InMind: Mobile Application for Sharing the Status of Serious Stuff
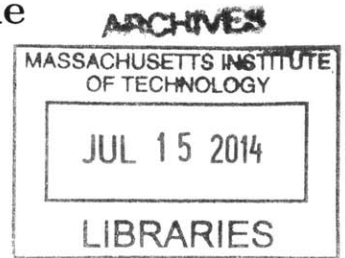
by

Joy C. Chen

Submitted to the Department of Electrical Engineering and Computer
Science
in partial fulfillment of the requirements for the degrees of

Bachelor of Science

and

Master of Engineering in Computer Science and Engineering

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Signature redacted

Author . . . .
Department of Electrical Engineering and Computer Science
May 23, 2014

Signature redacted

Certified by . . . .
Prof. Rosalind Picard
Professor of Media Arts and Sciences
Thesis Supervisor

Signature redacted

Accepted by . . . .
Prof. Albert R. Meyer
Chairman, Masters of Engineering Thesis Committee

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Abstract

Individuals under unusual stress, whether due to bereavement, illness, serious conflict, or other transitions can benefit from social support. Support is a valuable resource, but there are many psychological and technical obstacles that can get between an individual and those he gets support from. I am studying how the needs of these individuals are met or not met, how technology is involved, and what can help.

To compliment and improve upon existing communication strategies, I designed InMind, an Android application that mediates life-issue tracking between close relations. InMind helps individuals communicate the status of important topics in their lives and express their thoughts related to the topics, adding to awareness of these issues.

We deployed InMind for 3 weeks, with 7 groups of size 3 to 4 each. Only one group had full participation, while the others were dominated by 1 or 2 participants. By the end, the participants sent over 1000 messages through InMind and they reported better than average usability experience (p=0.0136). A majority of the users brought topics from within InMind to other media, such as emails or phone calls.

Interview results from 15 participants showed strong asymmetry in awareness and different preferences for degree of sharing and support from loved ones. Participants were split between those who were sensitive to the privacy of their status and a few who would prefer that everything be public. There were often only a few active participants within a group; the active participants found value in using InMind for self-reflection. Conducting studies that study strong-tie relationships have to overcome the difficulty of getting participation from each member of the relationship.

Thesis Supervisor: Prof. Rosalind Picard
Title: Professor of Media Arts and Sciences

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To my study participants! Your stories and experience made this study worthwhile.

To my mother and boyfriend, for their love and unfailing support for everything in my life, including this last year of study. And to my dad, who would have loved to be able to read this.

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Chapter 1

Introduction

Social support is an important resource during times of transition and stress. Whether it's friends, colleagues, families, or anyone else, the people in our lives are what help get us through difficult transitions [1]. The impact of this support has manifested itself in a broad range of studies. Rains and Young found that supportive communication can help manage uncertainty and help one feel in control of one's life [2], and Shor et al. even discovered that support from family is correlated with lower mortality [3].

However, as the complexity of personal networks suggests, the resources that people pull on are very specific, and their appropriateness is a complex subject. It is thus important to recognize that not all support is the same. Lehman et al. studied in 1986 the ways that attempts at support were helpful and unhelpful [4]. When Vachon and Stylianos explored the "goodness of fit" between offered support and the actual needs of the bereaved, they discovered that it varies wildly, and is sensitive to variables such as impact of loss and presence of other stressors [5].

Further, stressful transition periods can be accompanied by changes in the social structure that the support depends upon. The situation of illness or bereavement includes, by necessity, the loss of an individual that could otherwise be a source of support, but many other transitions can also cause rearrangement of personal networks. Consequently, during transitions is often when these much needed support mechanisms can weaken or fail [1].

In this thesis, I explore the ways that technology actually helps individuals going

through stressful transitions, and consider strategies for improving the situation.

This work fits into the broader universe of recent Human Computer Interaction research done to address the need to mediate social support and other forms of intimacy through technology [17]. Technology can help to mediate the appropriate type of resilient support that individuals may need. Promisingly, there has been significant evidence that mobile and web based social interactions can have positive effects similar to more traditional social interactions [6, 7].

1.1 Overview

The work of this thesis is split into roughly three different areas.

1. **Interviews and Questionnaires** were conducted to better understand university students' existing interactions with intimate socials such as family or friends while going through a stressful period in life.

2. **Field Tests** of a technological probe, the InMind Android application, over 3 weeks explore the concept of a life issue tracker that is shared with friends. Data that was logged was used to answer questions about privacy choices that users make.

3. **Feedback and Reflection** on the usage of the InMind application, as well as the evolving nature of the participants' situations will be used to motivate future design.

1.2 Project Vision and History

InMind began as an application designed to help bereaved individuals deal with some of their specific needs. My initial prototype, InMourning, targeted three needs that became apparent from needfinding studies conducted by Massimi and Baecker [8, 9, 10],

1. **Affect Sharing** - The well being of bereaved individuals is often a subject of inquiry, and sharing this information is a common task.

2. **Availability Sharing** - Caring friends and family often want to be present and available for the bereaved, however, the bereaved generally want to control the nature and timing of communication between them and their family, friends, and other supporters. The bereaved are sensitive to what kind of interaction (texts, calls, face-to-face visits) and when they occur (exactly what hour of what day, or frequency). The influx of media and ways to communicate actually make it consistently overwhelming for the bereaved, particularly added to the already stressful interactions that necessarily follow a loved one's passing. Thus, the availability of the bereaved, how able and willing they are to accommodate guests, is important to communicate.

3. **Story Sharing** - Bereaved individuals feel a need to share stories related to or inspired by their relationship with the departed. From reflecting on a trigger, pattern, or thought that carries unusual significance for the mourner to full blown story telling, bereaved individuals consistently want to share aspects of their experience with caring friends and family, many of whom are likely mourning the same loss.

These three needs were collected because they addressed the common theme of improving relationships with caring friends and family during the time of difficulty.

In the context of these needs, I developed InMourning in the theme of existing bereavement technologies, hoping to better understand how people can use technology to meet their needs. The initial prototypes of InMourning are in Appendix C.

However, the more we explored the needs of bereaved individuals, and how to best reach out to them, the more we realized that these needs exist in some form for all people who are dealing with the difficult periods of life. Problems such as chronic illness, physical or psychological, can make the wellness, availability, and story of individuals relevant to those close to them, as well.

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Chapter 2

Background

The three major goals that we outlined for our initial prototype: sharing affect, status, and story, led us to two broader themes.

1. Intimacy and Awareness through Technology.

2. Catalyzing Support During Crises

2.1 Intimacy and Awareness Through Technology

The sharing of statuses led us to the first theme of intimacy and awareness through technology. Sharing statuses, in the form of availability or affective state, was really just one example of providing awareness that was valuable to loved ones. Technology is used in many different ways for people to maintain awareness of people with whom they have relationships, in the workplace or at home, and there are correspondingly many opportunities for design.

2.1.1 Designing for Awareness and Expressivity

In 2012, Hassenzhal did a broad survey of published research that is related to using technology to mediate intimacy [17]. They found that the hundreds of published works in this domain indicate strong interest in designing technology to bring togher people separated by distance. Of the six broad strategies that Hassenzhal found

that researchers have used in the past few years to design for intimacy (and that they suggest all researchers consider), the two most common ones are awareness and expressivity. Awareness can result from passive or active signals from the object of awareness, and expressivity represents meaning attached to the act of expressing to someone else.

Designing technologies for a multi-person group is unusual because the usual standards of usability need to be applied to the unit as a whole, and not just the experience of a particular individual [12]. To better understand intimacy between couples, Vetere et al. used cultural probes and interviews in 2005 to find common themes that led to several preliminary designs for couples. Significant research has also gone into designing for couples that are separated by distance, a common situation that technology is used to help mediate [18]. Lottridge et al. designed MissU, which took in data collected from several separated couples to learn exactly, what, how, and when they choose to share [19]. Octavia et al. studied the relationship between friends separated by distance and learned that sharing problems and feelings are crucial to maintaining a relationship over distance [20].

2.1.2 Awareness Systems

The need for awareness is very common in the domestic realm, but the degree of need for this awareness between specific individuals within a personal network vary [13]. Interpersonal awareness systems are one type of technology used to help people maintain awareness of each other. In 2004, Markopoulos designed and tested an awareness system, ASTRA, for families that shared pictures and snippets from a mobile device [14]. ASTRA demonstrated measurable affective benefits for the members of two families that field tested the technology.

Another field study by Brush et al. in 2008, designed two prototypes, MessyBoard and SPARCS, for sharing photos and goals between extended family members [21]. Their study concluded that asynchronous chat and configurable sharing were valuable for user sharing, considerations that went into the design of InMind as well.

2.1.3 Technology Probe

Particularly inspiring to my work is the idea of a technology probe. Initially introduced in 2003 by Hutchinson et al., technology probes are a type of design probe that has three goals:

1. Understanding needs and desires of users in the real world.

2. Field testing an engineered product.

3. Inspiring the design of other technologies.

Since then, technology probes and their variants have been used to explore new design concepts and their applications [18, 19].

2.2 Support During Crisis

The sharing of stories, in the context of using them for reflection and sharing serious thoughts, led us to a second theme: support during crises, specifically social support and helping. Sharing stories is one of many ways that individuals reach out during life crises and only one of many ways they can be helped. Individuals dealing with other major life events or transitions reach out to loved ones with many variations of serious stories, and helpful responses can take many different forms.

2.2.1 Technology and Social Support

The most active community developing software for social support is, not surprisingly, in the realm of support for chronic diseases.

One of the earliest work related to using technology to encourage social support was from Morris et al. in 2004, who were concerned about the narrowing of social support that faced elders coping with cognitive decline. Morris et al. emphasized the importance of using technology as catalysts for human relationships [22].

In 2010, Skeels et al. used a participatory design methodology to explore what is most useful to breast cancer patients [23]. The support of intimate family relations

Figure 2-1: **System for Soliciting Help** – From Skeels et al. in 2010. Diagram of proposed method of handling suggestions for ways to help breast cancer patients.
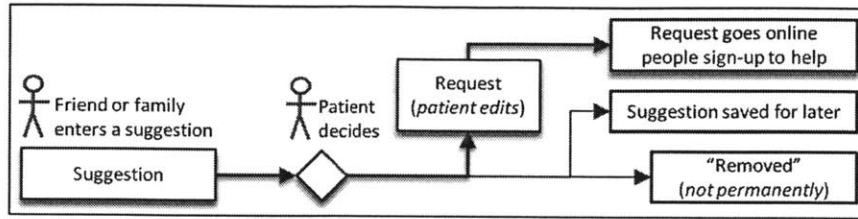
is a powerful resource that could have a very positive influence on the experience of individuals going through tough transitions. With breast cancer survivors and their friends, Skeels et al. compiled a model for how suggestions and requests for help can be compiled and managed by patients, shown in Figure 2-1, and collected all the many barriers to social support that are common for breast cancer patients. The prototype technology they implemented was a website, supported by Facebook Connect, that allowed patients to perform those request/help idea management tasks.

Luxton et al. performed a survey of the many mobile applications available to smartphone users in 2011 and highlighted many of the health and clinical uses of mobile phones. They emphasize that social support is often targeted in clinical practice because it can encourage engagement and connection, which for many conditions, has positive effects for mental health and well being [24].

Chapter 3

System Overview

Since my goal was to quickly influence the lives of real people and better understand the methods of communication likely to be used by modern people in the near future, I chose to design a mobile application, called InMind. The application icon is shown in Figure 3-1.

InMind would enable a kind of slow, targeted communication that had been useful to bereaved individuals in forums, but connect individuals with people that they choose.

Figure 3-1: InMind is an Android Application, which lives on users' personal devices, so that it is available during the day.
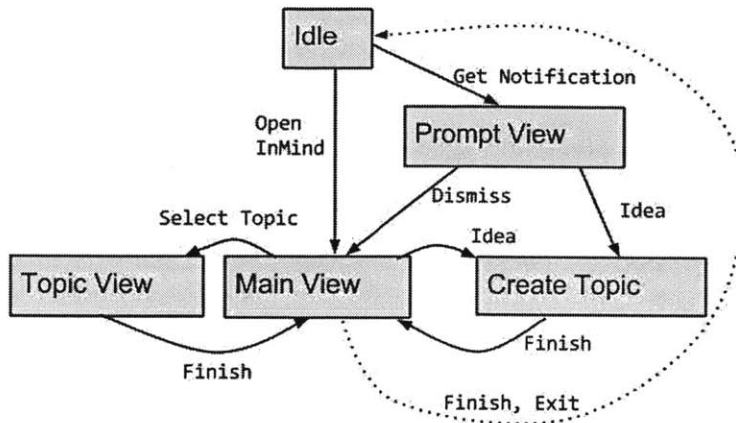
Figure 3-2: Flowchart of likely user interactions on InMind.

3.1 Interaction Design

Broadly, the goal of the application was to create groups and enable users within that group to create spaces with themed topics. The topics would persist over time and maintain a current status of some nature. This status could represent the owner's well being, the well being of someone else that the owner cares about, the progress of a project, the energy level of a group, the level of anxiety the owner is suffering from, etc. Since mobile applications are always accessible, these themed spaces could be updated at any point during the day when the status of that topic changes. At any point during the day, a user can choose to open the app and create or update a topic. Figure 3-2 shows the user activities that are likely, along with the application view screens that are involved.

Finally, since individuals have shown to be sensitive to which particular people they share sensitive topics with [25], the owners can choose when they begin the topic which of their people they want to share with.

To summarize, once shared, the topics would be defined by several characteristics:

1. **Title** - Answers the question of **What**. The user can choose what to call the topic.

2. **Share With** - Answers the question of **Who**.The topic is like a static chatroom, since the people who are listening in are always the same.

