Addressing Mobile Information Overload in the Universal Inbox through Lenses

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ABSTRACT

Increasingly, smartphones are being used to access all manner of information: email messages, Facebook status updates, tweets, RSS feeds, photographs and more. Approaches to dealing with this multi-faceted information stream developed on the desktop, such as switching between multiple applications or multiple browser windows, are unwieldy and scale poorly for mobile devices. In this paper, we propose the combination of the universal inbox and a system called 'Lenses' for extracting information of interest as part of a solution to this problem. These mechanisms allow the user to easily specify ways to sort, filter and manage their universal inbox in an intuitive way. We culminate with a discussion of implications for mobile phone interface design.

Categories and Subject Descriptors

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Design

Keywords

Mobile interfaces, mobile email, mobile messaging, information overload, lenses, entity resolution.

1. INTRODUCTION

Services that emerged on the desktop and through the browser are now migrating to mobile phones. The result is a large amount of social signaling across a variety of channels. Today, people frequently interact through each channel as a communication silo. On the desktop we frequently switch between different applications or browser windows to manage these multiple channels. This behavior works with adequate screen space, but becomes more challenging on mobile phone form factors. Instead of concentrating on simplifying application switching to the mobile phone, we consider this an opportunity to examine new ways to manage communications across multiple channels on the phone. With this opportunity comes the need to address information overload as the variety of channels and the volume of communications across these channels increase.

In this paper, we outline two related approaches to help address mobile information overload. The first is the universal inbox, a central point for all incoming communication including emails, text messages, tweets, Facebook status updates, and RSS feeds. The user may not interact directly with the universal inbox itself on a regular basis, but it provides an important first step in providing any scalable solution to dealing with multiple channels of communication on mobile devices.

The second is a tool to access that inbox in an easy-to-control manner, which we call *Lenses*. Lenses allow the user to control how collections of items from the universal inbox are grouped and displayed. For example, a user might have a Lens called 'My Love' for her boyfriend. If the boyfriend sends a text message or an email message, then it should show up in that lens. Additionally, if he updates his Facebook status message, sends out a tweet, uploads a picture to Flickr, or updates his blog, then all of those items would show up in the My Love lens. Other Lenses might separate out communication from a group of colleagues at work, messages related to a favorite soccer team, or discussions about an upcoming family birthday party. Filtering mechanisms using the lenses metaphor have also been applied to Usenet news [2], but we explore this metaphor on the mobile device.

Recently, there have been a number of commercial offerings that attempt to bring multiple streams of content together similar to the Lenses project. Motorola's Blur platform combines Facebook, Twitter and SMS data for each contact in a user's phonebook [1]. Palm Pre's synergy system has a similar approach by enabling users to continue conversations across a variety of services (e.g., switching from instant messaging to SMS) [3]. Our exploration goes beyond these systems by enabling users to create lenses around topics, individuals, and groups of people for focusing on the information they want. Insights into creating these flexible filtering mechanisms on a mobile device can help shape the future of mobile communication as information continues to be combined and available on one's mobile phone.

We show the relationship between the universal inbox and Lenses as a metaphor inspired by the actual physics of lenses as shown in Figure 1. Data streams from the phone, desktop, and other web services are all combined into the universal inbox and represented as a single light source. A lens filters this light source to show the user content from the universal inbox in their chosen format. The following sections describe our prototype design and a pilot study of Lenses running on a mobile phone. We propose the *Lenses* interface – a system designed to allow users to filter and interact with content across their entire digital content stream.
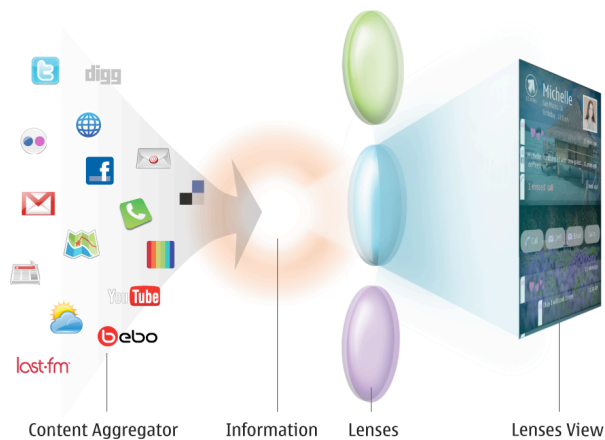
Figure 1: The Lenses Metaphor. Content is aggregated together and represented as a light source. Different lenses filter and focus the content on what the user wants to see.

