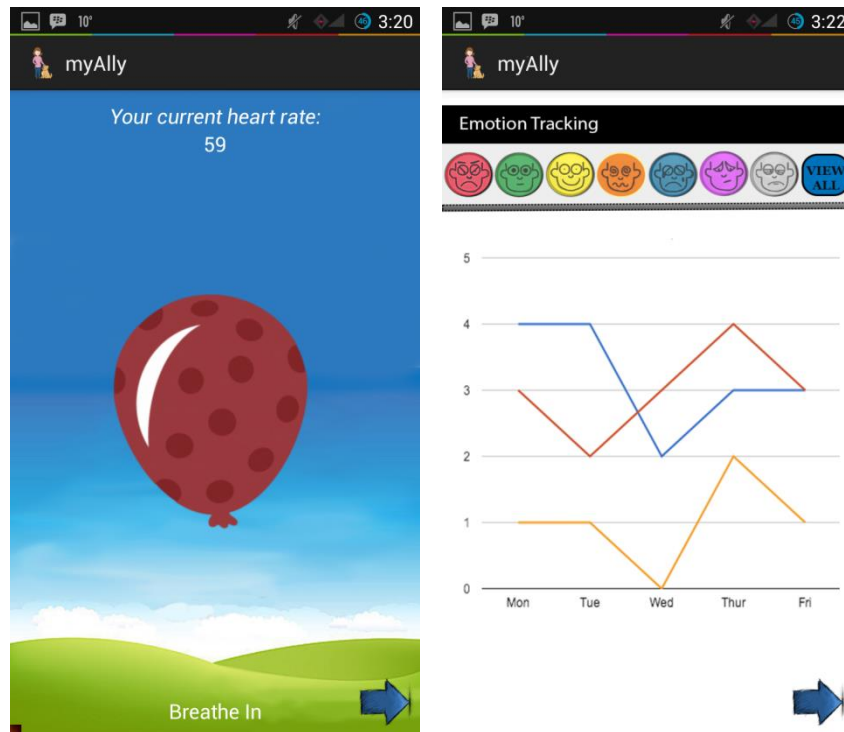


Figure 7 – Deep Breathing Activity (left) and Progress Screen (right)

2.9 Community

The last option in the drawer menu is the community screen, where users can see other people around them and their current moods. They cannot communicate with each other for security reasons, but just knowing that other people are out there feeling the same way can help the users cope and develop a sense of community that they are not going through this journey alone. The server part of this is not implemented yet due to time constraints and neither programmers having much experience in this topic.

3 myAlly Implementation and Design

myAlly's implementation is divided into two main packages: dbt and detectors. The detectors package contains classes that detect heart rate, fling gestures, and the phone shaking, and is shown as functional blocks in Figure 8. The dbt package contains implementations of each activity as explained in Section 2, and will impact the Visualization block in Figure 8.

- Fling Detector: Wrapper for a GestureDetector that only detects flings with a velocity in x and y.
- Shake Detector: Notifies a listener if a phone has shaken based on current and past accelerometer data
- Heart Rate Detector: Processes the redness of an image of the user's finger to determine heart rate (Appendix B)
- Visualization: Different graphics are displayed depending on the activity/component
- Log: A database that stores data for the various activities/components