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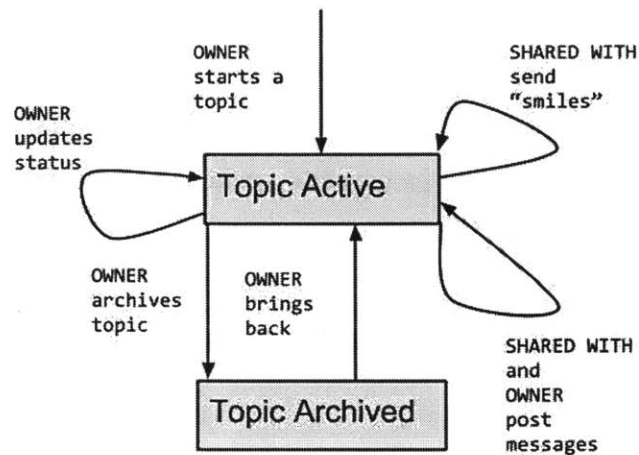
Figure 3-3: Topic lifecycle and possible interactions. The **Owner** creates the topic, and is in control of its status, as well as its archive state. The people the topic is **Shared With** can comment and send smiles.

3. **Status** - Answers the question of **How**. The "status icon" of the topic sets the mood of the topic. Unlike for chatrooms, this status allows the space to reflect the state of the user who started the topic.

Within those spaces, we wanted to encourage communication. Here, although I was inspired by the nature of online forums, where many people reach out for support, our goal was more influenced by the nature of mobile communications. On a mobile device, users expect to use abbreviated conversation. Although the thoughts may be complex, the messages composed on a mobile device tend to be very short.

3.1.1 User Model

It is interesting to note that the user interactions within a group are likely asymmetric on several fronts. On each individual topic, there is a significant difference between the owner and the users that were invited to share the topic. The topic life cycle and available interactions for the owner and those people the owner shares the topic with is shown in Figure 3-3.

The owner is able to control the state of the topic, and thus has the power to control the theme of the conversation. This becomes an outlet of expression for the

owner, as he can shape the icon to represent the status of the topic, and thus discuss the topic knowing that the group understands the status as well.

Another asymmetry is that it is very likely that most groups will have asymmetric participation. Some members will be eager to begin topics, initiate discussions, and others less so. This is anticipated in the design, as people have differing needs for communication, but the application will encourage ownership of at least a topic or two, otherwise the "Mine" filter will remain very empty.

3.2 Android Application

3.2.1 Platform Choice

The application was written for Android, targeting API 18, but supports down to API 13.

I chose to develop in Android partially because the Affective Computing Group has a recent tradition for doing so. This is for reasons related variously to the freedoms that Android developers have, and the availability of third party software toolboxes for Android. However, my primary reason for choosing Google Android over Apple iOS is the prevalence of Android devices. Android has been dominating the mobile market since 2012, and if InMind were to be released to the public, an Android application is more likely to reach out to a broader audience.

The InMind application supports API 13 through 18, corresponding, respectively, to Android 3.2 Honeycomb and 4.3 Jellybean.

Android 4.3, Jellybean, was released a year ago, but is by far the most prevalent in the MIT target population due to the devices that supported it sold over the course of the year. During development, Android 4.4, KitKat is being pushed out to devices, but yet isn't available to a significant degree.

At the opposite end, API 13, was released with Android 3.2 HoneyComb in 2011, 3 years prior to this date of writing. Mobile devices have a life span of about two years, and thus it is unlikely for Android users to be running versions of Android

older than API 13.

3.2.2 Hardware

InMind has to integrate into a user's existing communication methods, as that is the environment actually encountered in the lives of people. Thus, emulating more typical applications, InMind is designed to be installed onto the user's existing mobile device.

As previously suggested by the range of compatible Android versions, InMind is designed to be run on an assortment of devices. In addition to version issues, Android devices vary significantly in form factor. The two most popular are cell phone-like devices, which have roughly a 4" screen, and small tablets, which have roughly a 7" screen.

I developed primarily on two devices, a Samsung S4, with a 4" screen, and a 2012 Nexus 7, with a 7" screen. The design objective for all layouts was to be attractive on cell-phone-sized screens, and reasonably functional on larger tablet screens.

3.2.3 Application Structure

The interactive part of the application is best described by a description of the views and the actions available to the user on them.

Main View

The main view shows the topics that the user has access to. See Figure 3-4 for a series of screenshots of the home page design.

Since the iconography of the topics is very important, the main page gathers the icons of the topics in a scrolling view. Each topic is labeled with its title and owner. Whenever a topic is updated, whether with a message from someone, or with a status change, everyone who can see the topic will see the topic lit up with a yellow glow, indicating that there is something to see under that topic.

As the number of topics increases, it becomes important to have a way to organize

Figure 3-4: **Main View** – (a) The main view has a sliding window of topics. Topic icons are prominently displayed, as are the topic titles and owners. Topics that have updates are highlighted with a yellow glow. (b) Since there can be many topics shared within the group, the main view has filters that can show a subset of the topics. The filter dropdown is circled in red. The first 4 filters are defaults, the "+ New Collection" takes the user to the collection creation page (shown in the next subfigure), and the "Important" collection shown here is a custom collection. (c) Users can make their own collections to sort topics the way they want to. Boxed in red are all the topics that are available to the user at the moment, and can be included in the new collection.
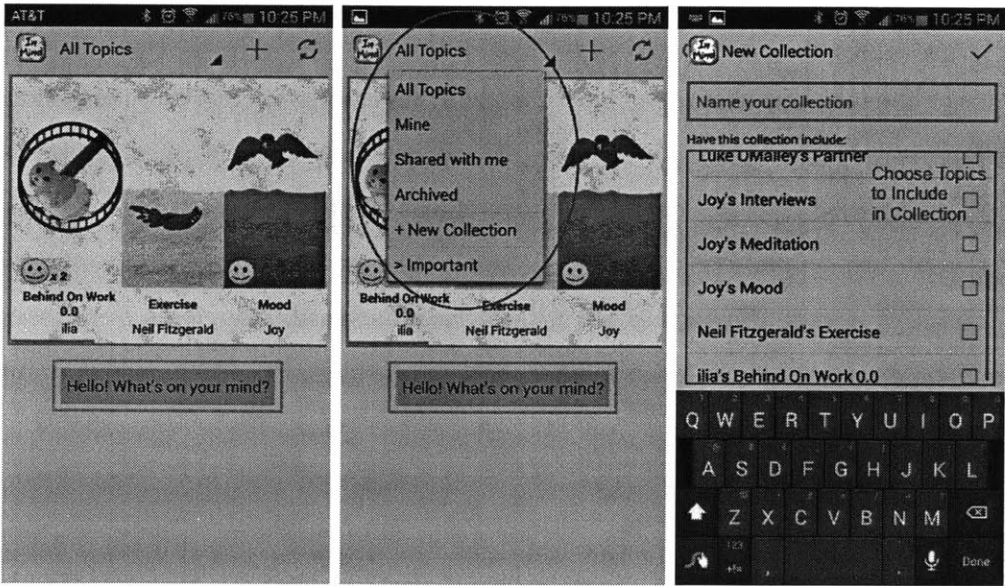
(a) Main Home view   (b) Filters   (c) New Collection

the topics. I chose to implement this in the form of filters. The filters are available in a dropdown menu in the action bar at the top of the screen. (The second screenshot in Figure 3-4) There are three default filters that always filter for topics that meet certain criteria. The first two are "Mine" and "Shared with Me" which filter for, respectively, topics the user has created and those he did not. The last is "Archived" which shows only the archived topics. Archived topics do not appear in any other filtered view.

Finally, the user can create their own filters. The filter creation page is shown in the third screenshot in Figure 3-4. The freedom to create their own filters allows users to organize their topics however they like. Some ideas include bringing out topics that are particularly important, particularly serious or un-serious, created by specific people, etc.

Creation View

When a user want to initiate the topic, they can click the add button on the action bar at the top of the home page. This opens up the creation view, which is shown in Figure 3-5. On this page, the user titles the topic, chooses an icon, and chooses who to share the topic with.

The choice of icon is very important in setting the theme for the topic, since its state represents the status of the topic in reality. The design of the icons influence how users interact with topics. There are three kinds of icons, and they represent three types of statuses.

1. **Plants** grow in a colored pot. They are a good general purpose icon as they are neutral, not personable, and a familiar icon in many other settings, since they are associated with positive feelings of growth.

2. **Birds** are positioned relative to a colored water level. They indicate affective wellness or degree of success in the face of difficulty.

3. **Hamsters** run on a colored exercise wheel. Their speed can represent arousal, or associated energy levels for the topic.

Figure 3-5: **Creation View** – (a) Topic creation involves naming the topic, choosing the icon type, and choosing whom to share the topic with. (b) A dropdown menu allows users to choose which icon represents the topic.
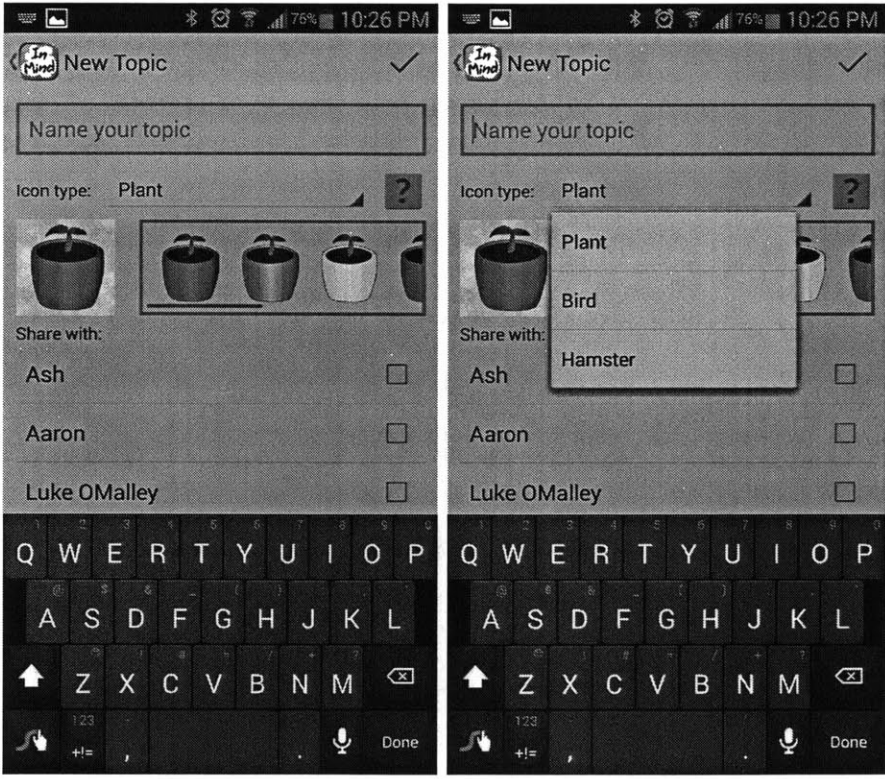
(a) Create Topic   (b) Choose Icon Type

Figure 3-6: **Icon Types** (a) Plants represent progress. (b) Birds represent wellness or general status. (c) Hamsters represent activity or arousal.

(a) Plant   (b) Bird   (c) Hamster
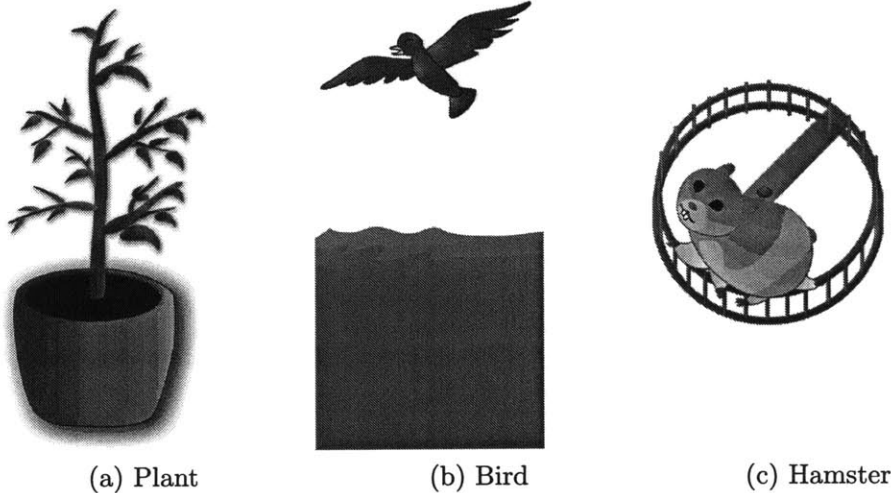
The progression of icons is completely detailed in the appendix, and a few sample icons are shown in Figure 3-6.

The symbology was unclear to early beta testers, suggesting that choosing an appropriate icon for a topic can be difficult. The topic creation page helps by providing a short blurb to describe how to use each icon type.

All icons are of a similar structure, and have two parts.

1. A background color, to make the icon distinct from others like it. This color never changes for a topic.

2. A "character" icon, whose status changes between 5 to 8 different levels. When the owner changes the status of the icon, the character icon changes to reflect it.

Topic View

From the home page, the user can select a topic to jump to that topic's page. Screenshots of the topic page can be seen in Figure 3-7.

