# Cell Phone Software Aiding Name Recall

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## Abstract
Senior citizens often find it difficult to remember names. This paper describes a novel cell phone application that uses information about one's social network and the places one frequents to suggest the names of individuals one might plausibly encounter in a particular place. We anticipate that this "names prosthesis" will help senior citizens to improve socialization, functional memory and levels of autonomy. We motivate the need for this application space before describing our design process, first implementations, and early testing and iterative improvement of both the concept and the implementation.

## Keywords
Cognitive prosthetics, cognitive aids, cell phones, mobile applications, name recall.

## ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## The Name Recall Problem
In a study of 1,205 adults, Crook and West [4] found that people's ability to remember names declines across the lifespan, affecting older adults more than younger ones. For example, Leirer *et al.* [5] found that 54 of 128 elders (mean age = 73 years) cited

remembering people's names as the most important memory skill they wanted to improve. In another study, 83% of 199 adult volunteers (39-89 years old, mean age = 62) complained about forgetting names [2]. In early Alzheimer's disease patients, awareness of their inability to remember the names of people they identify as important (such as family) was correlated with depression and social isolation [3]. These studies affirm the social, cognitive, and emotional meaning placed on the ability to successfully remember names in day-to-day life for older adults.

For many types of valued information and important data, people have supplemented their cognitive abilities with external prosthetic devices or processes. Examples are time prostheses such as watches, clocks, and sundials; location prostheses such as navigating via the stars, maps, or GPS technology; and body prostheses such as thermometers and electronic armbands. But we have never had elegant portable name prostheses, only cumbersome address books and personal information managers that do not exploit context.

To be successful, a prosthesis must tie together contextual information with digital information. (Watches are useful because they tell you what time it is *right now*, not because they provide a list of all possible times). Social networking sites (such as Facebook) provide de-contextualized digital contact information – the contact information is the same whether the contact is standing next to you, saw you last week at the coffee shop, or never met you in person. The popularity of social networking sites attests to the value of this de-contextualized information; however, older adults use these sites much less frequently than teenagers [1]. We believe that using context (in particular, location) in conjunction with social network information will be a more suitable way to design a "names prosthesis" for seniors.

Our work follows in a line of HCI research which has focused on reintegrating digital contact information with physical co-presence (though these technologies have not been studied with seniors). Ticket2Talk [7] is a stationary ambient display which proactively provides information about nearby people in the context of an academic conference for purposes of encouraging conversation and mutual disclosure. More recently, researchers have studied CenceMe, which uses mobile phone sensor data to infer and share social context information (*e.g.,* names) among multiple users [8].

This paper describes a novel solution to the design of a prosthetic device to aid name recall, starting with a sketch of a possible solution, a description of our first implementations, an account of how we've improved the solution through early user testing, and an enumeration of planned next steps.

## Sketching a Possible Solution

We began by conducting a series of participatory design sessions with 5 older adults in order to conduct a needs analysis, create requirements, and prototype (see [6]). This process was complemented by non-participant observation of a "memory strategies" educational seminar conducted by a clinical psychologist at a major geriatric hospital. From this work we developed a series of best practices with respect to developing mobile phone software for older adults. We learned that participants in these sessions had highly structured schedules, and revisited particular places frequently (*e.g.,* church, a friend's house, a hospital). However,

due to memory loss, they sometimes forgot the names of people they met at these familiar places. We also learned that a name prosthetic should allow review of names before, during, and after the user arrives at a location. Finally, we began to understand why seniors had difficulty interacting with off-the-shelf mobile phones, and could begin to design around these barriers. From this, we developed the following scenario depicting an anticipated primary use case of the software we call "Friend Forecaster:"

*Howard, a 67-year-old semi-retired real estate agent has been using the Friend Forecaster software for about 6 months. Today, he is putting on an open house and knows that in this market, he will have to go that extra mile to make a sale. Howard is slightly distressed since he has a poor memory and has trouble remembering the names of clients and prospective buyers, let alone people he just met at a similar open house the week prior. Before he gets out of his car, he pulls out his mobile phone and notices that Friend Forecaster has already recognized that he is at the open house and displayed a list of people he will most plausibly see. This list is made up of people he saw at the last open house, and the clients and buyers in his social network. Howard scans the list and takes a look at the personal reminders he has left himself for each person. He reviews the information for a moment and puts his phone back into his pocket. Howard leaves his car and enters the open house confidently – "Richard, so good to see you again, how's Judy and the kids? Are they playing hockey today?"*


**figure 1.** Friend Forecaster Mobile showing a list of people that our real estate agent Howard is likely to see at his open house.

## Implementation

Friend Forecaster is an XML-based web service combined with a context-aware mobile client. The server side is written in Ruby on Rails and is responsible for inputting, storing and performing inference on the user's list of contacts. The mobile client is designed to be thin (since most computation occurs on the server) and is primarily responsible for displaying the information in an easy to use manner. This allows for greater modularity and portability when porting the software to different cell phone platforms.

A web interface is used to add and organize the user's contacts, locations, activities and groups. The user can create each entity manually or can synchronize with popular calendar and productivity applications for automation. As entities are created, they are tagged by the user to provide additional metadata.

The mobile application downloads the data provided by the web service and displays it to the user. An on-board GPS receiver determines the current location. The initial software was written for Windows Mobile and has since been ported to Blackberry and iPhone.