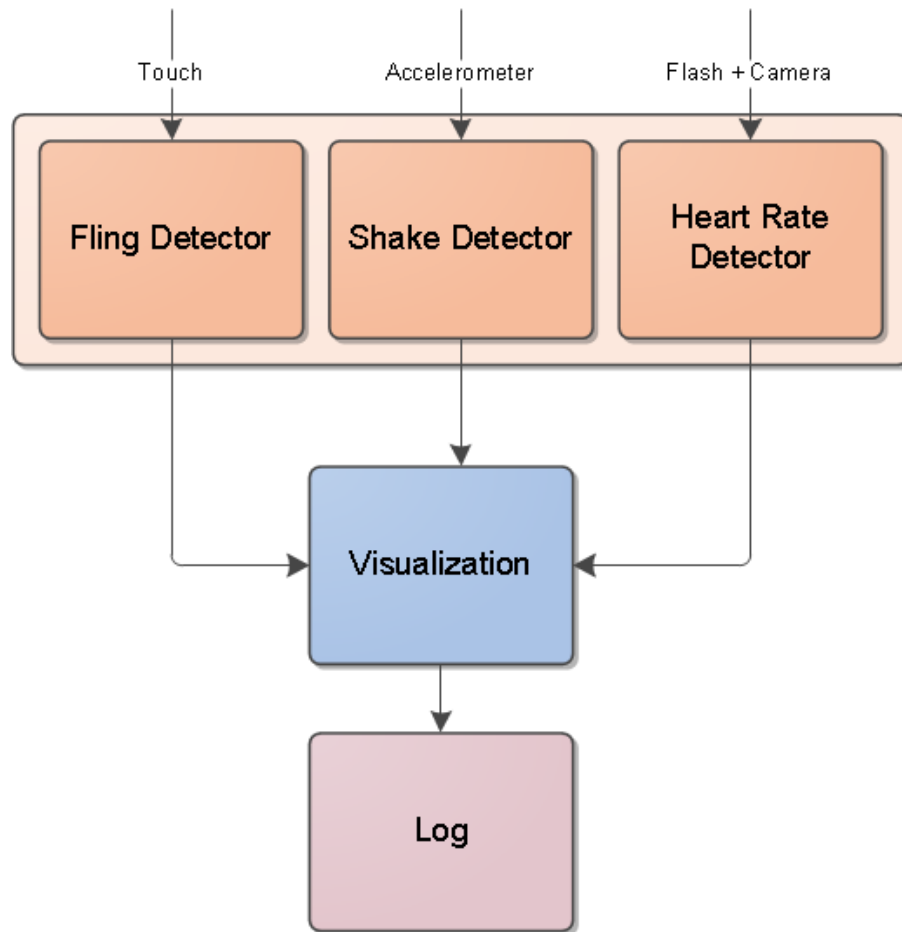


Figure 8 – Block Diagram of myAlly

Some activities required animation, which required some knowledge of game programming. Most animation based activities used a View that inherited from a custom AnimatedView class that caused updates and drawing refreshes at a specified frame rate. Figure 9 shows how this can be achieved by starting a new thread every certain number of milliseconds – the next thread is invoked by the last, creating an animation loop that is paused and finished in tandem with the lifetime of the View.

```
protected void onDraw(Canvas c) {
    onDrawAnimation(c);

    //Delay the next update by FRAME_RATE milliseconds
    _h.postDelayed(_game_loop, _frameRate);
}

private Runnable _game_loop = new Runnable() {
    @Override
    public void run() {
        if(!_paused) {
            onUpdate(); //Update locations/speed
            invalidate(); //Update visuals (ends up calling onDraw)
        }
    }
};
```

Figure 9 – Java code for how a screen can be updated at a specified frame rate.

An important thing to note here is synchronization between data. For example, the Mind Jar activity has two states: Shaken, and Not Shaken. When the phone is shaken, each snowflake's position and velocity must change, however this can occur while the snowflakes themselves are being updated. Wrapping snowflake code in a Java *synchronize* block will not work because it simply locks the object. To achieve the necessary effect, one must use a static variable, which ensures there is only one instance of the data type in the entire class (you could also use static synchronize, however this results in too much overhead and slows down the animation due to locks).

4 Lessons Learned

The key thing we would have done differently for myAlly is to establish ahead of time what user information needed to be tracked and stored. In this way, we could have established an interface for which activities could feed information into, simplifying the Community and Progress components that have been left for future work.