2. LENSES PROTOTYPE

Our prototype has two core ideas that we wanted to develop and explore with smartphone users.

    1. *Universal inbox.* Current mobile interfaces rely on multiple applications with their own unique datasets that typically cannot be shared across applications. Creating an application-less UI and user experience makes it possible to step away from the applications as the basic building blocks. Breaking down the application silos will free the content for appropriation in different ways and provide more fluid interaction.

    2. *People, places and things, not message types.* Current interfaces emphasize the source of messages: checking email in your email client, statuses in your Twitter client, photographs on Flickr. People, places, things and relationships among them are the basis for human orientation in the physical world. The effective user experience will elevate those relationships and achieve relevancy through them.

We created a prototype of Lenses that enables users to see their own data in the universal inbox and create lenses that manipulate their data. In brainstorming the types of lenses that users may want to create, we realized that we needed a method for easy creation of novel lenses by the user on the fly. In fact, we believe this will be a crucially important differentiator for other universal inbox filtering approaches in the future. Based on some early designs and feedback from a study of smartphone users, we implemented a high-fidelity prototype on a mobile phone with a touch screen and Internet connectivity.

2.1 Building the Universal Inbox & Lenses

The Lenses system is based on a thin-client-server model. We had two reasons for this approach. First, many mobile phones do not have the processing power to aggregate and filter content quickly. Second, we wanted Lenses to be available across heterogeneous devices, which includes mobile phones and desktop computers. Placing the computation on the server helps us address these concerns.

There are two main stages to the backend server: importing and filtering. The importing stage aggregates content from data sources across a user's devices and web services into a local data cache that represents the universal inbox. We currently support the following data types:

- SMS/MMS messages
- Call logs
- Web browsing history (phone and desktop)
- Photos from photo sharing services (e.g. Flickr)
- Social networking status updates (e.g. Facebook, Twitter)
- Email
- RSS feeds

Combining this data together breaks through the traditional application and data silos to create a single stream of content. The data cache is updated periodically to provide fresh content into the cache. Our architecture is designed to flexibly support other data types in the future.

The second stage is filtering and analyzing the data in the data cache. Lens filters are created as keyword matches based on Boolean operations. Keywords are identified in the content of the message as well as the creator of the message. For example, a lens could be created around "family" that would identify the word in the body of content and easily bring in content from other family members with the same last name, while also allowing the specification of other keywords, such as names or relevant topics. In addition to filtering content through lenses, we also enable cross-service interaction by allowing users of Lenses to continue conversations in lenses through other services (e.g., respond to a Facebook message through SMS).

2.2 Viewing & Creating Lenses on the Phone

Figure 2 shows the Lenses homescreen on the phone. The default lens is the Content Stream, which acts as the user's universal inbox. We represent this with a clear icon to show that no data is being filtered. The other lenses are filtered views of the content stream by different attributes. For example, a user from a study of smartphone users to inform this work indicated that she groups friends by geographic region (e.g., Palm Beach). The content stream would show the user data of all types generated by all her contacts. Clicking on these lenses shows a filtered view of the
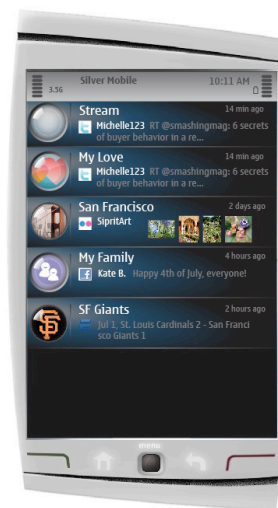
Figure 2. Lenses homescreen. The Content stream is represented by a clear icon indicating that all content is viewable. Other icons are chosen by the user.
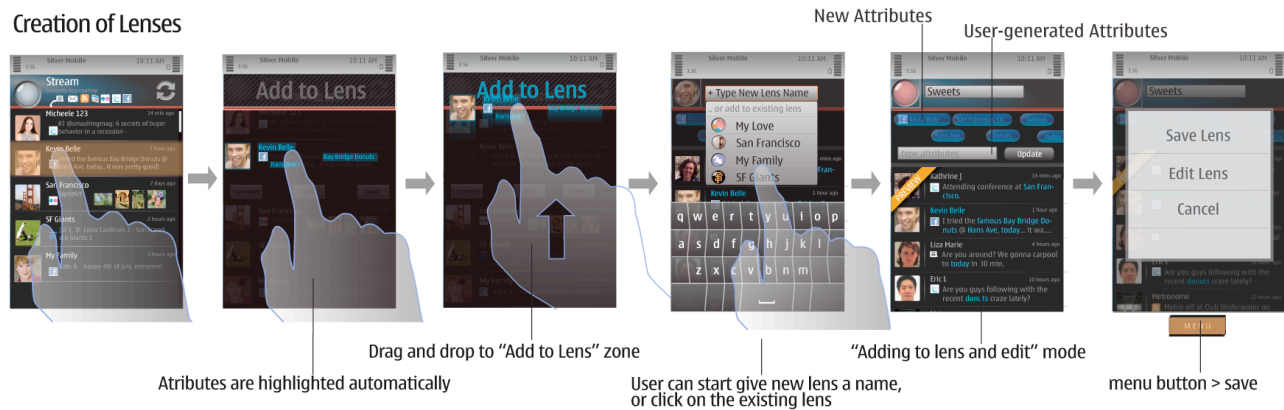
Figure 3. The process of creating lenses by example. A user selects a piece of content and drags the item to the "Add to Lens" area. The system generates matching attributes from the content. The user can also add their own attributes to the lens. When the user is satisfied with the preview, she can save the lens for viewing.