The topic page is primarily modeled after a chatroom, or more common on the mobile device platform, a text message log. The previous messages in that topic are

Figure 3-7: **Topic View** – Topic views show the topic's current status icon, controls available to the user, and messages that have been left under that topic. Messages have been blurred, and controls are circled in red. (a) If you own a topic, you can adjust its status. (b) On someone else's topic, you can leave a smile. (c) You can see only your own archived topics, and you can bring them back from the archive and read the messages attached to it.
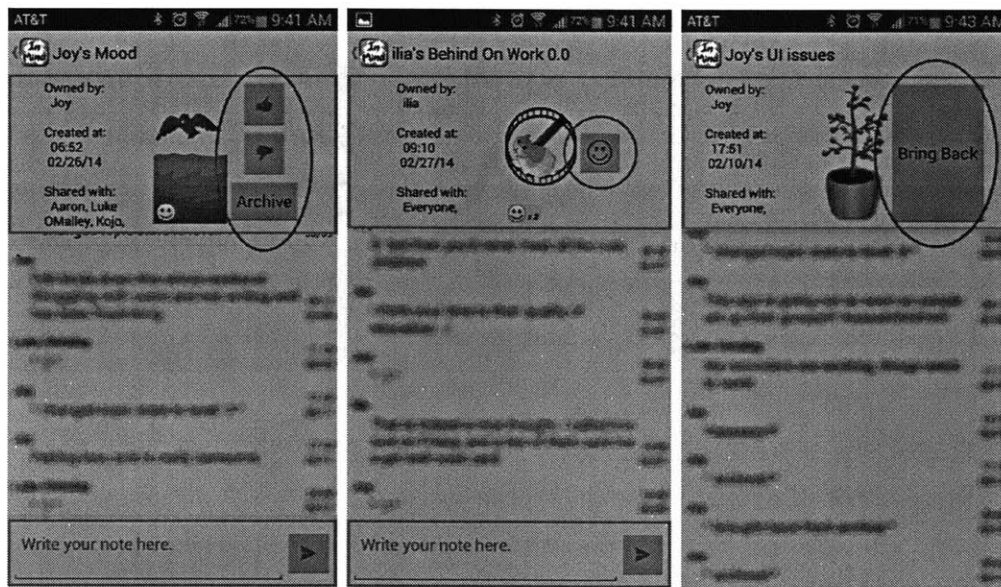
(a) My Topic   (b) Someone Else's Topic   (c) Archived Topic

displayed on the main view, in reverse chronological order, similar to most chatroom and text message application.

A button near the top toggles the appearance of a panel that shows data and controls related to the topic. The data panel has a text section with the topic creation date and who the topic is shared with. The current icon for the topic is shown, as expected, as are buttons for controls.

If the user owns the topic being displayed, 3 buttons are shown. With the first two buttons, the owner of a topic can increase or decrease the state of the icon. These changes are logged in the message logs, so that people with whom the topic has been shared can also track the status of the topic.

The last button allows the owner to archive a plant, effectively freezing the plant and constraining it to the archive view. Archived plants also have a similar view, but the status change and messaging capabiliies are disabled. Archived plants provide a record of interactions, but cannot be interacted with further unless they are brought out of the archive.

If the user doesn't own the topic, a smile button is shown. A smile is just a way for someone with whom the topic has been shared with to encourage the owner, and express that he/she is tuning in as well.

Lastly, for archived topics, nothing can be done to them except by the owner, who can bring them back to active status again.

Prompts and Notifications

InMind has a daily notification system. The purpose of the notification system is to dynamically remind the user to remember the existence of InMind. InMind relies on input from its users, so a notification a few times a day encourages the user to check in, and think about the topics that are currently kept there.

InMind chooses a random hour between 9:00 A.M. and 3:00 P.M., and another hour between 4:00 P.M. and 9:00 P.M. to show a notification. The notification is silent and is designed to be just noticeable when the user turns on their phone to do something else.

Figure 3-8: **Notification System** – InMind's daily notifications remind the user to check the application for updates from other users and new prompts. (a) The notification first appears as a small icon on the Android status bar, circled in red. Also circled is the InMind application on the Android launcher, the main way to get to the application. (b) Opening the Android notification drawer shows the InMind notification. Clicking the notification takes the user to InMind. (c) Once the InMind application is open, a prompt is displayed. The prompt dialog box displays a quote or a question, and allows the user to go to the main view, or jump to a topic creation if desired.
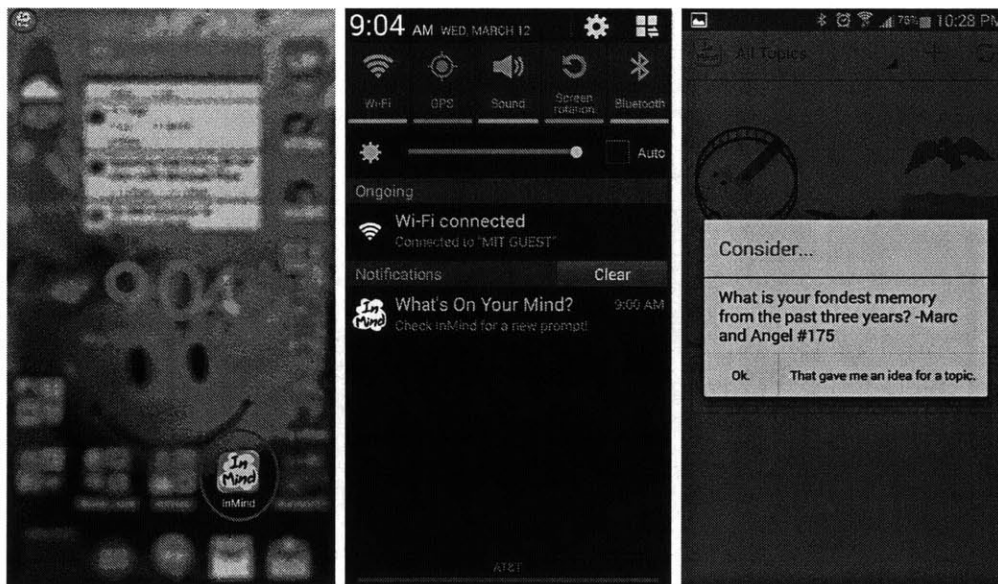
(a) Icons   (b) Notification Drawer   (c) Prompt Dialog

The notification first appears as a small icon in the status bar, in the upper left hand corner of the mobile screen, which is visible no matter what the user is doing on their phone. The notification appears on the Android notification drawer, which the user sees when they drag the notification drawer down. On selection, the notification sends the user to InMind, and shows a dialog with the prompt of the day. The prompt in the dialog changes every day, and is chosen random from a bank of 180 prompts, either a thoughtful quote or a question, that is designed to help encourage creative topic creation. See the screen shots in Figure 3-8 to see the progression from notification to the application. To see the prompt again, the user can use a small button below the scrolling view of topics match the filter.

The participants' perception of the notification system will be among the topics

addressed in interviews with the participants.

3.2.4   Security

Due to the sensitive nature of the application, many measures have been taken for security purposes. Although most security concerns are handled by the server, two were necessary on the application end.

First, since the topics and their corresponding messages may be private in nature, possibly even more private than the other material storied on the device, there is an option of logging out.

The log out option is available under options from the home page. When a user logs out, all the application data stored on the device is wiped. This makes it impossible for anyone to get access to that user's messages or topics without authenticating as that user. Conversely, on successful login, all the data is re-downloaded onto the device.

Secondly, all the messages are stored on the device in encrypted form. I will describe the encryption standard used by InMind more thoroughly later in the security segment of the server design, in Section 3.3.5. but suffice it to say for now that to encrypt or decrypt a message, the user needs an initialization vector (IV), a salt, and a passphrase. An authenticated ping to the server fetches an IV for the group that the user is in. Other authenticated calls to the server fetch topics, and topics come with the salt and passphrase that are neccessary to decrypt messages. The messages are only decrypted on display on the topic view.

3.3   Server

3.3.1   Platform and Hardware

The server for InMind was written using Node.js, run with an Express server. The choice of Express and Node.js over alternatives such as Django or Ruby offered many benefits, including asynchronous responses, lightweight maintenance, and easy inte-

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URL	Type	Action
/users	POST	Create a new user
/users/check	GET	Check for new users in your group.
/users/IV	GET	Get Initialization Vector for the group.
/topics	POST	Start a new topic.
/topics/update	POST	Update a topic that you own.
/topics/check	GET	Check for new topics shared with you.
/messages	POST	Post a message to a topic.
/messages/check	GET	Get messages posted since last pinged.

Table 3.1: API calls available on the server

gration with MongoDB for data retention.

MongoDB gave us flexibility for designing how we wanted data to be stored, and we took advantage of MongoDB's simple backup mechanism for data integrity.

The server was hosted on an MIT Media Lab server.

3.3.2 RESTful API

I used the Express server to support a RESTful API. The InMind Android application, which I'll often refer to as "the client" in this section, only ever performs GET and POST calls to the server to accomplish operations. The GET and POST calls are all that are needed to retreive, add, and modify data stored on the server. For example, a fresh login is a series of GET calls with a "last updated" timestamp of 0, and later refreshes are the same calls, with a more recent time stamp.

The RESTful API supported the creation and modification of the datatypes stored in the database. Please see the table in Figure B.1 for a summary of all the API calls.

3.3.3 Database Schema

The InMind server is supported by a MongoDB NoSQL database system. Database records were designed both to support application interactions and to log the data

that I was interested in investigating. The data saved on the server included records of all the app interactions. For each of the actions performed by the users, we logged the timestamp of the operation as well as the recipients.

Although MongoDB technically doesn't use a schema, it is still useful to describe the structure of the data in terms of its schema. See Appendix B.2 for a listing of the collections and data stored by the InMind server.

Broadly, the server has 4 collections:

1. **Groups** are collections of users. Notable stored fields are the initialization vector, used for security purposes, and the members list.

2. **Users** are individual users. This is mostly for authentication purposes. The user himself would recognize three of the stored fields, the login username, login password, an alias for display. Other fields include the group ID, which corresponds to the group the user is in, and a record of whether or not the user is the lead user in the group.

3. **Topics** are the topics that users generate. This datatype stores all the expected data for functioning, such as the title, current status, etc, but also helps with security and logs its own life cycle.

4. **Messages** are the messages that users send on each topic. Messages are also stored encrypted on the server, since both encryption and decryption happens on the app side.

3.3.4   Administration

Administrative tasks were simple enough to be handled by scripting and direct monitoring of the database. MongoDB provides an efficient way for directly viewing and manipulating the entries in the database.

The only consistently necessary administrative tasks were lead user creation and server restart.

I decided to write a simple webform to allow users to register into an existing group, however, I wanted to be aware of when lead users and groups were created. Thus, I left lead user creation as a manual task that I would have to perform myself. For these tasks, which involve modifying user and group membership, I just wrote javascript scripts I could run to manipulate the database as necessary.

To restart the server, whether to push new server changes or recover from server failure, I wrote a bash script.

3.3.5 Security

Authentication

For authentication, I chose to user regular HTTP authentication over HTTPS. This is a common implementation, since the SSL protocol of HTTPS protects against man-in-the-middle eavesdropping attacks that could steal the authentication credentials. To support this, all of the InMind server is served over HTTPS.

With this authentication scheme, every single request to the server has to be authenticated.

Encryption

For added protection for our users, all messages were encrypted. This encryption was on several levels, primarily using the AES standard.

1. **The IV** is shared within the group.

2. **The salt** is stored with the topic.

3. **The passphrase** is stored with the topic as well.

3.3.6 Other Precautions

During the study, while the server was running, it was password protected, as was the database in which the data was stored.

Data on all users are deidentified; the database remembers only an alphanumeric user id. All "lead" participants had to be entered into the database manually, and later participants sign up anonymously with a user id and password.

3.4 Design Challenges

3.4.1 Lightening the Burden of Communication

Everything about designing for mobile is to make tasks "easier" for the user. In this case, we have the even more daunting task of making the difficult task of communicating about tough topics easier.

We broadly called this the challenge of "lightening the burden of communication." The burden of communication can be split roughly into two types: logistical and psychological. Technology provides the convenience of text messaging, group messaging, etc, which helps to address the logistical burden, but the psychological burden is mostly left to the individual.

The psychological burden can take many forms. Two that we hoped to address were:

1. The difficulty of initializing a difficult topic.

2. The desire to not burden the receiver.

3.4.2 Technology as an Excuse

More ambitiously, we also want to aid in the usage of technology as an excuse. This mechanism involves individuals in a technological space being prompted to interact by the technology.

There is a degree of trust in technology, since it acts often as an impartial third party, and we can take advantage of that to encourage use of our technology as an excuse for action. These actions can be as varied as general communication, assistance, or even intervention.

Figure 3-9: **Evolution of the InMind logo** – On feedback from users, the icon evolved to better fit what users expect from mobile applications.
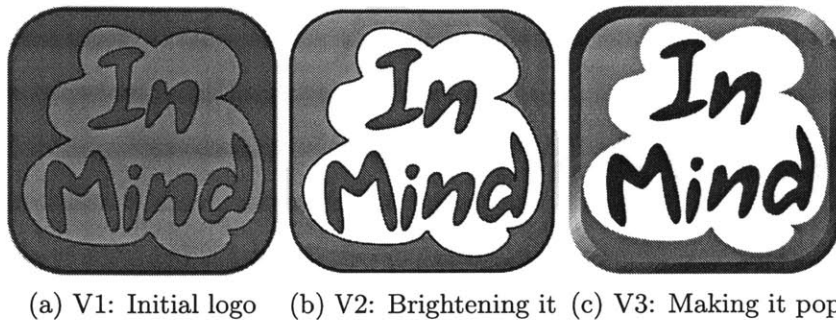
(a) V1: Initial logo   (b) V2: Brightening it (c) V3: Making it pop

3.4.3   Beautiful Mobile Experience

The more I developed for the mobile device, the more I realized that mobile applications are held to a high standard for beauty.

Although web designers can get away with sparse implementations on web browser based interactions, this does not apply equally well to mobile designers. Mobile applications are subject to a "survival of the fittest" in the application marketplaces, where the poorly designed applications die out from low usership. Thus, the applications that most users are used to are beautiful. From the icon design (see Figure 3-9 for the evolution of the InMind logo) to layout design (see Figures 3-10 and 3-11 to see examples of the evolution of the InMind look and feel), I designed InMind to live up to that high standard.

