I Feel Lucky: an automated personal assistant for smartphones

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ABSTRACT
Third generation devices, such as smartphones, have the possibility of knowing the position of the user. By combining time, position and data in the Cloud it is possible to make smart deductions as to what information the user needs. These deductions can be performed by an automated assistant that have access to the user’s e-mail and SMS messages, calendar, phone book, notes, etc., as well as to the position of the user. The assistant can present the information in an “I feel lucky” display on the user’s smartphone. These concepts have been evaluated in a case study with a group of students, simulating the output of such an interface.

Categories and Subject Descriptors
D.2.2 [Software Engineering]: Design Tools and Techniques – user interfaces. H.5.2 [Information Interfaces and Presentation]: User Interfaces – interaction style, screen design, user-centered design.

General Terms
Design, Experimentation, Human Factors.

Keywords
Personal Assistant, Input Free User Interface, Cloud data.

1. INTRODUCTION
Modern computer devices are here to help us. But often this is not apparent in the user interface. Yes, they use modern concepts with easy to understand interaction, requiring data in forms and having good menus or buttons for each command. But the problem is often that they require too much data. For example, we can use a smartphone for directions. But the effort needed to turn on the phone, open an internet connection, activate the GPS, download a map and enter the destination address is often so high that we turn to other solutions, such as asking a passerby. This cost of giving input is often very apparent on mobile devices, where the limited displays and keyboards makes it cumbersome and error prone to enter data.

But we can do better. We can assume that smartphones can be in “always online” mode, being continuously connected to the net paying a relatively cheap price. While battery capacity is still a problem we can hope that the manufacturers will be able to develop improved batteries, with more capacity and perhaps also high speed charging options.

An always connected phone will, of course, have access to our location and the time of day. As presented by Olsen and Malizia in [1], these two attributes can be used to search the Cloud for background data, such as email and text messages, bookings, calendar items and notes. Based on this, the software can make a good guess of what information you need at any time, at any position. Successively, such information can be presented on an “I feel lucky” display, inspired by the “I’m feeling lucky” interface proposed by Google, but, on your smartphone, in many cases without any need for input. In fact, Google’s homepage displays the user with a button labeled “I’m Feeling Lucky”. If a user clicks on such button the first search result will be automatically selected and the browser will show the corresponding web page, bypassing the list of search results as presented in the classic interface. When a user need an information a quick look at the “I feel lucky” display will generally satisfy her basic information needs.

In order to determine the usefulness and helpfulness of such a display, we have performed a user study based on a Wizard of Oz simulation collecting, not only opinions, but also suggestions of participants being involved.

2. BACKGROUND
As early as 1987 Apple CEO John Sculley described the “Knowledge Navigator” in his book Odyssey, a device that used software agents to assist the user. The concept was showed in several videos by Apple. It had natural sounding speech generation, speech recognition and the ability to really understand what the user was saying, that is, to grab the underlying semantics. Quite impressive, but these were only mockups. The real world assistants were of another kind. Perhaps the best example is the assistant that came along with Microsoft Office between 1998 and 2003. It was visualized as everything from a paper clip to an Einstein caricature. While implemented to aid users, this feature received a very negative response. The problem was that it tried to get the context, but most often missed. It took its clue from a minimum of information, for example, just a keyword. If you started by writing “Dear” the assistant could tell you “It looks like you’re writing a letter. Would you like help?” The advice that it could offer was often out of context, downright silly or too trivial to be of any use.
Today an assistant can have access to all relevant data. With data in the Cloud, it becomes irrelevant if the smartphone, home or office PC is used in the first place. Thus it should be possible to implement a “knowledge navigator”, but leaving out the magic parts of a “human-like” conversation. Instead we shall rely on a minimum of input, in some cases, eliminating all input. In fact, input free user interfaces are all around us. For example, the electronic sign on the platform will tell you the time to the next train. No input is needed; from the context, i.e. passengers waiting at this platform, it is assumed that this is an important piece of information to them.