content stream. A Palm Beach Lens would only show data related to contacts from Palm Beach.

Creating lenses is an important process of interacting with the system, and we explored several possible approaches for doing so. One approach would be to automatically create lenses based on how the user interacts with the system over time. With an automatic lens creation process, there is a high user cost to being inaccurate. If the automatically generated lens is not what the user wanted, undoing this process could be more painful than if the user had specified the created the lens themselves. Another approach would be for the user to explicitly specify what types of content they want to view in a lens, possibly through a query language. This can be a very high cost to the user, especially on a mobile with constrained screen sizes and limited attention.

We adopted a hybrid approach: enabling lens creation by example (Figure 3). The process leverages the power of the backend system to identify potential attributes that would be useful as lens attributes. The user first selects a piece of content from the Content Stream that is an example of what the user would like to see in the lens. Once the user selects "Add to Lens" for this piece of content, the system returns a set of attributes that it identifies based on the example content. These attributes can be the contact (e.g., creator of the status message), location associated with the content, and other keywords. The next screen is a preview screen that shows each of the automatically generated attributes and what data the lens would return if all the selected attributes were applied. The attributes are combined as a logical OR operation to filter the stream. Each of these attributes can be turned on and off to change the filtering mechanism. In addition, a user can choose to enter her own attributes that are comma separated, in a text box provided below the attribute buttons on the lens creation screen. Once the lens is created, it shows up on the user's homescreen and can be quickly accessed to see content filtered by that lens (Figure 2). The user can further edit existing lenses by tweaking with the attributes if need be.

3. LENSES PILOT USER STUDY
We began our study with five participants (2 male, 3 female) whose job titles included researchers and administrative staff. Intellectual property restrictions meant we had to use participants

internal to our lab. Participants were issued the experimental phones to allow them to become used to the new platform, which was notably different from the phones that most of the users were accustomed to. They used these phones for two weeks, which we felt would give them sufficient opportunity to become accustomed to the platform. All phones used GSM technology so the users could use their existing SIM cards and transfer contacts to the phone. We asked all participants to use the phone as their primary phone throughout the six-week Lenses study.

Participants filled out an initial questionnaire about their current patterns of communication in terms of technology use (Facebook, email, Twitter, etc) and in terms of contacts (partners, family, work team, etc). We then installed Lenses on their phones and gave them a tutorial of interacting with content and creating new lenses. Midway through the study, participants filled out a second survey to explain how their patterns had changed, and finally we conducted open-ended interviews at the end of the study to understand their Lenses usage, and how Lenses had influenced their thinking about the filtering and aggregation of data.

With a small number of users in a longitudinal study it is hard to provide statistics that serve to describe the experiences of the users. Due to this, we have decided to write this section in two parts. The first provides the aggregate information we were able to gather from data logging; the second discusses the individual stories of the users we learned from interviews and surveys during and after the study, and in particular what we learned from their experiences using Lenses.