Figure 3-10: **Evolution of InMind Look and Feel: Home View** – On feedback from users, the interface evolved to be more intuitive and attractive.
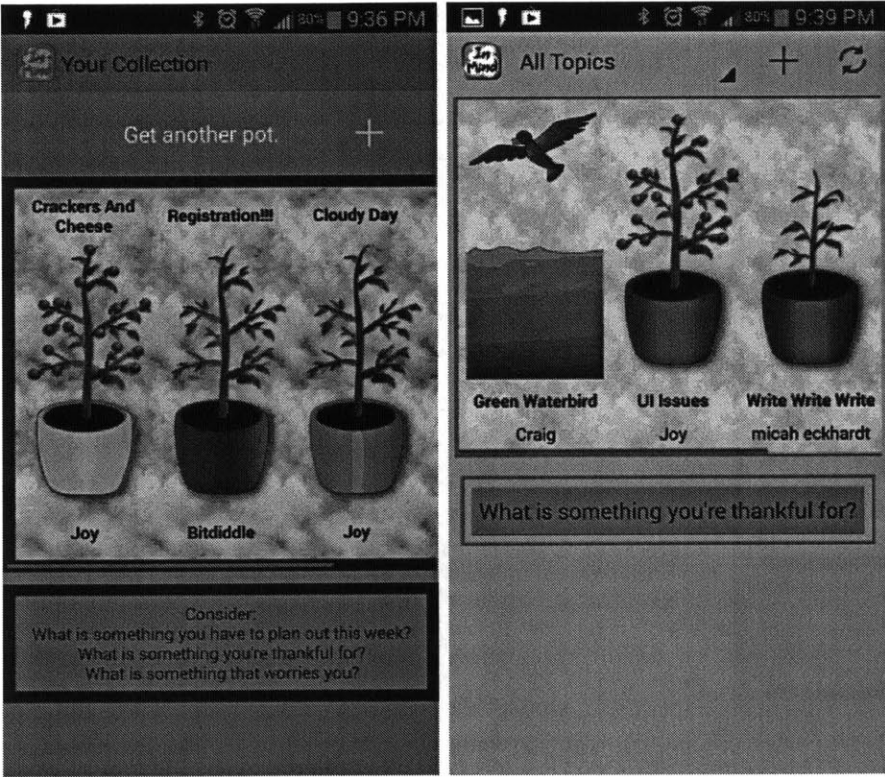
(a) Home View v1.0   (b) Home View v1.4

Figure 3-11: **Evolution of InMind Look and Feel Topic View** – On feedback from users, the interface evolved to be more intuitive and attractive.
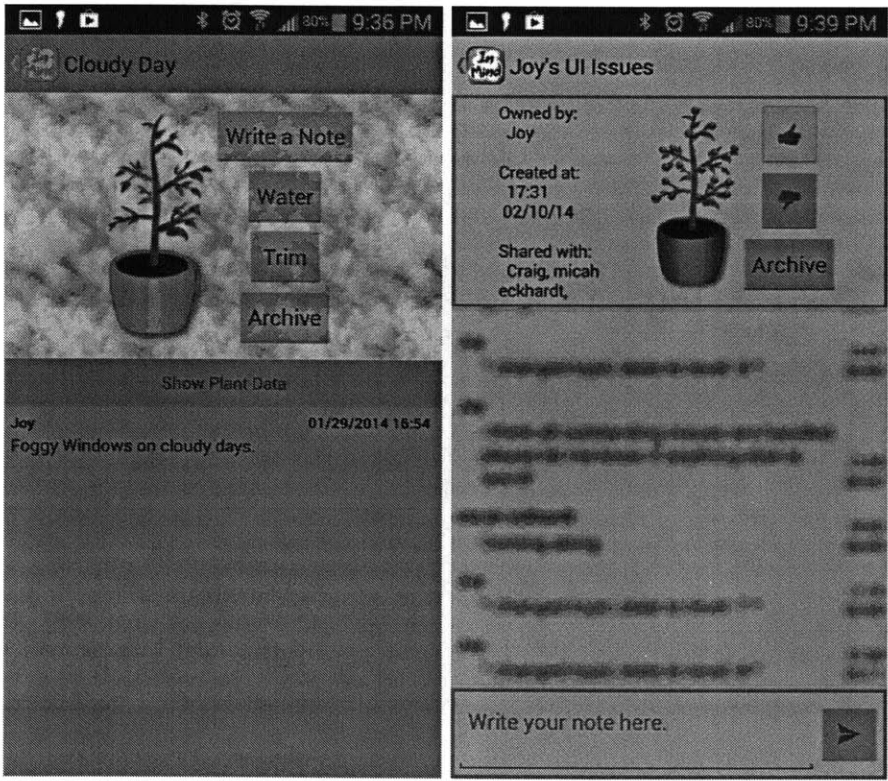
(a) Topic View v1.0   (b) Topic View v1.4

Chapter 4

User Study

To evaluate the relevance of InMind as well as better understand the social support needs of individuals, I conducted a user study which was the bulk of the work for this thesis.

In this section, I will broadly outline the specific goals and practices of this study's protocol. Briefly, the steps involved were:

1. Introduction and Opening Questionnaire

2. Opening Interview

3. Setting Up/Recruitment

4. Android Study (Three weeks, with weekly Check-Ins)

5. Closing Interview

For a complete collection of the documents involved, the interview scripts, emails, questionnaires, and other exchanges, please see Appendix A.

4.1 Introduction and Opening Questionnaire

For all participants, I first met with them to describe to them the study goals, my expectations from them, and to confirm their interest. If that all proceeded well, I got

their informed consent, and administered an opening questionnaire, which included a few lines for basic information, a few questions about their habits, and a perceived stress scale.

4.2 Opening Interview

The opening interview, scheduled individually, aimed to answer a few high level research questions:

1. What are some common social support needs of individuals dealing with illness, bereavement, or other crises?

2. In what ways do their current social interactions satisfy or fail to satisfy those needs?

3. How is technology involved?

The script of the interview was designed to answer those questions, and came in 5 parts.

1. **Background** - Understand their social support network, friends, family, and other mentors and the frequency of contact.

2. **Support Needs and Topics** - This involved understanding the participant's stressors and how their support network is involved in helping to manage them. The last segment sought to understand how much the interviewee and the members of the interviewee's network valued mundane awareness.

3. **Meeting Needs** - In this, I sought to understand to what degree, and in what ways, are their needs met or not met. I was interested in the useful tools and constricting barriers that were involved, and their specific methodology of seeing out support. This segment often involved interviewees explaining how they used technology and often segued into stories.

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4. **Technology** - This was to wrap up any further questions on existing technology use, particularly for participants that tended to focus on the human aspect instead of the logistics of contact in earlier segments.

5. **Motivation and Expectation** - Wrapping up the interview, I asked about what they hoped to get out of participating in this study, which helped me transition towards asking them if they had questions or concerns.

In practice, the opening interview was conducted in spaces that the participants chose, to maximize their level of comfort. The interviewees were encouraged to take any tangents they felt were relevent or interesting, and thus, in addition to learning about their more quantifiable, comparable practices, it also become a good opportunity to hear their individual stories.

4.3   Android (+ Set Up)

After the interview, the participants were sent specific instructions for setting up the Android portion of the study. They had to invite at least two of their friends/family/other supporters to interact on the application. Once that was done, I distributed the In-Mind application file as an installable APK over email, which was then forwarded to their people.

Field testing InMind was complicated by the fact that it involved significant self-motivated participation from the participants. Because this step and the previous step of scheduling interviews involved significant delays, we chose to accept participants on a rolling basis, and allowed the field testing period to begin at a pace allowable by the individual participant. The target was three solid weeks of application usage, and these three weeks started as early as mid March and as late as early April.

Once the application was distributed, I marked the date down as that particpant's start date. They would keep the application installed and in use for up to 3 weeks, at which point they would be asked to uninstall it.

4.4 Questionnaires and other Feedback

At the end of every week of the study, I sent out a weekly questionnaire to the participants. The questionnaire had two parts:

1. **Written Feedback** - This short questionnaire asked for general usage feedback and thoughts.

2. **Affective Benefits and Costs Questionnaire** - designed by Ijsselsteijn et al. in 2009, it is a validated questionnaire that addresses factors related to the costs and benefits of communication [30]. Some factors in the costs category included obligations, expectations, threates to privacy, and process effort. The benefits included personal effort, thinking about each other, situational awareness, sharing experiences, staying in touch, recognition, and group attraction.

In the last week, we also administer a System Usability Scale, to assess the general perception of usability by the participants.

4.5 Closing Interview

The closing interview followed the same pattern as the opening interview. The research questions to answer were:

1. How did InMind fit into their existing support network and methods?

2. What were the perceived costs and benefits of integrating InMind into daily life?

I chose to use the same five sections, but asked questions more directly relevant to their experience with InMind.

1. **Background** - General feedback on experience using InMind, potentially piggybacking off of information provided via questionnaire or other feedback.

2. **Support Needs and Topics** - Asking about changes in the participants' lives over the course of the study, as well as which topics were useful to discuss over InMind.

3. **Meeting Needs** - Assess InMind's effectiveness as a tool to get support.

4. **Technology** - Assess if InMind influenced other communication methods.

5. **Motivation and Expectations** - General feedback on the experience during the study.

4.6 Data Collection

4.6.1 Database

Most of the data that is used is directly pulled from the InMind server's database. The database logs all objects and datatypes, along with creation and modification times.

4.6.2 Google Analytics

Some of the app timings do not involve contacts with the server. I used Google Analytics logging tools to record the time spent on each of the views.

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Chapter 5

Results

5.1 Users

15 people, recruited from MIT students and affiliates via email group mailing lists, participated in the user study. They were young, ranging from age 18 to 30.

All of the 15 people participated in the opening and closing interviews, but only 8 of them participated in the Android portion of the study. The reasons for this will be discussed in the Section 5.5.1.

The participants were compensated for their degree of participation, and the compensation structure is outlined in Table A.1. in Appendix A.

5.2 Opening Questionnaire Results

The results from the opening questionnaire (See Appendix A) help to characterize the group's general thoughts on the subject of stress and support.

Part of the survey included questions, scored on a Likert Scale, addressing to what degree they reach out to friends or family when troubled, and to what degree they feel supported by friends and family. The results are shown in Figure 5-1.

Also in the opening questionnaire, we administered a Perceived Stress Scale. The results, shown in a histogram in Figure 5-2, show that in general, the users in this study had relatively low self-reported stress.

Boxplots of Likert Scale Scores
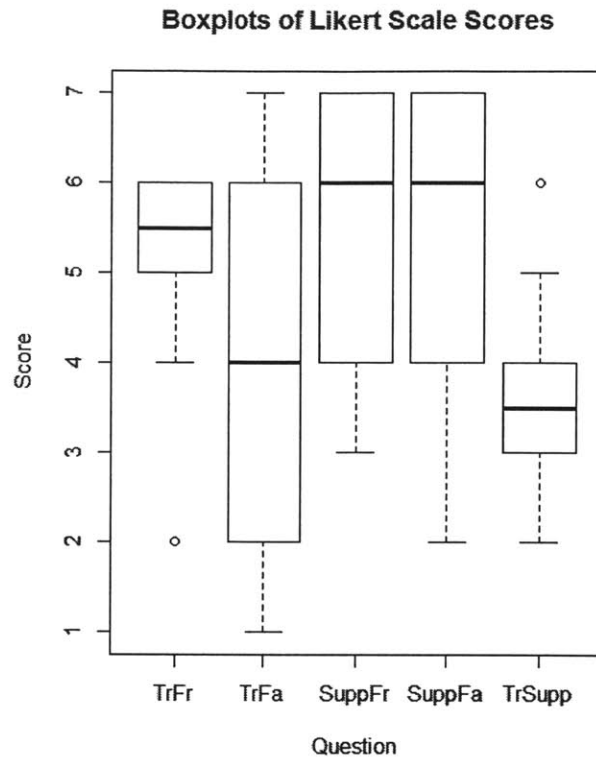
Figure 5-1: Results of Likert scale styled questions on the opening questionnaire. TrFa and TrFa asked whether participants want to talk to Friends or Family when Troubled. SuppFa and SuppFa asked whether participants felt supported by Friends or Family. TrSupp asked if they reached out, in general, when troubled.
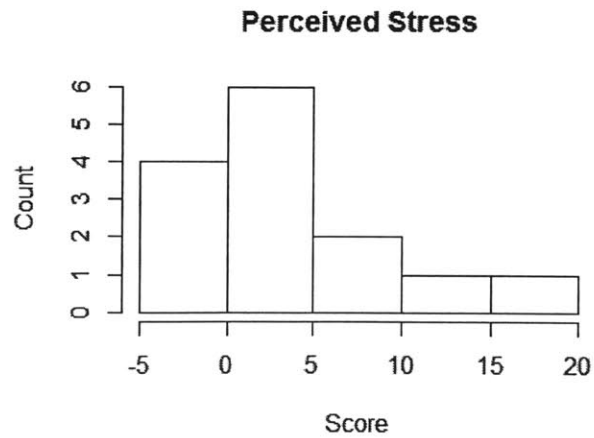
Perceived Stress

Figure 5-2: Distribution of Perceived Stress scores amongst the 15 participants.

5.3 Opening Interview: Script Based Results

The opening interview, as mentioned in Section 4.2, followed a script, so some results were in response to scripted questions.

5.3.1 Support-Interest

Because the participants' situations were so different, the degree to which they wanted or needed social support were very different as well. I assessed their general degree of need and interest in reaching out, what I call support-interest, during the interview. I define support-interest as the trait of consistently having a desire and making efforts to connect on an emotional and empathetic level with loved ones. Based on the nature of their support network and how they choose to interact with the members in it, it is relatively straightforward to characterize the interviewee's current level of support-interest. From the interviewees descriptions, support-interest isn't an inherent trait, and is instead also dependent upon the current situation of the interviewee.

Interviewees on the low support-interest end of the spectrum have a preference for keeping their concerns to themselves. Two interviewees seemed especially independent, expressing a desire for and general pattern of dealing with things alone, without much external input. Both reported having plenty of friends that they interacted with regularly, but they chose to keep them at a greater distance when it came to things they were particularly sensitive about. When asked about how they discuss serious subjects with those closest to them, they tend to express a lack of interest. A quote from one of them helps to express the sentiment:

- *"[These thoughts are] my personal complications. I usually don't share that much with people because I'm not comfortable with them knowing me too well. I prefer to keep a personal boundary."* - Participant 1847, on her thoughts about keeping her privacy,

On the high support-interest end of the spectrum, there was a lot of variability. High support-interest people included my married participants, who notably, married

within the last 5 years or so, and expressed being very open with their spouses, sharing everything. They also included a participant very active in her church community, and other individuals close with their parents or significant others. These participants expressed investing a lot of time in sharing feelings and struggles. Quotes associated with them included:

- *"She was the first person that I felt like I could talk freely with. We can talk about anything and everything. She asks questions that really pin at trying to figure out where emotions are coming from, what's really bothering me at a certain time. Just the fact that she lets me talk freely and with understanding makes me more comfortable."* - Participant 8594, about her mentor figure.

