Rethinking mobile search: towards casual, shared, social mobile search experiences

Sofia Reis
CITI
Universidade Nova de Lisboa
2829-516 Caparica – Portugal
se.reis@campus.fct.unl.pt

Karen Church
Telefonica Research
Plaza de Ernest Lluch i Martín, 5
08019 Barcelona – Spain
karen@tid.es

Nuria Oliver
Telefonica Research
Plaza de Ernest Lluch i Martín, 5
08019 Barcelona – Spain
nuriao@tid.es

ABSTRACT
The mobile search space has witnessed phenomenal growth in recent years. As a result there has been a growing body of research aimed at understanding why and how mobile users search the Web via their handsets and how their mobile search experiences could be improved. However, much of this work has focused on addressing the many challenges of the mobile space. In this short position paper argue the need for more casual, shared, social mobile search experiences. We outline a number of open and challenging research questions related to shared, social mobile search. Finally, we present our ideas through a proof-of-concept mobile paper prototype designed to support causal mobile search and information sharing with co-located groups of friends.

Categories and Subject Descriptors
H.5.2 [**Information Systems**]: Information Interfaces and Presentation – *User Interfaces.* H.3.3 [**Information Systems**]: Information Storage and Retrieval – *Information Search and Retrieval.*

General Terms
Design, Human Factors.

Keywords
Mobile search, mobile internet, mobile web, social search, social context, casual search, shared search, collaborative search

1. INTRODUCTION
Mobile phones, once deemed as simple communications devices, have now evolved into sophisticated computing devices, offering users the ability to access a wealth of online information, anytime and anywhere.

As mobile Internet usage has increased, there has been a growing body of research aimed at understanding why and how mobile users search and browse the Web via their mobile handsets as well as how their mobile search and browsing experiences could be improved [2, 4–9, 13, 17]. However, much of this work has focused on addressing the challenges of the mobile space and enabling mobile users to find the information they need as quickly and effectively as possible.

While past research has shed key insights into mobile Web behaviours and lead to a number of great advances in mobile Web services, recently there has been a shift in the mobile world, which we believe will force the community to *re-think* the mobile Web and mobile search space. In the past mobile meant on-the-move, portable, personal and dynamic. However recent research has highlighted that (1) more and more users are accessing the mobile Web in non-mobile settings like at home or at work [2, 13] (2) mobile users are often motivated not by an exact need or urgency, but rather curiosity, boredom and even social avoidance [2, 17] and (3) mobile web access, and mobile search in particular, is often a social act, carried out among groups of people, rather than while the end-user is alone [2, 5, 18]. Given these findings, we believe it's time to devote some effort to enable mobile users to search the Web in a more casual, social setting.

In this short position paper we motivate and argue the role of shared, social search experiences in the mobile space. We highlight what we think are important and fruitful areas of research related to this new direction in mobile search. Finally, to illustrate our ideas we present examples of a proof-of-concept mobile paper prototype, which is designed to support causal search and information sharing with co-located groups of friends via their mobile handsets.

2. BACKGROUND & MOTIVATION
The gaining momentum of mobile Web and mobile search usage has also resulted in a growing body of interesting research related to understanding mobile users, mobile information needs [3, 16] and mobile Web behaviours [2, 4–6, 9, 13, 17]. In this section we highlight key takeaway messages extracted from this past work that we believe motivate a rethinking of the mobile search experience we provide to users.

2.1 Mobile does not always mean on-the-move
Recent findings suggest that mobile users often access online content in non-mobile settings. For example, a one week diary study of mobile Web access carried out by Nylander et al. [13] shows that mobile Internet access occurs mostly at home (31%). A more recent study by Church & Oliver shows that > 70% of mobile Web accesses are recorded when users are in familiar, stationary settings like at home and at work [2]. Cue & Roto [5] discovered a similar trend emerging in a series of studies they carried out between 2004-2007. That is mobile Web access is becoming a more stationary activity. These findings point to the changing pace of the mobile Web. Location-dependency isn't the only factor to consider when designed mobile services. With more and more mobile users connecting to online content while engaging in their everyday lives, we need to focus on how we can build innovative services that integrate seamlessly into their world.