The progress component is important because it would have shown users which activities they benefit most from and how their emotions and urges are changing over time. This results in a sort of self-gamification, where the game being played is to better one's self (in the context of avoiding harmful and destructive behaviours).

5 Group Member Contributions

Spirals 2 and 4 presented rough prototypes of myAlly and its activities. In the final spiral, myAlly was rewritten with a new UI in mind. Table 1 shows a breakdown of how members contributed to different aspects of the app.

Table 1 – A breakdown of contributions by different members implementing myAlly

Component	Sharon	Ilona	Mario
Diary Card	Graphics	Final	Initial
Crisis	Graphics	Initial, Final	
Thought Diffusion	Graphics	Editing	Initial, Final
Mind Jar	Graphics	Initial	Final
Body Scan	Graphics	Initial, Editing	Porting
Muscle Relaxation	Graphics	Initial	Final
Deep Breathing	Graphics	Editing	Initial, Final
Community	Graphics	Initial, Final	Porting
Home Screen	Graphics	Final	Initial

In addition to the graphics created by Sharon for myAlly (with no prior knowledge of Photoshop), she also consulted with and interviewed clinicians and users of DBT, and provided demos of the app as it spiraled towards completion. Sharon also attended a number of workshops on DBT to get suggestions/feedback.

6 Apper Projects: Apper Context

6.1 Bringing DBT skills to a mobile platform for adolescents

Treating suicidal and self-harm adolescents are often fraught with challenges. While emerging research has shown support for the effectiveness of Dialectical Behavior Therapy (DBT) for suicidal and self-harm adolescents, DBT was originally designed for suicidal adults. Due to the different developmental levels and needs of adolescents, clinicians have often found it difficult to gain the compliance from their adolescent patients (e.g., to practice DBT skills outside of therapy sessions, fill out a diary card daily – both are essential components of the therapy). While there has been a strong demand calling for an adolescent-friendly platform that can address these common therapy-interfering behaviors, none is available to this date that is based on the DBT theory and is designed catered towards children and adolescent population. myAlly addresses this gap in applied clinical child psychology by bringing DBT skills and techniques onto a mobile platform (which our targeted users are very familiar with) so that these exercises are fun, interactive, and easily-accessible. While it would be extremely important for adolescents to have access and apply the DBT skills during times of crisis, DBT skills are most effective when they are practiced on a daily basis. Hence, making these skills and activities more fun and easily accessible through a specially designed app would have the potential of improving the treatment compliance and hence outcomes with this population.

6.2 Contribution to the emerging field of using physiological measures to inform clinical practice

Using physiological measure to inform practice in clinical psychology has been a recent, emerging field. Biofeedback is one of the techniques that has been used to provide patients with an enhanced capability to monitor physiological indices of relaxation or arousal. The ability to be aware of bodily processes is an important component in acquiring the overall ability to relax, regardless of which relaxation skill is used. The physiological information (audio/visual) provided by biofeedback could be used to indicate to the user that s/he is capable of brining physiological functions under voluntary control by practicing relaxation skills. However, the elaborate equipment usually used in biofeedback training precludes it from use in most mental health settings. By integrating the heart rate measure into the deep breathing exercise, this application has made it possible for the user to obtain objective feedback. The ability to easily measure physiological data using this application will not only make the use of biofeedback training easily accessible, it will also allow the collection of physiological data and to further inform how to best use the data in applied clinical settings.

Focus group with clinicians who work mainly with adolescents has been conducted to obtain feedback for this application. All the participants have expressed enthusiasm for this application and believed that it holds promises for addressing some of the most challenging obstacles in working with the adolescent population. Nevertheless, further field tests and research will be needed to determine the efficacy of applying this application to the field.

7 Future Work

In terms of development, myAlly can be expanded by adapting more DBT skills into activities to be used by adolescents. The activities currently implemented expect a clinician to provide context to the user on how to apply the different DBT skills in myAlly. If the app were to be released on Google play, additional context and instructions behind each activity would be required.