3.1 Statistics from Data Logging
The statistics we gathered by logging interactions with Lenses do tell part of the story. For example, users created an average of 3 lenses (min:0, max: 9), and most frequently accessed the content stream rather than any of their prepared lenses. As we expected from the previous user study of existing smartphone users, Lenses were typically created around people and locations (such as "San Diego" or "My [name]"). Our users connected data from Facebook, Flickr, and Twitter in their Lenses.

3.2 User Stories

After describing the Lenses concept to Amber (all names are anonymized), she wanted to create two different Lenses around two different topics. The first was around her interest in rock climbing. However, in the process of trying to create this Lens she realized that none of the Tweets or messages in her Facebook feed contained discussions of rock climbing. In response to her problem we improved the software to allow users to specify free-text strings rather than just words found in existing messages. Amber also wanted to create a lens for communication by, from and to her sister, Jessica Rose. However, our system was set up to assume logical OR results, meaning that the Jessica Rose Lens picked messages containing the words Jessica and/or Rose. This produced... *"too much cruft in [the Lens] that I didn't want... I have a lot of friends named Jessica from when I was ten, and that was exactly the people I don't want in the Lens."* Amber's experience emphasized the difficulties in finding the right balance between letting the Lenses be easy to set up and use and yet sufficiently configurable. Amber's primary request for future versions of Lenses was to make it easy to set up groups of people to correspond to, in her words, different "realms" of her life, *"like work, or fun... or family. People would be assigned to a realm and then I could have favorites [within those realms]."* Again, this underlies the need for easy-to-use entity resolution to accompany any such system for the filtering and displaying of overwhelming amounts of data.

By contrast, Samantha created several Lenses over time. When we interviewed her, she had settled on four Lenses: two defined by geography – 'San Diego' and 'Boston', one defined by the word '<Anonymized Company>' and one for her husband Anthony. Samantha's system had some of most significant technical difficulties we saw: in particular, missed calls would get repeated multiple times in a given Lens, and the timing of calls would be reported incorrectly (as over thirty years ago). Despite these problems, Samantha used the system with enthusiasm. We found it particularly interesting that Samantha's choices centered around places, a group of people and her partner.

4. DISCUSSION AND CONCLUSION

Our study of Lenses explored the need for a universal inbox and the value in interacting with fine-grained filtering mechanisms of content on a mobile phone. Although the application paradigm worked well on the desktop, the same paradigm on a mobile phone results in information and communication silos that are difficult to manage. Lenses represent an alternative to the application paradigm where people can engage with their data using different perspectives such as topics of interests, tasks, or roles in their life. We offer several lessons learned through our research.

First, the universal inbox that combines personal content streams provides easy access to content from a variety of sources. We found this to be a useful starting point to explore one's content and view data without the traditional application silos. Samantha said:

> I went to it daily. I went to it, then checked it. I really like the stream… that everything is there. I really liked the first lens which was just the stream.

Instead of opening the Facebook application and then the Messaging application, Samantha could open the content stream to quickly view her data from a variety of data sources. Future mobile interfaces would benefit from a universal inbox in addition to traditional applications as a method to quickly view content in a single interface.

Second, Lenses at its core, is about enabling the creation and viewing of filtered content on one's mobile device. Although many systems provide filtering mechanisms on desktop and web platforms (e.g., Facebook friend groups), few have attempted to address the creation of filters on the mobile phone. Part of the reason for this is the complexity of creating these filters given the wide variety of filters a user may want to create. For example, as we saw with Amber, there is a need to provide additional methods of creating lenses beyond simple Boolean OR operators. Our initial solution was to provide a hybrid approach of creating lenses by example and automatically filtering the lens based on an OR operation. Pane *et. al.* have studied how to make the construction of Boolean equations easily understandable for children, but these techniques have not been explored on a mobile device [4]. We believe that exploring how lenses can be effectively created on a mobile device hits a deeper research problem of creating complex filters on a mobile phone. This is an area for further research as the need to reduce information overload increases.

Finally, lenses seemed most useful being created around people groups. Designing for these types of lenses could help address the filtering needs of many users. Our users naturally created lenses around geographies of where connections were made with people (e.g., San Diego). People and groups are at the center of how users think about viewing content and should be actively supported in filtering mechanisms for personal content.

5. ACKNOWLEDGEMENTS

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