2.2 Social interactions are key
Mobile phones have always been deemed as intimate, personal communications devices. They tend to be owned by one

individual and do not tend to be shared. Despite this trait, recent studies show that there is a social, shared aspect to consider in mobile environments. For example, two studies of mobile information needs have highlighted that conversations have a significant impact on the types of information needs that arise while mobile and how users choose to address those needs [3, 16]. The same is true for mobile Internet behaviours. For example, Church & Oliver have shown that in > 65% of cases, mobile search was conducted in the presence of other people [2]. Likewise, a recent study of local mobile search has shown that in 63% of cases, mobile searches took place within a social context and were discussed with someone else in the group [18].

While research on the social context of mobile search and tools to facilitate collaboration in mobile search have been limited to date [10, 11], the same is not true for general Web search [1, 12, 14, 15, 20]. Going forward we believe there will be a need to support social, collaborative online experiences in mobile environments.

2.3 Curiosity & boredom are important motivators

Although research has shown that mobile Web access is motivated mainly by awareness [17], curiosity and diversion also account for a significant proportion of mobile Internet motivations [2]. These motivations relate to the users desire to kill time, to alleviate boredom and to find out something about an unfamiliar topic (normally encountered by chance).

Searching the Internet has traditionally been viewed as driven by a specific information need in which search is considered successful if the information the user is looking for is found in a minimal amount of time. However, in casual search scenarios finding the right answer to a given query and finding that answer as quickly as possible may not be the main goals [19]. In fact, in casual search settings, the search may be considered successful even if the information the user is looking for is not found. In casual search scenarios people may browse the Web to pass time while they are idle, *e.g.* waiting for the bus. The information need may be vague or even nonexistent. Therefore, the measure of success of a casual search process is typically based on the level of user enjoyment during the search activity and/or on how long the user has been entertained for. Given that recent research in the mobile search space highlights that more and more users access content to kill time, to eliminate boredom, to satisfy their curiosity, we believe there is more opportunity to support casual search scenarios in mobile settings.

3. UNDERSTANDING THE SOCIAL CONTEXT OF MOBILE SEARCH

In this section we briefly outline results of a survey we conducted to understand more about social mobile search behavior. Survey participants were asked to recall their most recent social mobile search experience, i.e. a search conducted in a co-located group, to address a shared information need, and answer a series of questions. The questions we asked included: what they searched for, their information need, their motivation, who they were with, their relationship(s) to the people present, where they were located, what they were doing before and after the search activity, if and how they shared the search results, and if the search had any effect on their future plans.

193 participants were recruited from internal and external mailing lists, online social networks and discussion forums. All participants had to own an Internet-enabled mobile phone and must perform mobile web searches at least a few times per month. Participants ranged in age between 18-61 (average: 31, SD: 6.9). Responses were provided by 134 men (69.4%) and 59 women (30.6%) and users came from a diverse range of backgrounds, e.g. IT, engineering, sales, telecommunications, education and customer service. The majority of our participants were residents of Spain (68%) and respondents primarily used Android (40.4%) handsets to perform their searches. Finally we found that the majority of participants (87%) stated that they used mobile search in social settings at least once per week, with 54.9% of participants using it at least once a day.

Three key findings from this survey that are relevant to this position paper are as follows: (1) curiosity and alleviating boredom was the primary motivation in social mobile search (almost 50% of responses), (2) the most popular information need related to trivia and pop culture (almost 40%) and (3) mobile users tend to share results by simply speaking aloud or sometimes showing their mobile phone screen. Rarely will users hand over their phone or share the results through electronic means.

After analyzing user comments about what would improve their social mobile search experiences many users pointed to more facilities for sharing the search results easily with their peers. Here's some examples of end-user comments: "*Being able to share information through WhatsApp or applications like that*", "*Shortcuts to send the information*", "*sharing results should be a lot easier*", "*sharing the screen between all participants*", "*Some kind of co-browsing perhaps? Phone results mesh together*".