In order to understand the context of what the user is doing, it is necessary to access to background information storing data in the Cloud. In fact, the main cloud computing benefits probably resides in its cost-efficiency, remote accessibility and flexibility. Nevertheless, there are still relevant and persistent objections mainly related to trust, security, privacy and regulatory policies that are partially limiting the embracing of such technology [2].

Focusing on scenarios in which mobile devices are the access point to services, applications and media in the Cloud [3], there are other issues to take into account. On one hand, smart phones allow to explore, visualize and index data on the Cloud considering also mobility and location information. On the other hand, small displays and peculiarities of input modalities, such as small keyboards and complicated multi-touch gestures, should derive usability and interface problems. The assistant’s interpretation of the context, even if defined through Cloud data, may not always be correct though. There may be cases where the assistant does not have updated information, where it lacks information or where it makes the wrong deductions. However, since the system is working as a personal assistant to the user, these cases will most often be recognized as the errors they are, even if they can be annoying.

3. INFERRING HABITS FOR THE “I FEEL LUCKY” DISPLAY

We aim at designing an input free user interface that infers useful information from the data stored in the Cloud. Portability is an important issue. With such information the assistant will know the position of the user and thus we will use it to find the items of interest in the Cloud.

Thus, in order to infer which information users could find more appropriate in a particular moment of their day, the “I feel lucky” display will consider two dimensions:

(1) Context descriptors: geographical location and time.

(2) Habits patterns: focusing on daily actions, not only scheduled events, but also habits and routines.

Habits patterns can be inferred from events that happen at certain points of time and at certain locations. For example, assume that a user is commuting, leaving home at seven thirty every morning, going to the bus stop. At the bus stop she uses her mobile phone to open an Internet connection and go to the home page of the bus company, to access the service that tells her the bus scheduling. Next day, at the same time and the same bus stop the assistant may find this information and present it on the display automatically.

We designed the “I feel lucky” display by using inferred habits and a learning scheme. The idea is that the assistant will present information that the user needs at the right time in the right place. The interface takes the entire screen and it is also visible when the smartphone is blocked. Several alert boxes depending on information to visualize compose it. Each box contains useful data (e.g. schedule and terminal of a flight), a link to an action to carry out (e.g. change a reservation) and a graphic icon (e.g. a small blue square with a white airplane for flights). The contents of the display will change automatically depending on the context (e.g. time and location).

In Figure 1, a mockup of the “I feel lucky” display is shown: the displayed information is related to a user stuck in traffic on the way to the airport. She wonders if she will catch the flight, or perhaps the bad weather might affect the flights. With the time of day, her location, the location of the airport and flight information the system is able to infer what she may need, such as an updated departure time for the flight or directions that may avoid traffic congestions.

Figure 1. Mockup for the "I feel lucky" display
With this adaptive ability to infer habits and learn, there will be no need to initialize the assistant. However, the user will have the possibility of tuning the system, for example changing the name of a location to something more appropriate, adding more personal data about plans and activities in the Cloud or selecting web services to query.

4. USER STUDY

In order to evaluate if the efficiency of the “I feel lucky” display, we have performed a basic user study. In this case, efficiency has been defined as giving users support for their daily activities and providing helpful information as an early response to their needs. We employed a Wizard of Oz methodology to simulate the assistant. As described by Dahlbäck et al. in [4], during Wizard of Oz experiments participants believe that they are interacting directly with the system, while there is a mediation of a human operator (the Wizard) that simulates the behavior of a theoretical application using natural expressions. The aim of this technique is to identify which basic features the simulated system might include to satisfy user’s needs. The results of this study are used for improving the problem settings and designing real prototypes. We identified different scenarios to test the idea of the “I fell Lucky” display. As defined by Carroll in [5], a scenario is considered as a brief story that describes people and activities they perform.

4.1 Set up

The participants, in our experiment, were ten students from the Computer Science Department of Universidad Carlos III of Madrid: eight of them PhD students and two of them Master students. Although we are aware that the size of the sample is small, we feel that it is adequate for a preliminary evaluation. The characteristics (age, genre, and education) are compliant with demographics of smartphones users. The user study has
been performed in two different steps. During the first step, we have asked participants for personal information, such as name, age, phone number, everyday activities and favorite lunch and dinner places. Moreover, they were requested to choose a day for the simulation and to detail performed activities with scheduling, frequency and location.