- *"I talk most to my mom... I try to tell my mom everything. She's not pushy, but she won't let me not tell her things. She'll ask 'And then what did the doctor say? And then? What's this medicine? I need to look it up!' [So] then I tell her everything, because she worries."* - Participant 1496, about her mother.

- *"We're on GChat a lot. We chat throughout the day. I know how she's feeling with about a 15 minute resolution."* - Participant 3792, about his girlfriend.

- *"I have a really honest relationship with [boyfriend name]. He'll be the first one to check in after a medical appointment, so is most aware... Rather than him trying to make sense of it, it makes more sense for him to just be supportive and be there. ... If I say anything negative, he'll jump on it. If I'm feeling down on myself, just him kinda being, 'Hey, you're doing the best you can.' ... Sometimes I'm in the place to hear it."* - Participant 4416, about her boyfriend.

- *"I have a group of two women.. we call ourselves accountability partners. We meet up, like, every week. The idea of keeping each other accountable is [about] committing to listen to one another, encourage one another, and challenge one another to live a life of faith."* - Participant 5397, about her certain members of her church community.

5.3.2 Choosing People and Choosing Topics

On discussing the support network of the interviewees, they tended to have a certain group of people that they turned to for general day-to-day support. These people could be family, or family-like people, as well as friends, but most times, participants had a strong preference towards one or the other. In most cases, the interviewee chose to discuss serious subjects — about things that were really on their minds — with only friends or only family, and chose to discuss only mundane, less serious topics with the other.

For example, Participant 1010, talking about her parents, expressed a common sentiment. *"We only talk about mundane things... things not directly related to life."*

5.3.3 Serious Situation

Although the call for participant recruitment called for participants dealing with some serious situation in their lives, whether mourning or illness or other unusual difficulty of transition, the severity of the participants' situations varied.

On the lighter end of the spectrum included six participants who were dealing with regular academic and career pressures. On the heavier end, three participants were dealing with very serious chronic illnesses, another was bereaved, and others were battling other forms of daunting transitions and trials.

5.3.4 Meeting Needs

Luckily, all of my participants who wanted support had people who could provide it. However, as anticipated by other research [23], when the needs grew, it became harder for some of my participants to get what they needed.

Participant 9541 expressed a general sentiment about discussing tough topics: *"Feeling like you need it and actually reaching out are two different things. It's a lot harder to say 'I'm struggling with whatever's going on.'"* and Participant 5397 described a high learning curve *"Two years ago. Actually, even a year ago, I was not*

very good about reaching out to people. It takes a lot of energy to reach out to people and explain what's going on. [We thought] 'If these people are really my friends, they should be reaching out to me,' but actually, if they don't know, they don't know. Nowadays, there's a group of people we'll email or call. Maybe we should be asking a few people, specifically, to be on-call."

5.3.5   Technology

Participants tended to be technically savvy. and used a complex range of technologies to connect with friends and family near and at distance, for a range of complicated reasons.

Texting and instant messaging were were used frequently for casual things such as keeping in touch, and other modes of communication, such as video, phone, or in person meetings, were used for more serious topics. The exception to this was email, which despite being digital and text based, afforded a level of thoughtfulness that participants felt were especially valuable in a different way. Email was favored by two participants, one who wrote distant friends about the condition of her chronic illness, and the other who had depressive episodes. They found that email communication was more comfortable than media that were more immediate.

5.4   Opening Interview: Other Trends

Many interesting results, decision patterns, and phenomena were not anticipated by the script.

5.4.1   Direction of Awareness

In many cases, there was a clear directionality to the type of awareness information shared. For example, it was common for children to report a lot to their parents, but the parents often shared little in return. This could also be true for other relationships, such as between siblings or friends, with one party in the habit of disclosing more to

the other. A specific example was from Participant 1010: *"With some of my friends, I like to know what they're doing. I kinda mother them. I like to make sure they're doing okay."*

5.4.2 Extreme Information Withholding

Another phenomenon that became apparent with interviews is that many, normally trusting, close relationships, can exhibit information withholding. On the topic of awareness and updates from family, a rather sad event was recounted with dry laughter by Participant 2928. *" They don't tell me anything, no. They feel like I should focus on me. Even when my dog passed away, they didn't tell me for an entire month. They didn't want me to be upset. I just noticed the dog wasn't there, and they never straight up told me."*

It's important to note that the story is one instance of a general trend of not sharing bad news. This can take the form of general reticence on the subject. Participant 9451 explains, *"[My struggles are] not really fun to talk about. Most people already have enough on their plate"* Another strategy is positivity, described by Participant 3792, *"I try to look on the bright side. For example, my Facebook page used to be full of sad things. I decided not to do that anymore."*

This can also be taken to the extreme. One specific example from my participants involved completely not telling family members about a serious issue, while maintaining communications otherwise.

5.4.3 Changes in Support Structure

Lastly, closely related to the extreme information withholding, there are many situations in our lives that result in drastic changes in the nature of our support structure. As mentioned in Section 1, death can be the most tragic cause of such a change. When the person who passed away had a pivotal role in the support structure of another, it can be even harder to cope with the difficult period of mourning. Though this was true for a participant who was bereaved, the drastic changes that other in-

terviewees described usually involved a falling out of some sort. These falling outs could be between family members, significant others, or even friends, and completely overturn an existing network.

5.5 Android User Study

After the Opening Interview, participants were instructed to invite at least 2 people to join their group. Once there were 3 people in a group, they were given the InMind application, and they could begin the second phase of the study.

5.5.1 Participants

Of the 15 participants who could convene groups for the Android portion of the study, 2 could not continue due to timing constraints and 5 more did not get two people in their group. Thus, we had 8 group leaders who participated in the full Android study. Two were in the same group, since they had signed up to participate in the study together, so the Android study involved 7 groups in total.

For the 5 groups who did not manage to get two more people into their group, we decided to call them in for a closing interview after two weeks. The closing interview, instead of asking about the experience of using the application, just inquired into the reasons for not recruiting friends. One benign reason for failing to recruit is that users did not have friends who used Android phones. One participant asked 5 friends and discovered all were iPhone users. Another was that the participants simply became too busy to interact with friends and ask them to be in a study with them.

5.5.2 Weekly Feedback

During the study, I asked for feedback via open ended online questionnaires, and offered optional in-person check-ins that 3 participants took me up on.

Most of the weely feedback consisted of feature requests. Some participants wanted to be able to change the sharing status of a topic after it was started. Others

wanted to be able to post pictures onto a topic. A full list of feature requests has been compiled in Appendix B.

In general, the suggestions were reflective of the users' experience with other applications for communication, such as Google Hangouts [26], Line [27], or QQ [28], in that users expected to be able to send pictures, emoticons, video, and receive notifications for messages.

On the other hand, one participant contrasted the slow messaging design with the other forms of communication she was more used to, and said she liked knowing that the other people in the group weren't being immediately contacted when she wrote messages.

5.5.3 Affective Benefits and Costs Questionnaire

The Affective Benefits and Costs Questionnaire (ABC-Q) as described in the Study section, is intended to measure various factors related to the usage of a communications technology.

Figure 5-3 shows the scores, over 3 weeks, that the participants reported. Once I drop the outlier data point, Participant 1847, the average ABC-Q scores hold at a steady positive 13 for all three weeks.

Note: The outlier participant, visible in Figure 5-3 as changing extremely from very positive, to very negative, and back to very positive may have had reporting errors. Her questionnaire's subscores reported that in the second week, she felt that the application invaded her privacy. I brought up the topic of privacy during our closing interview, and she reponded, *"I don't think it invaded my life. It was a very optional thing, if I wanted to use it, I used it. Maybe I submitted a bad feedback. I don't think it's an invasion of privacy."*

5.5.4 System Usability Scale

This distribution of System Usability Scores (SUS) is shown in figure 5-4. The SUS is scored from 0 to 100, but the average score for the SUS is 68, so we compare our
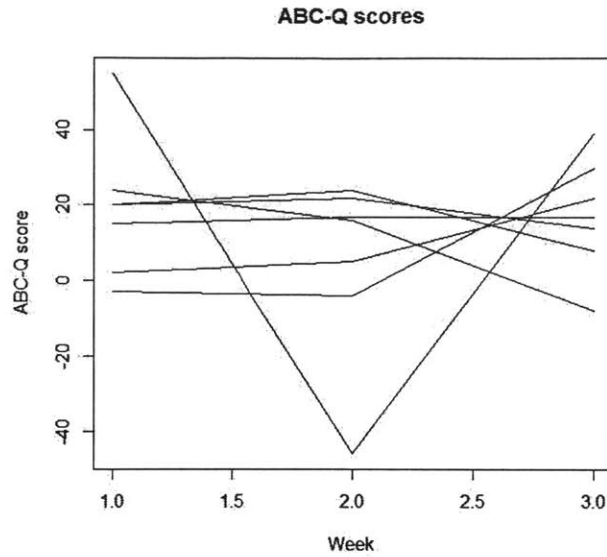
Figure 5-3: Over 3 weeks, the ABC-Q scores reported by participants tended to vary a little. The outlier may be due to bad reporting.

results to that. A students t-test of the average score of the data, minus an outlier, is significantly different from the expected average of 68 (p=0.0136), suggesting that InMind is doing reasonably well in usability.

5.6   Data from Application

Since the data set only includes 7 groups, it is not particularly meaningful to derive any statistical conclusions from them. However, a data set of 36 users, 70 topics, and 1043 messages is still useful for observing some likely trends. The questions that I will discuss in this section address permissions given to topics, the life cycle of a topic, user interactions over 3 weeks of usage, and variability between the 7 groups.

5.6.1   Permissions

An important question posed at the beginning of this study considered the privacy level of topics. The hypothesis was that for many serious topics, the privacy of the information was very important to the owner of the topic, so the owner would want to

System Usability Scale
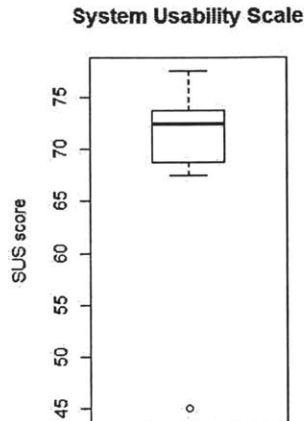
Figure 5-4: System Usability Scores included an outlier, but was otherwise centered around 72, and is significantly different (p=0.0136) from the expected average of 68.

control who had access to it. In this study, of the 70 topics observed, 13 were shared with no-one, and were used by the owners to organize their own thoughts. 27 topics were shared with "Everyone" within the group, and the remaining 30 were shared with some subset of people. It is safe to assume from this usage data that there is a desire to organize thoughts for oneself, and the topics that are shared are roughly evenly distributed between those that the owner is fairly comfortable sharing with the public, and those that are shared with specific people.

5.6.2 Topic Life Cycle

Topics are created generally in the mornings and evenings, and as interviews confirmed, generally before the day starts and after the day ends, and not when things are happening. The distribution of hours of creation is shown in Figure 5-5, which shows a bimodal distribution centered on waking and sleeping hours.

After the opening interviews, we considered the types of stressors the interviewees faced, and postulated two likely types of topics: short lived and long lived ones. Short lived topics we imagined would last a few days to a week, and would include things like class projects, work deadlines, short conflicts with friends, and other temporary

Topics Created Per Hour
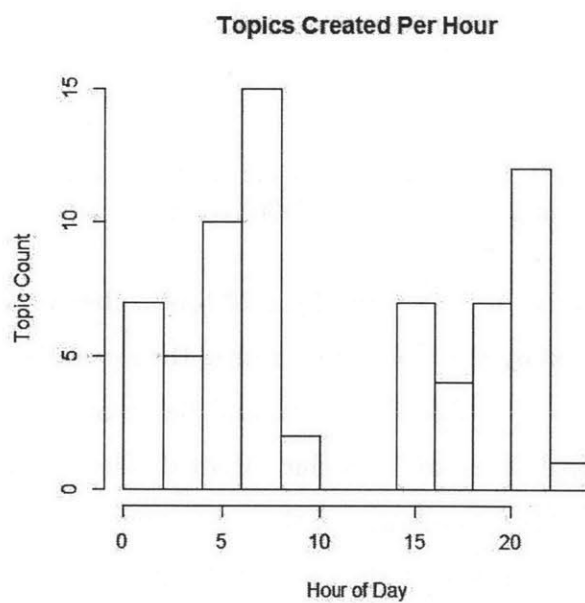
Figure 5-5: Topics were created at varying hours of the day. The 70 topics shown in this bar chart appear to show topics being created in the morning and evenings, and occasionally in late evening/early morning, but fewer in the middle of the day, between 10:00 A.M. and 3:00 P.M.
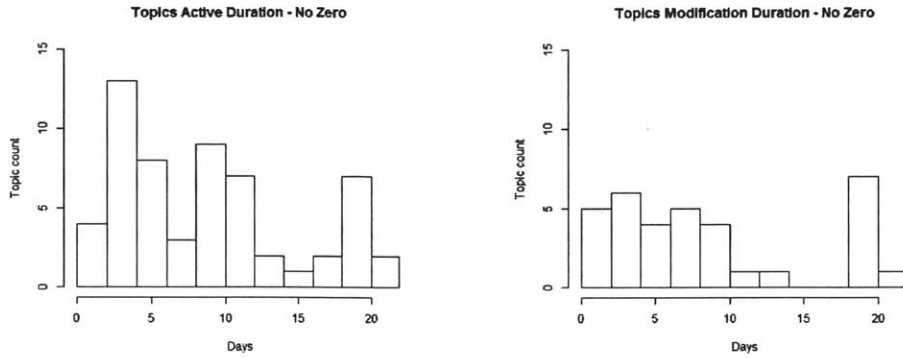
(a) Days topics were had messages sent on them, after creation, minus 12 topics not discussed after the first day.

(b) Days topics had icon status changed, after creation, minus 36 topics whose status didn't change after the first day.