These findings combined with insights from past research shows that searching and sharing search experiences, in a casual manner, among groups of friends represents a potentially fruitful area of future research that has been largely ignored to date. In the following section we outline what we think are important and open research questions within this new direction of mobile search.

4. DISCUSSION AND OPEN RESEARCH QUESTIONS

In this section we outline a set of open research questions to frame the challenges and opportunities of developing applications to facilitate casual, shared, social mobile share:

- What types of mobile interfaces and interactions would support or enrich the "sharing experience" during social mobile search?
- How can we enrich shared search experiences in relaxed social scenarios?
- Can we make shared mobile search experiences more entertaining for end-users?
- Will users share *more* search experiences if the sharing process was simple, quick and easy?
- Does the type of content have any impact on the sharing experience? That is, will users share differently if the content is dynamic (e.g. a mobile map) versus static (a simple web-page), or if the content is textual versus visual.
- Do users have preferences in terms of how they share contents? Do users prefer to share entire pages, snippets of pages or a "print screen" type view of the page in question?
- Would users enjoy and like the ability to re-visit shared mobile search experiences? How could shared search experiences be presented to users?
- Does time, group size or the relationships within the group impact on the sharing experience?
- Do users need to share remotely, i.e. beyond co-located

groups? How might this physical distance impact on the experience?

- What are the technological challenges in building services to support casual, shared, social mobile search?

We are currently working on an early stage prototype designed to facilitate shared social mobile search in casual settings. By designing, building and evaluating this prototype, we hope we will be able to answer some of the research questions outlined previously. In the following section we present our initial ideas to support causal search and information sharing with co-located groups of friends via their mobile phones.

5. TOWARDS SHARED MOBILE SEARCH

To illustrate our ideas we present details of an early stage mobile prototype, the design challenges we face and our plans for future evaluations of this novel mobile search service. The prototype is designed to enhance social mobile search by facilitating (1) easy group identification in co-located settings, (2) options to share a variety of search elements among groups and (3) the ability to view and reminisce about past social mobile search experiences.

The software architecture we're working on consists of two components: (1) an Android application that allows users to search and share their experiences; (2) a server that synchronizes and stores all search behaviour in a database. The server will also handle group identification and coordinate a notification facility, which will inform members of the co-located group about new "shares". In addition, the server will log all the interactions between the user and the Android application for off-line analysis of user behaviour.

As a first step we worked on a number of iterations of a paper prototype. The prototype focuses on three main components, each with its own design challenges:

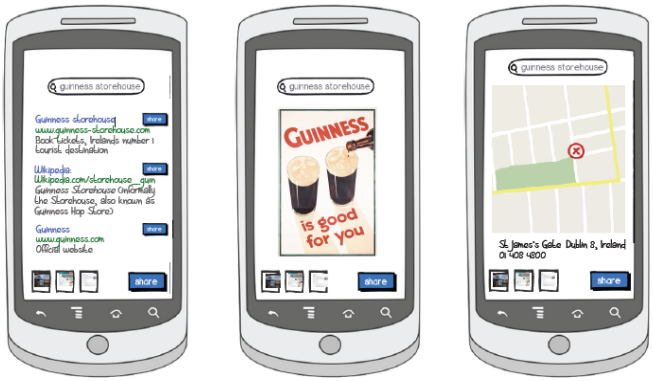
5.1 Easy Creation of a Sharing Session

Information sharing on mobile phones is currently a complicated process and results of our survey reveal that this is the main reason that people do not share results with one another at present. Existing mobile browsers tend to require the user to click several times in order to finally share a web page. And this sharing is normally supported via email, SMS/MMS or social media like Facebook or Twitter. Each time a user wants to share another page, the same long sequence of clicks has to be repeated all over again. Other approaches to content sharing on mobile phones rely on Bluetooth, which is well known to be a cumbersome communication mechanism for end users. The goal of our application is to make the process of mobile Web information sharing as simple as a *single click*.