In the second step, we have set up the Wizard of Oz experiment, starting from the simulation environment for the Wizard: it was composed by four different elements, as shown in Figure 2. On the right there is a map displaying the geographical location of each user. On the left, there are three panels: one for the scenario defined by the user, the other for main activities of the simulation process and the last is used by the Wizard to notify users with information.

![Figure 2. The Wizard of Oz simulation environment](image)

The alert boxes of the “I feel lucky” display have been simulated as notifications of iMessage, a service for iPhone devices that allows notifications made of, not only text, but also multimedia content, such as geographical location, photos, videos and contacts. In Figure 3, there is an example of such a notification. Through iMessage, the Wizard had also the possibility to send a link to an action, i.e. a Skype call to a favorite contact.

![Figure 3. Example of alert box with iMessage](image)

Considering information specified by participants within collected scenarios, we have identified four different categories of notifications:

1. Transportation, like train schedules, bus routes or public services. The following example has been sent to a user that usually leaves home and takes the train to reach the university at about 8:30: (8:55) Next train in 3 minutes (8:58, Atocha Station, Platform 9).

2. Routes to reach a specific place, both by walking or by car, considering weather, parking or traffic. The following iMessage has been sent to a user that usually drives to the university between 8:30 and 9:00 and it also contains a link to visualize the suggested route: (8:55) There is a free parking near the university. See how to reach it.

3. Practices related to personal preferences or habits, like favorite places to have lunch or dinner. The following example has been notified to a user that calls her family every night between 22:00 and 23:00 and it also contains a Skype link for calling the family contact: (22:00) Call your family clicking here.

4. Calendar, not only as a reminder, but also considering how contextual information could delay or cancel scheduled activities. The following iMessage has been sent to a user that had a lecture class from 14:00 to 16:00 on Mondays and it also contains a link to send the suggested advice by email: (13:50) Notify your students that the class will begin late by sending them an email.

### 4.2 Questionnaire

The last part of the user study consisted of a post-questionnaire about received notifications. For each notification, we have asked involved participants to indicate their agreement (or disagreement) with four statements over a Likert scale from 1 (strongly disagree) to 5 (strongly agree), following a query technique suggested by Dix in [6].

<table>
<thead>
<tr>
<th>Statement (ST)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST1</td>
<td>The displayed notification helped me when I needed it.</td>
</tr>
<tr>
<td>ST2</td>
<td>The displayed notification was clearly presented.</td>
</tr>
<tr>
<td>ST3</td>
<td>The displayed notification was not useful when I received it.</td>
</tr>
<tr>
<td>ST4</td>
<td>What other kind of information would you like to receive?</td>
</tr>
</tbody>
</table>

The aim of the questionnaire was, not only to determine the helpfulness and understandability of the provided information, i.e. the first three statements, but also to collect any suggestion or improvement to the system, i.e. the fourth statement (Table 1). In order to keep the participants’ attention, we have designed a balanced questionnaire with two positive (ST1 and ST2) and two negative (inverted Likert scale) statements (ST3 and ST4). Each one of them is both a close-ended and an open-ended question, except for the ST4 that is just open-ended, for collecting qualitative data.

### 4.3 Results

Participants involved in the user study have shown a great interest for the “I feel lucky” display as confirmed by the questionnaire. In order to draw more detailed conclusions, we have analyzed obtained results from the first three statements (ST1, ST2, ST3) comparing the different classes of notifications (Transportation, Route, Habit and Calendar), and taking into account collected suggestions and improvements from the fourth statement (ST4).