In terms of research, it would be interesting to see how effective myAlly is by performing field tests with clinicians and patients. While feedback has been a main component during myAlly's development, having patients use the application on their own phone for a time could elicit different criticisms and opinions regarding myAlly's activities and design.

8 References

- [1] Linehan, M. (1993). Cognitive behavioral treatment of borderline personality disorder. Guilford Press.
- [2] Rathus, J. H., & Miller, A. L. (2002). Dialectical behavior therapy adapted for suicidal adolescents. *Suicide and life-threatening behavior*, 32(2), 146-157.
- [3] Miller, A.L., Rathus, J.H., & Linehan, M.M. (2007). *Dialectical Behavior Therapy with suicidal adolescents*. New York: Guildford Press.

Ilona Wong
(996945908)

Mario Badr
(994625116)

Sharon To
(994268010)

Appendix A

A traditional diary card is shown below, and can be quite complicated.

Dialectical Behavior Therapy Adolescent Diary Card		First Name		Filled out in session? Y/ N		How often did you fill out this section? Daily 2-3x Once		How often did you use phone consult? _____		Date started / /											
Date	Self Harm		Suicidal		Alcohol		Drugs		Meds		Out class/ school	Risky Sex	Emotions								Notes:
	Urge	Actions	Thoughts	Actions	Urge	Use amount/ type	Urge	Use amount/ type	Taken as Prescribed	Anger			Fear	Happy	Anxious	Sad	Shame	Misery	Skills *		
	0-5	Yes/ No	0-5	Yes/ No	0-5	0-5	0-5	0-5	Yes/No	Yes/No			0-5	0-5	0-5	0-5	0-5	0-5	0-7		
/																					
/																					
/																					
/																					
/																					
/																					
/																					
/																					

*** USED SKILLS**

0= Not thought about or used
1= Thought about, not used, didn't want to
2= Thought about, not used, wanted to
3= Tried but couldn't use them

4= Tried, could do them but they didn't help
5= Tried, could use them, helped
6= Didn't try, used them, didn't help
7= Didn't try, used them, helped

Rating Scale for Emotions and Urges (above):

0= Not at all 1= A bit 2= Somewhat 3= Rather Strong 4= Very Strong 5= Extremely Strong

Urge to quit therapy: _____ Misery Index: _____

Instructions: Circle the days you worked on each skill

	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Core Mindfulness	1. Wise mind						
	2. Observe (Just notice what's going on inside)						
	3. Describe (Put words on the experience)						
	4. Participate (Enter into the experience)						
	5. Don't Judge (Non-judgmental stance)						
	6. Stay Focused (One-mindfully: in-the-moment)						
	7. Do what works (Effectiveness)						
Emotion Regulation	8. Identifying and labeling emotions						
	9. PLEASE (Reduce vulnerability to emotion mind)						
	10. MASTER (Building mastery, feeling effective)						
	11. Engaging in pleasant activities						
	12. Working toward long-term goals						
	13. Building structure // time, work, play						
	14. Acting-opposite to current emotion						
Interpersonal Effectiveness	15. DEAR MAN (Getting what you want)						
	16. GIVE (Improving the relationship)						
	17. FAST (Feeling effective & keeping your self-respect)						
	18. Cheerleading statements for worry thoughts						
	19. ACCEPTS (Distract)						
	20. Self-soothe (5 senses)						
	21. Pros and cons						
Walking the Middle Path	22. Radical Acceptance						
	23. Positive reinforcement						
	24. Validate self						
	25. Validate someone else						
	26. Think dialectically (non black and white)						
	27. Act dialectically (walk the middle path)						

Miller, Rathus, & Linehan, 2004

Appendix B – Resources

External code/libraries used by myAlly.

- Heart Rate Detection: <http://code.google.com/p/android-heart-rate-monitor/>
- Rajawali, used for 3D graphics: <https://github.com/MasDennis/Rajawali>