The first step to achieve this goal is to detect which phones are associated with the shared search experience/session. At present we're focusing our efforts on using (1) GPS to identify all people within a given location who have the application installed and (2) a simply way for users *identified* in step 1 to confirm or verify they are a member of a *specific group*. Given that it's likely that the use case for such an application is indoors, GPS will not provide the fine level of location granularity we require. This is the motivation for employing a second step in the group identification process. For step 2, we're investigating a number of alternative approaches to confirm association with a specific group. We'd like this process to be fun and playful, therefore we're playing with the use of accelerometers, gestures, images and video. For example, one option is to ask all users within the group and at a given location to *shake their phones* within a given time period to join a group. This fun, interactive action will involve using the accelerometer within the phone.

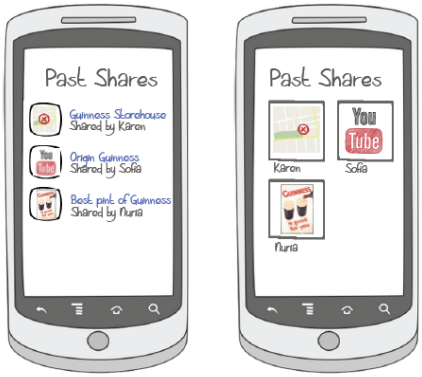
5.2 Easy Content Sharing

Our goal is to enable mobile users to share all Web search related content with the members of their group. Figure 2 illustrates a simple paper prototype with our main thoughts on how to approach this task. Given it's likely that users will want to share a range of content types we want to provide the users the ability to (1) share a single search result or the entire page of search results by pressing an appropriate "share" button (Figure 2 (a)), (2) an entire Web page or image result (Figure 2 (b)), as well an interactive maps and addresses (Figure 2 (c)). Each time a piece of content is shared, that content is shown as a thumbnail in a bar at the bottom of the screen (Figure 2). Pressing a thumbnail opens the respective content again. The thumbnails' bar is scrollable horizontally.



(a) (b) (c)

Figure 2. Sharing different contents.



(a) (b)

Figure 3. Visualizing past shares.

5.3 Visiting past sessions

Finally, our prototype will enable users to access their past shared social search sessions. While our survey did not reveal a large proportion of users expressing a need for revisiting past sessions, this need was expressed by a few users and it's a feature we'd like to implement and explore to see if it is in fact deemed useful by end users. A past shared social search session is any session for which the user instigated a "share" or was the recipient of a "share". We are currently playing with different forms of presenting past shared search experiences to the end user. The

first method is *by time*. Figure 3 illustrates two potential approaches to grouping shared experiences by time. We could show a small thumbnail for each past share, the name of the shared content and the name of the person who shared it (Figure 3 (a)) or a larger set of thumbnails to support a more visual UI (Figure 3 (b)). Another means of showing past shared search sessions is *by group*, that is allow users to view all shared searches carried out with or among a certain group of people or with an individual. Finally, we could show past shared search sessions *by location*, that is, allow users to view all shared searches carried out at a specific place. It's likely that the choice of interface will depend on a range of factors including personal preferences.

To date, we have developed a number of iterations of a paper-based prototype and carried out design reviews with 6 users in-house to gain feedback and insights on the interface, the interaction and the core functionality. We are currently working on implementing an Android application, however, we still have a number of technological challenges to overcome. Our plan is to deploy and evaluate the application in-the-wild, among groups of friends, to learn more about shared, social mobile search behaviours in the real world.

6. CONCLUSIONS

In this position paper we motivate the need to support casual, shared, social search experiences in the mobile space through a review of past work and an outline of key findings from a recent survey of social mobile search. We highlight a set of open research questions that we think will be important for the community going forward. Finally we illustrated our initial ideas by presenting examples of a work-in-progress mobile prototype, which is designed to support causal search and information sharing with co-located groups of friends.

7. ACKNOWLEDGMENTS

This work is funded as part of a Marie Curie Intra European Fellowship for Career Development (IEF) award held by Karen Church. Sofia Reis is currently an intern in Telefonica Research. As such this work was partly funded by Telefonica Research and by FCT/MCTES, through grant SFRH/BD/61085/2009. Note that the survey portion of the work was conducted with Antony Cousin of University of Nottingham while he was an intern at Telefonica Research in Autumn 2011.