<table>
<thead>
<tr>
<th>Notification Type</th>
<th>ST1 (positive)</th>
<th>ST2 (positive)</th>
<th>ST3 (inverted)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>µ (positive)</td>
<td>σ (positive)</td>
<td>µ (inverted)</td>
</tr>
<tr>
<td>Transportation</td>
<td>3.96 0.9</td>
<td>4.77 0.39</td>
<td>2.22 1.11</td>
</tr>
<tr>
<td>Route</td>
<td>3.31 1.12</td>
<td>4.28 0.74</td>
<td>1.95 1.07</td>
</tr>
<tr>
<td>Habit</td>
<td>3.65 0.92</td>
<td>4.20 0.67</td>
<td>2.12 0.78</td>
</tr>
<tr>
<td>Calendar</td>
<td>3.75 1.02</td>
<td>4.52 0.56</td>
<td>2.12 0.99</td>
</tr>
</tbody>
</table>

Looking at computed means and standard deviations (Table 2), we can conclude that notifications have been recognized as a useful support for the involved participants. The best results have been obtained for the understandability (ST2): the high
mean and the low deviation represent an overall agreement about the clear language and presentation of the notifications being sent. A higher deviation underlines a less shared agreement for the helpfulness (ST1) and the usefulness (ST3). Analyzing scenarios collected from participants, we have recognized that this is related to different habits and experiences of users. For example about transportation notifications, users that drive cars or other personal vehicles are more interested in receiving information about routes than users of public transport services. By analyzing suggestions on the four statements, and in particular focusing on the ST4, we have identified several interesting improvements for the “I feel lucky” display. First of all, notifications about transportation, like timetable or directions, have been considered as the most helpful:

The route from the metro station to the train station takes some minutes. Thus, it is important to know the time left for me to decide if I have to run.

Secondly, suggesting routes is useful only if the place to reach is not well known or if there are external factors that force the driver to choose another route. For example, users that drive each day to the university have found it annoying to receive information about normal routes, while they were very interested to receive notifications about alternative routes to avoid traffic jams:

I go every day to my office: maybe the route information is not necessary; Information about any traffic or weather problem is very useful if you drive every day.

Another interesting consideration concerns information about habits. Within this scope, users have received notifications with suggestions about calling a contact, buying food in the nearest supermarket or booking in a restaurant for lunch. They have found this information helpful, in particular due to the contextualization, but they would prefer to have the possibility to choose among a range of alternatives. For example, on her way home a user has received a suggestion to go to the nearest supermarket, but it could be most useful to also know the cheapest or the biggest one, as pointed out by this user:

The notification is very useful, but maybe I would prefer other supermarkets information, as cheaper, less crowded, etc.

Concerning the understandability, several users have suggested that a more conversational language could stress the idea of a personal assistant, i.e., expressions like “good morning” for the first notification in the morning or “good night” for the last one, for example:

I would prefer more “human” expressions in order to see it as a real assistant, and not just as a set of notifications.

Moreover, participants prefer to combine information about the same context into the same display in order to minimize the number of times that they have to check their smartphones. This is an example of several opinions on this topic:

Would be nice to combine several notifications about all available cafeterias around me.

5. CONCLUSIONS AND FUTURE WORK
Third generation devices can support our daily activities, both for work and personal purposes. As a consequence, the user interfaces have to offer a great amount of services and functionalities, often requiring data already available on the device or in the cloud. We propose an input free interface that retrieves and displays useful information automatically on an “I feel lucky” display, based on time, location, and background data.

In this paper, we have presented a user study performed to evaluate the helpfulness of the proposed idea and to collect suggestions for future work. The study has been achieved by a simulation using a Wizard of Oz methodology. Involved participants have been very positive for having a personal assistant on their smartphones that not only reminds, but also suggests information they could need in a particular moment of the day. From collected results, we have identified several improvements for the “I feel lucky” display, in particular about the kind of data to take into account.

From this initial step, future work will include the definition of a methodology to collect and combine data about the user from the Cloud, the context and the practice. In particular, we are thinking in the definition of a Bayesian Network that takes these data as input and determines the most probable action the user is going to perform, and based on this, information needed.

Another interesting contribution could be the integration of the “I feel lucky” display with other applications or services that currently smartphones offer. For example with Siri, the new personal assistant implemented by Apple on iPhone 4s, is able to understand questions made by users in natural language and to answer them adequately.

REFERENCES