Figure 5-6: The large majority of topics had messages sent on them for several days after creation, but many didn't have icon status changes after the initial creation.

frustrations. Long lived topics we imagined would last much longer, and would include the more chronic, serious topics, and since these stressors can last from several months to indefinitely, they should remain active for the duration of the 3 week study. This ended up remarkably accurate, but we had not anticipated that many topics would be created, and never become active. These "zero-day" topics were created, but were neither updated nor discussed after the day they were created. Explanations from the interviews general expressed a lack of interest in the topic after the initial posting.

In Figure 5-6, charts show two different measures of topic duration, filtered to remove the zero-day topics.

Some of the groups felt more of an affinity to using the icons to communicate. This is best demonstrated by comparing, for each group, the average number of days that a topic had messages sent on it with the the average number of days that a topic had its icon updated. This difference, if positive, signaled that the group preferred using the icon status, since they persisted in using them after messages sent on the topic had halted. A negative difference, on the other hand, showed that messages were sent on a topic long after the icon's status was ignored. Those differences are shown in Table 5.1. One group used icon updates and messages almost perfectly concurrently,

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with a difference close to zero. Two other groups had positive differences (preferred the icon status updates), and the other four had negative differences.

Table 5.1: **Average Days Topic Icon Updated After Last Message** - Between the 7 groups, 2 preferred using icon updates, 1 was balanced, and 4 preferred messages.

Group Number	Difference
1674	9
3452	6
3792	0
1847	-1
2927	-4
8594	-5
5397	-11

From this, we believe that the iconography related to the status is meaningful to only some of the population, and is not to the rest.

5.6.3 General Usage During Study

The number of topics created and number of messages sent changed over the course of the 3 weeks. Counts of how many of each occurred each week are summarized in Table 5.2 On average, each group created about 5 topics the first week, 2 topics the second week, and 1 topic the third week, and similarly, sent 70, 45, and 15 messages. This pattern was explained by the users in the closing interviews. The first week or so saw heavy usage because users had to inform people within the group about both long and short term topics, as they were all newly introduced into the application. Then, after some time, usage stabilized to a few updates to long term topics, and occasionally a new topic. We can reasonably postulate that the 3rd week's usage is much more likely to be that demonstrated by users in the long term, but the study duration was not long enough to get to a stable equilibrium.

Table 5.2: Weekly Activity

Week	Topics Created	Messages Sent
1	43	558
2	17	361
3	10	124
Total	70	1043
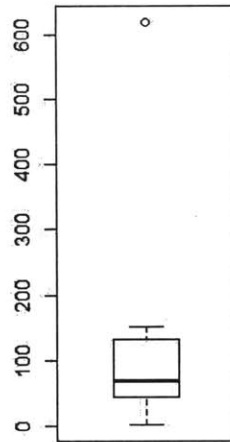
Figure 5-7: The number of messages sent by each group varied between 2 and an outlier at more than 600 messages.

5.6.4 Variability Between Groups

The variability between groups is best explained by the qualitative contents of the closing interview, but the data gives us a preview. Looking at the number of messages sent within a group, shown in Figure 5-7, we see that a likely typical number of messages sent within a group is between 30 and 100, but there is an outlier of more than 600 messages in one group.

5.7 Closing Interview

The closing interview also followed a script, and similarly to the opening interview, some themes quickly bubbled up from beyond the explicit content of the questions in the script.

5.7.1 Positive Experiences: Unique Usage Methods

The positive experiences were mostly reported by the people whose groups sent a total of more than 100 messages. Each of these groups found their own unique way of making the topic-based communication work for them.

Day-Logging

The group with the heaviest usage, over 600 messages in the course of 3 weeks, was the group led by Participant 5397. Suffering from a chronic illness, Participant 5397 was interested in logging her day to day activities, food consumption, and wellness. *"I have one topic about my diet, and foodstuff, and another that was on how I'm doing or feeling, and those would be the ones I'd update even if no-one had said anything. Typically my friend was very good about making some sort of comment, so I'd be responding to her, but I'd also just update it."*

Several features of Participant 5397's habits suggest why her and her group's usage was so high. In the second week, she said, *"I've become more accustomed to working with InMind and had somewhat of a "schedule" (a very loose one) to check it before bed, which coincided somewhat nicely with my nightly reflection time. [T]he active group member has been asking me questions that might not come up in our typical interactions... This kind of daily back and forth has developed our friendship and made me think more."* This suggests a regular schedule and habit of reflection, and that InMind integrated smoothly with her existing habits. She also got value out of having someone being on the other end, responding and reflecting with her.

Further, during the closing interview, she described InMind as a convenient way to send logs to other people every day, as opposed to other forms of communication, such

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as email, in which she sends one email a week at best. When asked about comparing InMind updates to her weekly emails. *"The two different formats of email vs status messages are good for different things. One of them is weekly. One of them is daily. The emails weren't as minute in terms of details. In the app, it doesn't encourage long messages, so I updated more as if it were a Twitter feed."*

Self-Reflection

The second most active group was associated with Participant 8597. She reported early on that her friends weren't really involved in her group, and didn't seem to find a use for InMind, but she did. Participant 8594 used it for regular self reflection, and found personal value in using it. *"It has helped me keep an overview of everything on my mind, and it let's me try to be more honest with how I assess my feelings on each thing."*

Activity Sharing

Finally, the last group that had over 100 messages was that of Participant 1674. His group's advantage was that the participants in the group were all more active on InMind. Thus, there was generally more interaction, and the activities were not as individually driven. The members of his group were in his research group, and they were sharing some common stressors that they could come together on. Further, they also were traveling together, and there were logistical/experience-based communications that were valuable for the members in the group.

5.7.2 Negative Experiences: Limitations of Study Deployment

Sparse Interaction

When asked about negative experiences, 5 of the 8 participants described, in various ways, the disappointment associated with a lack of interaction from the other members within the group. The disappointment came specifically from instances when

members of the group did not respond to messages sent through InMind.

This was due to two primary reasons. The first reason, which applied to 1 of the 5 people, reflected that he expected much faster message turnover rate, and that for him, more timely responses are more useful for him, and getting a message several hours/a day after the incident is not helpful. The second reason, is related to the people in the group.

Group Membership

At the end of the study, when I compared the descriptions of the members of their actual research group with the people they reported as close to them during the opening interview, I realized that in all but 1 of the 7 groups, the members of the group were not people the participant would normally go to for support.

In some cases, this was discovered when I asked about the membership of the participants' groups. Besides them being not being the people that the participants felt close to, they also tended to respond less. *"I wish that the people I invited in could have done more."* - Participant 8597.

The group for which the members were actually likely to be sources of support for the participant was that of Participant 1674. His group of coworkers were very close, and their interactions were thus the most balanced of the 7 groups.

Besides them, every single other group was composed of the participant and 2 or 3 people somewhat arbitrarily drawn from their pool of acquaintances, based on the requirement that they own an Android phone. This is primarily a result of the study limitation imposed by requiring an Android device for admittance into the group, and it severely limited the depth of interaction possible over InMind. In the end, the value of the application depends on the value of the connections it supports. In one group (that of Participant 5397), it rekindled a relationship between the participant and an old friend, but in most of the groups, without existing strong ties, there really just wasn't much that anyone wanted to share.

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5.7.3 Support Needs and Topics

The participants did not report any significant changes in the stressors in their lives, though the intesity of the stressors varied over the course of the 3 week study.

5.7.4 Meeting Needs: Dependence Upon Group Members

Related to the fact that relationships between members of the groups were not particularly strong, most of the time InMind was not used to explicitly reach out for support. I believe that it is due to the lack of confidence in getting a response from the group, but most consistent interactions within a group were for personal purposes, so instead of encouraging the actions of reaching out for help it seems to have encouraged self-organization and independence instead.

5.7.5 Interaction With Other Technologies

This topic resulted in varied results. Some groups (4 out of 7) brought topics from within the application to outside of it, via text messages, emails, or phone calls, and InMind functioned as an initiator for conversations. In many ways, this was the primary function of InMind, to give serious topics a place in the minds of the relevant close ties, and allow them to bring it up over richer communication pathways.

For 3 out of the 7 groups, not so coincidentally the lower usage rate groups, topics that existed within InMind stayed within InMind, and never made it into the participants other interactions with their group members.

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Chapter 6

Discussion

6.1   Existing Support Needs

In this work, we took a small sample of MIT affiliates and interviewed them to better understand their support needs and strategies for obtaining them. We discovered that the degree of need varies among individuals, and although some prefer to have close connections with whom they connect and share many personal feelings, others do not.

6.2   Privacy Concerns of Individuals

The privacy concerns of the individuals in the study varied as well. Although most were very sensitive to who is able to read what they write, surprisingly, a good number reported to be completely neutral as to the degree of exposure their writing receives. Some of the participants actually expressed a desire to place the status material in a public location on the web, where anyone with a link could get access to it.

6.3   Value of Topic Based Communication

The biggest contribution of this work was to bring topic-based communication, in the style of forums with a status icon, to a personal network. The degree of interest

in this structure varied among the participants. The two heaviest users expressed value in organizing things for themselves in a topic based way, and using the icons to communicate for themselves, but most participants felt that the icons were not mutually understood by the other members of the group. Our analysis on the usage of the icon status updates show that it's very likely that symbology for topics within normal life only connects with a subset of the population.

6.4 Designing Within an Existing Technological Space

InMind was valuable as a topic initiator, giving a space to rarely mentioned topics, but understanding that the bulk of communication happens through other, more instantaneous means of communications that people are more familiar with.

Further, by the many feature requests that the participants made throughout the study, I conclude that modern users expect a certain large bucket of features that accompany any communications application. Standards set by other products lead users to expect a certain feature set that includes rich content such as a large set of emoticons and the ability to share pictures, video, and sound.

6.5 Future Directions: Observing Strong-Tie Relationships

What intrigued me the most, upon finishing the first round of interviews and understanding my participants better, was observing how members of a strong-tie relationship interact through technology. However, it is very difficult to conduct a study that involved strong-tie relationships between loved ones, and very possibly impossible in an university setting.

Trying to recruit participants' close ties is difficult. To actually observe the real connections that people are invested in, being involved with existing communities may be the best way to understand their connections and would be very valuable.

Appendix A

Additional Materials

A.1 Compensation

Table A.1: Compensation Chart

Task	Compensation
Opening Interview	$10
Android Week 1	$5
Android Week 2	$5
Android Week 3	$5
Android Week All	$25
Closing Interview	$10
Total	$60

A.2 Documents for Participants

E-Mail to potential participants

Subject Line:

Invitation – Media Lab Study on Dealing with Serious Stuff

Body:

Are you or someone in your family dealing with a health or life-threatening condition?
Have you lost a loved one, and are you still coping with bereavement?
Are you dealing with a transition in your life that is causing you extra stress?

We seek participants for a 21-day study centered on an Android application that lets you share your wellness and stories with loved ones. Help us research the use of mobile applications on coping with these issues.
Please email me at joyc@mit.edu for more information.

Warmly,
Joy C. Chen
Affective Computing Group at MIT Media Lab

E-Mail to potential participants, second round.

Subject Line:

Media Lab Study on Dealing with Serious Stuff [up to $60 for participation]

Body:

Are you or a friend experiencing a particularly serious or difficult period in your life right now?

This can take the form of someone in your families suffering from poor health or a life-threatening condition, bereavement, or it may just be a transition in your life that is causing you extra stress.

We seek participants for a study to better understand how people deal with the serious stuff in their lives and how modern technology is involved.

You (and friends) can help us research the use of mobile applications on coping with these issues. This can be by signing up for an interview and/or using an Android application for up to 21 days.
You can be compensated up to $60 for your participation.

Please email me at joyc@mit.edu for more information.

Warmly,
Joy C. Chen
Affective Computing Group at MIT Media Lab

Follow up email:

Thank you for your email! I'm pleased to meet you. My name is Joy. Here is some additional information about this study. We will have information sessions on 3/9, 3/11, 3/12 at 4:00 in the Media Lab [rooms TBD]. If you are eligible to participate (see details below), **please RSVP for a session by replying to this email.**

Our Mission:
By making it easier to share our feelings and worries with loved ones, we aim to:
1. Improve day to day feelings of presence and connectedness.
2. Build resilience and cohesion for times when support is critical.

What's involved:
If you would like to help by being a participant, you will be asked to:
1. Attend one of our information sessions.
      - Fill out a questionnaire.
      - Sign consent forms for participation.
2. Chat with me in an individual session.
      - This can be in person or over the phone.
      - You can opt out of this and still participate in the study.
3. Install an app on your Android phone and use it for 21 days.
4. Answer a questionnaire at the end of each week.
5. Have another chat with me at the end.
      - Same conditions as #2

Requirements:
- You are an MIT student
- You own an Android mobile phone
- You are between 18-60 years old

Compensation:
You will be compensated with $25 at the conclusion of the study, or if you decide to stop at any point, $1 * days you participated. You will also receive another $5 at the end of each completed week. If you choose to participate in the interviews at the beginning or end of the study, you will also be compensated $10 for each. Payment will be at the end of the study.
Lastly, if you are fairly sure you would like to participate, please let me know if you want to schedule an interview time, now, instead of after the info session, so you can have your pick of time slots.

Warmly,
Joy C. Chen
Affective Computing Group at MIT Media Lab

InM Group Introduction

Thank you for coming today to volunteer in the study. Today, I will give you a description of the study, and then ask you to sign some informed consent forms.

My name is Joy. I'm a Masters' student at the MIT Media Lab. My thesis research is in developing technologies for people, specifically those who are dealing with dire situations, such as if someone close to them is suffering from a health or life-threatening situation, or if they are bereaved.

Based on previous research, I've designed an application called InMind. The purpose of this application is to help people keep connected with and moderate communication with their friends and other loved ones. Now, we're running a study to determine how and to what degree InMind can help people manage support and communicate with loved ones.

As part of this study, you will be asked to install and use InMind, as well as invite some of your friends to be a part of your InMind group for three weeks. Whenever your group, including you, reaches a membership of three, the three weeks will begin. From then on, the application will be available on your phone, and you can use it as frequently as you like.