8. REFERENCES

[1] Amershi, S. and Morris, M.R., CoSearch: a system for co-located collaborative web search. In *Proceedings of CHI'08,* ACM (2008), 1647–1656.

[2] Church, K. and Oliver, N., Understanding mobile web and mobile search use in today's dynamic mobile landscape. In *Proceedings of MobileHCI '11,* ACM (2011), 67-76.

[3] Church, K. and Smyth, B., Understanding the intent behind mobile information needs. In *Proceedings IUI '09*, ACM (2009), 247-256.

[4] Church, K., Smyth, B., Bradley, K. and Cotter, P., A large scale study of European mobile search behaviour. In *Proceedings of MobileHCI '08*, ACM (2008), 13-22.

[5] Cui, Y. and Roto, V., *How people use the web on mobile devices*. In *Proceedings of WWW'08*, ACM (2008), 905-914.

[6] Kamvar, M. and Baluja, S., A large scale study of wireless search behavior. In *Proceedings of CHI '06 ,* ACM (2006), 701-709.

[7] Kamvar, M. and Baluja, S., Query suggestions for mobile search. In *Proceeding of CHI '08*, ACM (2008), 1013-1016.

[8] Karlson, A.K., Robertson, G.G., Robbins, D.C., Czerwinski, M.P. and Smith, G.R. , FaThumb: a facet-based interface for mobile search. In *Proceedings CHI '06*, ACM (2006), 711-720.

[9] Kim, H., Kim, J. and Lee, Y., An Empirical Study of Use Contexts in the Mobile Internet, Focusing on the Usability of Information Architecture. *Information Systems Frontiers*. 7, 2 (2005), 175-186.

[10] Komaki, D., Oku, A., Arase, Y., Hara, T., Uemukai, T., Hattori, G. and Nishio, S., Content comparison functions for mobile co-located collaborative web search. *Journal of Ambient Intelligence and Humanized Computing*. (2011), 1–10.

[11] Kotani, D., Nakamura, S. and Tanaka, K., Supporting sharing of browsing information and search results in mobile collaborative searches. In *Proceedings of WISE'11*, Springer-Verlag (2011), 298-305.

[12] Morris, M.R., Lombardo, J. and Wigdor, D., WeSearch: supporting collaborative search and sensemaking on a tabletop display. In *Proceedings of CSCW'10*, ACM (2010), 401–410.

[13] Nylander, S., Lundquist, T. and Brännström, A., At home and with computer access. In *Proceedings of CHI '09*, ACM (2009), 1639-1642.

[14] Paul, S.A. and Morris, M.R. , CoSense: enhancing sensemaking for collaborative web search. In *Proceedings of CHI'09*, ACM (2009), 1771–1780.

[15] Perez, J.R. Whiting, S., and Jose, J. M., CoFox: A visual collaborative browser. In *Proceedings of CIR '11,* ACM (2011), 29-32.

[16] Sohn, T., Li, K.A., Griswold, W.G. and Hollan, J.D., A diary study of mobile information needs. In *Proceedings of CHI '08*, ACM (2008), 433-442.

[17] Taylor, C.A., Anicello, O., Somohano, S., Samuels, N., Whitaker, L. and Ramey, J.A., *A framework for understanding mobile internet motivations and behaviors*. In *Proceedings of CHI '08 Extended Abstracts*, ACM (2008), 2679-2684.

[18] Teevan, J., Karlson, A., Amini, S., Brush, A.J.B. and Krumm, J. Understanding the importance of location, time, and people in mobile local search behavior. In *Proceedings of MobileHCI '11*, ACM (2011), 77-80.

[19] Wilson, M.L. and Elsweiler, D. Casual-leisure Searching: the Exploratory Search scenarios that break our current models. *HCIR'10: 4th International Workshop on Human-Computer Interaction and Information Retrieval* (2010).

[20] Wiltse, H. and Nichols, J., PlayByPlay: collaborative web browsing for desktop and mobile devices. In *Proceedings of CHI'09*, ACM (2009), 1781–1