We model context as the tuple <user,location,time>. Each user has their own set of entities on the server into which we query. Location allows us to narrow down a potentially long list of contacts into a much smaller one since contacts tend to be clustered around a set of predictable locations. Finally, time and calendaring information is used to select from the most likely contacts to be seen at a location.

A typical request takes the following form. The user presses a button on the mobile phone to generate a new "forecast." The user's location and unique identifier are bundled into a context object and passed to the application server, where the inference engine processes the context and builds a list of contacts by cross-referencing tags. The list is wrapped as XML and returned to the cell phone to be displayed to the user.

## Iterative Design, Field Testing, Evaluation

User-centered design and field testing were used at each stage of development to ensure that features and design metaphors provided value to users.

We began with a pre-pilot Wizard-of-Oz study with Mr. R, a 65 year old normally aging senior who spends a month a year traveling. We asked Mr. R to map out his social network on paper, along with the locations where he meets them. He then created his own tags for these people and locations. At the completion of this exercise, Mr. R found reported that externalizing, analyzing, and reflecting upon his social network made him feel more connected to his travel community and to his friends. This was true even though it was a pencil-and-paper exercise with no working technology.

While Mr. R's feedback suggested the benefits of reviewing social network information, we needed to better understand the types of data we would encounter in the development of Friend Forecaster. One researcher conducted a journal study wherein he wrote down everywhere he went and everyone he saw for one month in order to gain insight into the use cases and patterns that emerged over time. We found that the people and locations he visited were not only predictable but also fewer than we had originally thought. This provided us with more confidence that modeling this domain was possible and that we would be able to produce accurate results.

In the summer of 2008, we conducted a pre-pilot study with two student participants: Mr. M and Mr. C. We tested with a student population since the goal was to better understand the problem space and discover major design flaws both of which do not depend on the age of the subject. The two participants used the device for one month and were interviewed at the beginning, middle and end of the deployment. During the interviews, we discovered that our location-sensing technologies needed to be more accurate to discern locations in close proximity. We also learned that contact management should occur over a series of incremental, meaningful interactions with the device. A "bulk add" of all Facebook contacts (conducted by Mr. C) resulted in poor organization of the list of people and less reflection on the nature of his social network.

To evaluate Friend Forecaster more rigorously, we have chosen a mix of quantitative and qualitative instruments. Because one of our design goals was to improve functional memory for names, we are actively tracking how well our suggestions match with the situations encountered by participants in real life. When users are given a Forecast, they are asked to identify how many of the suggested people they did see and if there are any people that they did see which were not suggested. This allows us to create precision and recall scores based on the number of true positives, false positives and false negatives. In addition, after each forecast we ask the users to indicate how many times they forgot someone's name, as well how confident they felt in their name recall ability on a ten-point scale. We believe that by tracking precision and recall as well as self-assessed name recall ability, we will be able to more confidently conclude if the application is improving memory, confidence, and social cohesion.

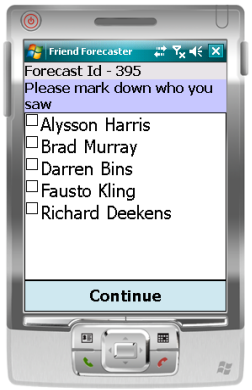


**figure 2.** Friend Forecaster Mobile showing the evaluation screen after delivering a forecast. Users can check off who they did see from the list they were given, allowing us to calculate precision and recall scores.

## Current Status, Discussion, Future Work

We have now begun pilot testing with three normally aging senior citizens and one young business professional. Following that, we plan a controlled field study with individuals from a memory clinic who have been diagnosed with mild cognitive impairment (MCI). Because individuals diagnosed with MCI have a 50% chance to develop Alzheimer's disease within five years [9], they may be motivated to try mobile phone software to help them with their memory.

Although our initial target market was seniors with cognitive impairments or fearing the onset of cognitive impairments, we conducted an interview study with business professionals that suggests that such a device would be of interest to a broader audience, a hypothesis we plan to test.

In December 2007, we conducted 20 semi-structured interviews with business people in the Greater Toronto Area. Our subjects ranged from newly hired interns to the president of a large real estate and development company. We asked a wide range of questions focused around the importance of name recall in business, what technologies or techniques they currently use to improve their name recall ability, and what they would expect from a device designed to improve their name recall ability. We discovered that the need and demand for this kind of technology is very high and that our initial prototypes met many of their needs, with some participants eager to use the prototype that day. Therefore, we believe that this demographic could greatly benefit from this kind of technology. A field

study involving a wide range of different business people would allow us to see how our design could be improved and modified to better suit their needs and expectations. Understanding the different needs and circumstances surrounding name loss in a variety of populations continues to inform our use cases, interface design, and group characteristics. Indeed, many of the concerns and design implications uncovered by interviews with business people corroborate the needs we identified with seniors [6]: autonomy, dignity, and ease of use among them.

We also plan additional research to improve the capabilities of Friend Forecaster. One step will be integration of our software with personal information managers such as Outlook and social networking sites such as Facebook. The addition of machine learning algorithms could improve the device's recall and precision for providing the right names at the right time. Adding the capability to display faces is of great interest, as is the use of ambient displays to allow viewing of information at home as well as "on the road."

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