Because this is a research study, there are some things you should know:

1. Everything you do on the application will be saved on the servers here at the Media Lab, and be analyzed as part of the study. For example, we will log when you send messages and who they go to. There is one notable exception. As mentioned on the consent form, for any stories and messages that involve a text body, the text will encrypted before being pushed to the server, so nobody besides you and the recipient(s) will ever read it.

2. To help me understand your experience, I'd like to interview you twice during the study. The first would be as soon as we can schedule it (if we haven't yet), and the last would be after the conclusion of the study. These can be in person or over the phone. If you would not like to be interviewed for either one, please indicate it on the sheet I'm about to give you.

3. At the end of each week, I will email you a questionnaire for you to fill out.

4. At the end of the study, InMind will stop working, and you'll be asked to remove it from your phone.

5. Also at the end of the study, you will be compensated up to $60. If you would like to quit the study at any point, for whatever reason, please just let me know. You will be compensated $1 for each day you were in the study. You will also be paid $5 for every week of the study you complete, and $10 for each of the interviews you held with me.

If you have questions, suggestions, or any other thoughts, please email, call, or text me at joyc@mit.edu and (510) 565 – 8416. I welcome feedback of any sort at any time!

Please fill out this opening questionnaire as best as you can. We require that you are over 18 and own a compatible Android phone, but beyond that, you will not be excluded from the study based on any of the information you provide.

Basics:

Name: _____

Age: _____

Sex: Male / Female / Other

Academic major: _____

Class Year: _____

Eligibility:

Do you have an android phone?   Y (Android OS Version _____), N

Do you have data plan?   Y (unlimited / data limit _____), N

Interview Interest

Would you like to take part in an opening interview within the next few days (I will schedule this with you) so that you can tell me about your situation and your interests?   Y/N

Would you like to take part in a closing interview at the conclusion of the study so that you can tell me about your experience with the application? (You can change your mind at any point, including any time before or during the interview.)   Y/N

Other helpful information:

Living situation

___ Dorm   (Which one? _____)

___ Independent Living Group   (Which one? _____)

___ Off Campus

How often do you talk with close friends?

___ a few times a day   ___ a few times a week   ___a few times a month

How often do you talk with family?

___ a few times a day   ___ a few times a week   ___a few times a month

How often do you use your smart phone?

___ all the time, often   ___ a few minutes a day   ___ less, rarely

On a scale of 1 (Never) to 7 (Almost Always), please rate the following statements.

1. I want to talk to my friends when I am troubled.   _____
2. I want to talk to family when I am troubled.   _____
3. I feel supported by my friends.   _____
4. I feel supported by my family.   _____
5. I reach out for support when troubled.   _____

On the next page, you will see a 10-item perceived stress scale, please fill it out.

Perceived Stress Scale- 10 Item

Instructions: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

1. In the last month, how often have you been upset because of something that happened unexpectedly?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

2. In the last month, how often have you felt that you were unable to control the important things in your life?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

3. In the last month, how often have you felt nervous and "stressed"?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

4. In the last month, how often have you felt confident about your ability to handle your personal problems?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

5. In the last month, how often have you felt that things were going your way?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

6. In the last month, how often have you found that you could not cope with all the things that you had to do?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

7. In the last month, how often have you been able to control irritations in your life?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

8. In the last month, how often have you felt that you were on top of things?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

9. In the last month, how often have you been angered because of things that were outside of

your control?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

___0=never ___1=almost never ___2=sometimes ___3=fairly often ___4=very often

This scale can be found in the following articles:

Cohen, S., Kamarck, T., Mermelstein, R. (1983). A global measure of perceived stress. Journal of Health and Social Behavior, 24, 385-396.

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapam & S. Oskamp (Eds.), The social psychology of health: Claremont Symposium on applied social psychology. Newbury Park, CA: Sage.

Upgrade Your Health and Happiness

Updated February 2007

InM Opening Interview Script

High-level research questions to answer:
1. *What are some common social support needs of individuals dealing with illness or bereavement?*
2. *In what ways do their current social interactions satisfy and fail to satisfy those needs?*
3. *How is technology involved?*

Thank you for taking the time to talk with me today.

During this interview, I will ask you a series of questions. Please take as much time as you would like to answer them. I'm here to listen to you, and answer any questions you have. If you don't want to answer any particular question, just say "let's skip this one" and we'll move on. If you want to end our discussion at any point, please just let me know. There is no penalty and there is nothing wrong with doing this.

Lastly, although this study aims to serve those who are dealing with dire situations, not every question in this interview has to feel dire for you. Please feel free to answer as truthfully and thoroughly as you are comfortable.

Do you have any questions before we start?

Part 1: Background
1. [Repeat back some of the information from the opening questionnaire to verify.]
2. Please tell me about your close family and friends. Who are they and how do you interact?
   a. How often?
3. Who else do you reach out to for guidance or support?
   a. How often?

Part 2: Social Support Needs and Communication Topics
1. What is the situation that motivated you to want to participate in this study?
   a. [empathize as appropriate]
   b. Please tell me about some of the stressors in your life.
2. [Ask this for each distinct group of people they talk to.] When you talk with [subset of people], what are some topics you most appreciate discussing?
   a. With what frequency do these topics come up?
   b. Are there any topics that fail to get communicated, and why?
3. To what degree are you aware of how your friends and family are feeling on any given day?
   a. To what degree do you think they are aware of how you are?
   b. If you currently communicate this information, how do you do it, and how often?
   c. What value do you think this knowledge might have for you or your loved ones, if any?

Part 3: Meeting Needs
1. How do you contact people when you feel like you need support?
   a. Did it work?
   b. Why?

Part 4: Technology
1. How comfortable are you with technology, in general?
2. Does technology currently play a role in your support network?
3. What do you use, in the course of an average week?

Part 5: Motivation and Expectations
1. Why did you decide you were interested in participating in this study?
2. What do you hope to get out of this experience?
3. Any final thoughts/questions?

InM - Weekly Questionnaire

During the previous week, how has your health been?

	Very good
	Fairly good
	Neutral
	Fairly bad
	Very bad

During the previous one week, how would you rate your stress level?

	5 (highest stress level)
	4
	3
	2
	1 (lowest stress level)

How was your experience with InMind this week?

_____

_____

_____

_____

What did you feel about the status sharing capability of InMind? When was it useful/not useful, confusing, or frustrating?

_____

_____

_____

_____

What did you feel about the story telling capability of InMind? When was it useful/not useful, confusing, or frustrating?

_____

_____

_____

_____

Is there anything you wish you could do through InMind but could not?

_____

_____

_____

_____

If you have any further comments or questions, please call or email me!

On the following pages you will be asked questions about your experiences regarding communication with your group using InMind.
There are no right or wrong answers; we are interested in your personal opinions and experiences. Do not think about questions for a long time, but try to rely on your first reaction.
Some questions ask you about the experiences of the other members in your group. We are interested in your view on their feelings and experiences, so it is no problem if you are not sure about this. Just try to give the answer that you think is most suitable.

ABC-questionnaire 60-item

Let "the medium" be the InMind application, "contact" be any interaction through InM, and "other" be any/all members of your group.

On a scale of 1 (Strongly Disagree) to 7 (Strongly Agree), please rate the following statements.

If there are potentially different values for different members of your group, feel free to use the extra columns. Otherwise, we will assume the first value applies to the group as a whole. Please inform the questionnaire administrator if you need more columns.

1. I feel obliged to contact the other. _____ _____ _____

2. After a contact the other keeps thinking about me for a long

time. _____ _____ _____

3. I find it difficult to infer from a contact how the other is

doing. _____ _____ _____

4. I feel that the contacts with the other take a lot of time. _____ _____ _____

5. The contacts keep the other informed about important

events in my life. _____ _____ _____

7. The other finds it difficult to stay in touch with me through

this medium. _____ _____ _____

9. If I contact the other, I expect him/her to respond. _____ _____ _____

10. The other experiences the contacts as an invasion of

his/her privacy. _____ _____ _____

11. The other knows what I feel during a contact. _____ _____ _____

12. The other can easily avoid a contact if s/he wants to. _____ _____ _____

13. The contacts keep me informed about important events in

the other's life. _____ _____ _____

14. I find it easy to keep to myself those things that I don't

want to share. _____ _____ _____

15. I expect the other to contact me regularly. _____ _____ _____

16. The other hardly invests energy in the contacts. _____ _____ _____

17. During the day I regularly think back to a contact with the

other. _____ _____ _____

20. This medium helps me to keep contact with the other. _____ _____ _____

21. The other is disappointed if I don't contact him/her for a

long time. _____ _____ _____

22. I find it difficult to share experiences with the other

through this medium. _____ _____ _____

24. Through our contacts, the other learns more about me than

I would like him/her to know. _____ _____ _____

26. The contacts make me feel involved in the other's life. _____ _____ _____

27. The other could do some more effort to contact me. _____ _____ _____

28. Because of the contacts the other can identify with me. _____ _____ _____

29. If the other contacts me, I feel that I should respond. _____ _____ _____

30. Aside from our contacts, the other hardly thinks about me. _____ _____ _____

32. The other expects me to contact him/her regularly. _____ _____ _____

34. Aside from our contacts, I hardly think about the other _____ _____ _____

35. The other finds it easy to keep to him/herself those things

that s/he doesn't want to share. _____ _____ _____

36. I know what the other feels during a contact. _____ _____ _____

37. Because of the contacts the other knows how I am doing. _____ _____ _____

38. I hardly invest energy in the contacts. _____ _____ _____

39. The contacts make the other feel involved in my life. _____ _____ _____

40. The other feels obliged to contact me. _____ _____ _____

41. I am disappointed if the other doesn't contact me for a

long time. _____ _____ _____

43. The other finds it difficult to share experiences with me

through this medium. _____ _____ _____

45. After a contact I keep thinking about the other for a long

time. _____ _____ _____

46. The other feels that the contacts with me take a lot of time. _____ _____ _____

47. I find it difficult to stay in touch with the other through

this medium. _____ _____ _____

48. Through our contacts, I learn more about the other than

s/he would like me to know. _____ _____ _____

49. Because of the contacts I can identify with the other. _____ _____ _____

50. If I contact the other, s/he feels that s/he should respond. _____ _____ _____

51. If the other contacts me, s/he expects me to respond. _____ _____ _____

53. I experience the contacts as an invasion of my privacy. _____ _____ _____

54. The other finds it difficult to infer from a contact how I

am doing. _____ _____ _____

56. During the day the other regularly thinks back to a contact

with me. _____ _____ _____

57. I could do some more effort to contact the other.   _____   _____   _____

58. I can easily avoid a contact if I want to.   _____   _____   _____

59. Because of the contacts I know how the other is doing.   _____   _____   _____

60. This medium helps the other to keep contact with me.   _____   _____   _____

InM Closing Interview Script

High level research questions to answer:
   1. *How did InM fit into their existing support network and methods?*
   2. *What were the perceived costs and benefits of integrating InM into daily life?*

Thank you for taking the time to talk with me today.

During this interview, I will ask you a series of questions. If you don't want to answer any particular question, just say "let's skip this one" and we'll move on. If you want to end our discussion at any point, please just let me know.

Do you have any questions? Let's begin.

Part 1: Background
   1. [Repeat back some of the information from the weekly questionnaires to verify and give them a chance to reflect.]
   2. Thinking back on the last three weeks:
      a. What was your experience with InMind?
      b. What were some good experiences you had with InMind?
      c. What were some bad experiences or annoyances you faced?

Part 2: Social Support Needs and Communication Topics
   1. How have the stressors in your life changed since the beginning of the study?
   2. What were some of the topics that were helpful to discuss over InMind?

Part 3: Meeting Needs
   1. Did you use InMind when you needed support to contact someone?
      a. If you are comfortable sharing, what were the general circumstances, and how did InMind help or hurt?

Part 4: Technology
   1. [If not answered in opening interview.] What tools do you normally use to communicate and what is your experience with them? (Texting, email, calendar, video chat, phone calls, etc)
   2. Did InMind change the way you used other technologies in your social support network?
      a. [Ask about individual technologies if mentioned.]

Part 5: Motivation and Expectations
   1. How was your experience in this study, overall?
   2. Any final thoughts/questions?

System Usability Scale

	Strongly disagree				Strongly agree

1. I think that I would like to use this system frequently

1	2	3	4	5

2. I found the system unnecessarily complex

1	2	3	4	5

3. I thought the system was easy to use

1	2	3	4	5

4. I think that I would need the support of a technical person to be able to use this system

1	2	3	4	5

5. I found the various functions in this system were well integrated

1	2	3	4	5

6. I thought there was too much inconsistency in this system

1	2	3	4	5

7. I would imagine that most people would learn to use this system very quickly

1	2	3	4	5

8. I found the system very cumbersome to use

1	2	3	4	5

9. I felt very confident using the system

1	2	3	4	5

10. I needed to learn a lot of things before I could get going with this system

1	2	3	4	5

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Appendix B

Data

B.1 Questionnaire

B.1.1 Weekly Questionnaires

In the weekly questionnaires, when we asked for general feedback, we got a lot of feature requests instead.

Existing Functionality Improvements:

1. Allow changes in visibilty for a topic, after creation.

2. More flexible ways to arrange topics.

3. Clarification on how to use icons.

4. Make it easier to add people to a group.

5. Make it possible to separate actions performed by oneself and those by others.

Functions emulating other communications applications:

1. Enable picture sharing.

2. Enable video sharing.

3. Enable emoticon sharing.

4. Make it possible for anyone to see contents from a website.

5. Allow notifications to be sent to other users for some urgent actions.

6. Allow scheduling appointments with other people, in the context of a topic.

Affective Benefits and Costs Questionnaire (ABC-Q) results

Participant ID	Week 1	Week 2	Week 3
8594	-3	-4	30
5397	20	22	14
3792	24	16	-8
1672	2	5	22
2927a	15	17	17
2927b	20	24	8
1847	55	-46	39
Average	13	13.33333	13.83333
Average including 1847	19	4.857143	17.42857

The following table are the complete scores and subscores reported by each participant in each week. The left column lists the participant number as well as the names of the subscore category. The first 4 categories are benefits and the second 4 are costs.

The first two columns are scores for the self and other, and the final column in each week is the sum of the two. The final reported scores are the sums of the benefits minus the sums of the costs, and have been duplicated in the summary table above.

* IJsselsteijn, Wijnand, et al. "Measuring affective benefits and costs of mediated awareness: Development and validation of the ABC-questionnaire." *Awareness Systems*. Springer London, 2009. 473-488.

8,594	Week 1			Week 2			Week 3		
Thinking About	10	10	20	7	8	15	13	14	27
Sharing Experiences	7	16	23	12	15	27	9	14	23
Staying in Touch	12	7	19	8	7	15	6	6	12
Recognition	9	12	21	10	12	22	11	12	23
Obligations	16	9	25	12	13	25	9	6	15
Expectations	13	6	19	10	7	17	8	3	11
Inv of Privacy	5	12	17	6	12	18	5	4	9

Proc Effort	19	6	25	16	7	23	14	6	20
			-3			-4			30
5,397	Week 1			Week 2			Week 3		
Thinking About	13	15	28	15	15	30	13	12	25
Sharing Experiences	10	13	23	10	13	23	10	13	22
Staying in Touch	9	11	20	10	12	22	10	12	22
Recognition	13	15	28	11	14	25	10	15	25
Obligations	14	9	23	9	9	18	10	10	20
Expectations	10	9	19	10	10	20	10	11	21
Inv of Privacy	7	4	11	7	7	14	8	7	15
Proc Effort	14	12	26	13	12	25	12	12	24
			20			22			14
3,792	Week 1			Week 2			Week 3		
Thinking About	10	7	17	14	14	28	9	6	15
Sharing Experiences	13	9	22	12	9	21	5	6	11
Staying in Touch	8	9	17	6	7	13	4	6	10
Recognition	6	14	20	6	7	13	9	5	14
Obligations	13	5	18	11	6	17	10	9	19
Expectations	6	4	10	11	6	17	9	4	13
Inv of Privacy	4	4	8	3	4	7	5	5	10
Proc Effort	7	9	16	9	9	18	12	4	16
			24			16			-8
1,674									
Thinking About	8	4	12	13	15	27	14	14	28
Sharing Experiences	20	14	34	11	15	26	14	15	29
Staying in Touch	8	10	18	13	15	28	16	13	29
Recognition	2	14	16	15	13	28	16	16	32
Obligations	14	3	17	16	14	29	19	10	29
Expectations	13	6	19	17	18	34	17	12	29
Inv of Privacy	2	13	15	9	10	18	7	12	19
Proc Effort	16	11	27	12	11	23	10	9	19
			2			5			22
1,847									

Thinking About	13	13	26	11	10	21	12	12	24
Sharing Experiences	16	15	31	9	10	19	16	12	28
Staying in Touch	15	15	30	9	11	20	15	16	31
Recognition	15	15	30	11	10	21	14	14	28
Obligations	8	7	15	15	16	31	10	9	19
Expectations	6	9	15	16	15	31	12	11	23
Inv of Privacy	8	7	15	20	18	38	6	6	12
Proc Effort	8	9	17	13	15	28	9	9	18
			55			-47			39
2927a	15	13	28	12	13	25	12	13	25
Thinking About	10	13	23	13	14	27	13	14	27
Sharing Experiences	12	12	24	14	15	29	14	15	29
Staying in Touch	13	13	26	11	12	23	11	12	23
Recognition									
	13	11	24	12	10	22	12	10	22
Obligations	14	11	25	17	11	28	17	11	28
Expectations	7	10	17	8	11	19	8	11	19
Inv of Privacy	11	9	20	8	10	18	8	10	18
Proc Effort			15			17			17
2927b	14	15	29	12	16	28	11	12	23
Thinking About	12	11	23	11	12	23	12	11	23
Sharing Experiences	12	14	26	9	12	21	14	13	27
Staying in Touch	10	16	26	13	14	27	12	11	23
Recognition									
	11	11	22	13	12	25	12	13	25
Obligations	15	14	29	13	13	26	13	12	25
Expectations	5	11	16	6	8	14	8	8	16
Inv of Privacy	8	9	17	10	10	20	10	12	22
Proc Effort			20			14			8

B.2 Database

Collection	Fields	Type
Groups	group_id	String
	IV	String
	members	array of Strings
Users	alias	String
	is_lead	Boolean
	passphrase	String
	user_id	String
Topics	archived	Boolean
	color	Integer
	group_id	String
	modified_at	Date
	owner	String
	passphrase	String
	salt	String
	shared_with	array of Strings
	smiles	Integer
	state	Integer
	title	String
	type	String
Messages	owner	String
	topic	String
	text	String

Table B.1: All datatypes in the database have a unique id and a created_at date, in addition to the fields listed.

B.2.1 Summary Statistics from Database

Archived	TRUE	13
	FALSE	57
Type	plant	38
	ham	13
	bird	19
Everyone	TRUE	27
	FALSE	43
Only Self		13

Table B.2: By the end of the study, some topics were archived. A majority of the topics were plant topics, the default, but the split of the remainder between hamsters and birds was pretty even. A minority of topics were shared with everyone, and a minority of topics were shared with nobody.

Topics per Week	1	43
	2	17
	3	10
Topics per Group	1674	14
	1847	9
	2927	3
	3452	1
	3792	17
	5397	9
	8594	14

Table B.3: Topic Distributed by Week and Group

Messages per Week	1	558
	2	361
	3	124
Messages per Group	1674	114
	1847	63
	2927	68
	3452	2
	3792	26
	5397	619
	8594	151

Table B.4: Messages Distributed by Week and Group

Appendix C

InMourning Prototype

C.1 Background: Bereavement Technologies

For inspiration and guidance for this initial prototype, I looked into existing bereavement technologies. Research into bereavement from the perspective of HCI is young, but the existing literature reveals some of the core problems that technology can address. Among the earliest research is that of Massimi and Baecker in 2010 [9], a needs-analysis of all the ways that technology intersects with the lives of the bereaved. Part of their study was an observation of how, in the potentially-dispersed setting of the modern world, technology is already used to help bring people together during mourning. Massimi and Baecker proposed a wide set of design opportunities and challenges. They were primarily interested in exploring technological artifacts, both inherited from the deceased and those created by the bereaved to remember and grieve, but they also mention the possibility of technology helping to provide social support.

There have been few technologies designed explicitly for the grieving. One example is Besupp, an online platform for maintaining a support group between people who have experienced similar losses, designed and tested by Massimi and co. in 2013. [10] A screenshot from the study is shown in Figure C-1. Massimi and co. observed that technologies can be helpful as one of many ways to help with coping, as the needs of the bereaved are best addressed by a variety of interactions. This further study

Figure C-1: **Besupp Screenshot** – Besupp offered circles for people with like losses to share thoughts and feelings with each other.

demonstrated that there is value in support systems that are maintained over long periods and designed for to low and intermittent usage.

Other research has generally been observational, for instance Brubaker's study in 2011 of usage of existing technologies. [11]

C.2   Original Application Design

On the home screen, the user sees two tabs, which direct them to each of the two functions of the application. (Figure C-2)

The first function is to aid in communication management. The application supports efficient input of the user's current availability and preferred method of contact, if any, and broadcasts it to any subscribers. The current design changes an avatar that represents availability and mood. (Figure C-3)

Availability is indicated pictorially by a door that can be opened and closed; mood is indicated pictorially by a smiley face whose expression changes. The preferred method of contact will be included in the message that accompanies a status.

Figure C-2: **Application Homescreen** – The homescreen has two tabs, one for status updates and one for stories. The status page shown currently shows the user's own status, but can be expanded to have many users' current status. The story page shown has a list of stories written by the user. There are photographs when they are available, otherwise a small candle icon stands in.
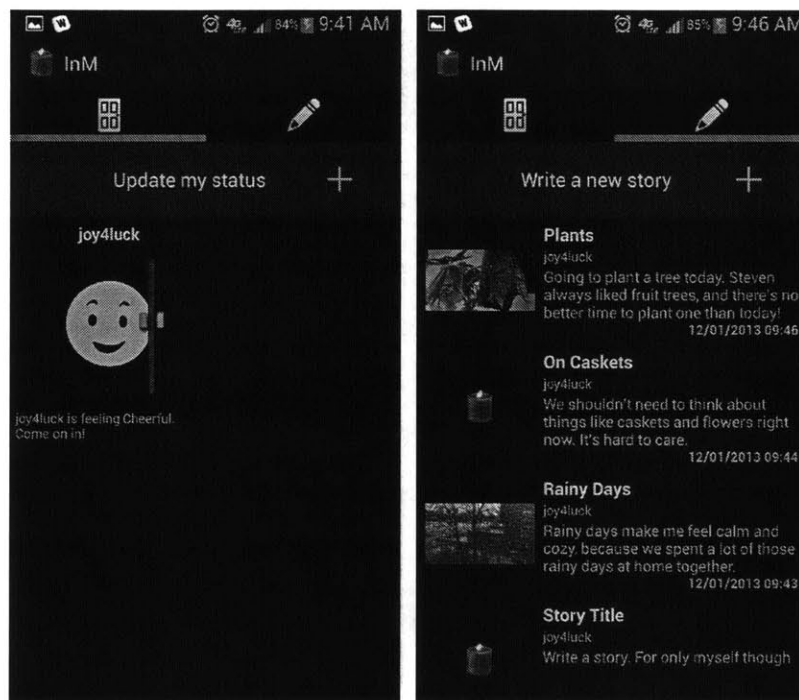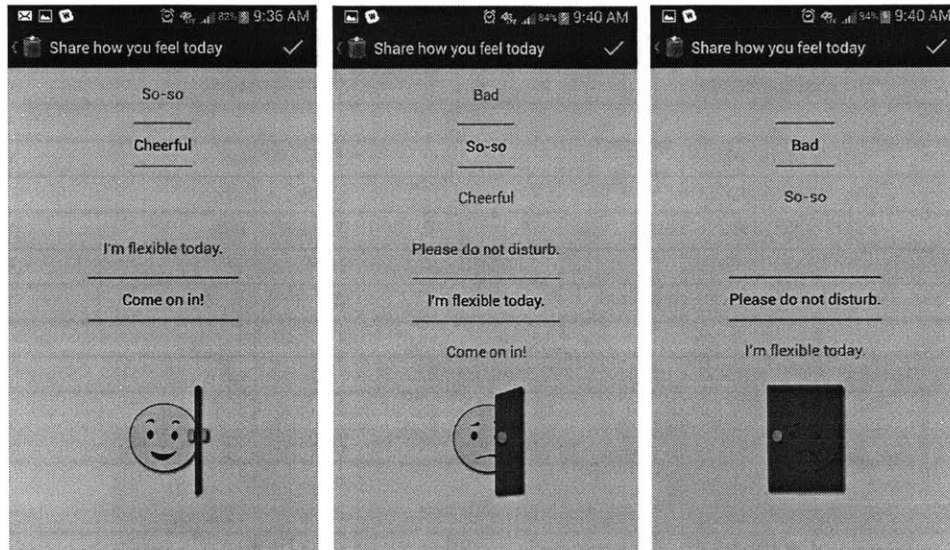
Figure C-3: **Status Update Window** – The status update window lets the user toggle between three moods and three availability states. Three representative combinations are shown, but any is possible.

The second function is to share stories and affect. The application allows the user to input pictures and/or text and choose who the recipients are. A technology to support these interactions would consist of a mobile application and a supporting server.

In the initial prototype, the focus is on giving users space to write out their story. The mobile interface is largely an open space for writing, as Figure C-4 shows.

C.3 Maturation into InMind

However, we soon ran into a problem. If we want to use technology to improve the relationships between friends and family during the process of bereavement, we have to introduce technology well before the crisis happens. This is for primarily two reasons.

1. Death is often a stunning, overwhelming catastrophe, and bereaved individuals cannot be burdened with learning how to use a new technology. Many recently bereaved individuals already find it difficult to do things they normally can.

Figure C-4: **Story Compose Window** – The story sharing window lets the user title their story, write their story, and optionally add a photo.
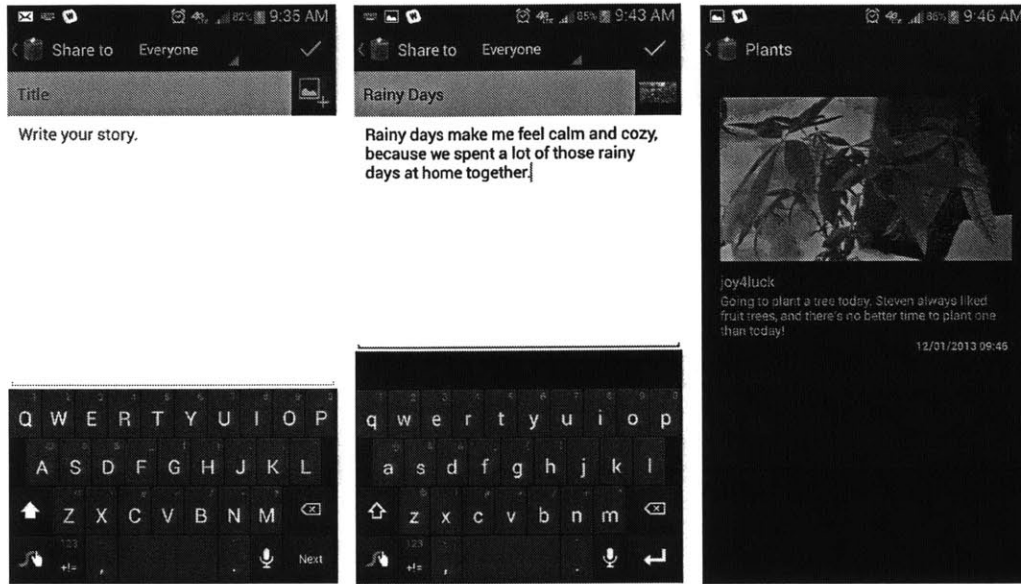
[29]

2. For the deaths that are more forseeable, such as due to illness, there is often a long period of handling the dire situation, in which many of the same needs exist.

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