

# Understanding the Importance of Location, Time, and People in Mobile Local Search Behavior

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## ABSTRACT

People often search for local information (e.g., a restaurant, store, gas station, or attraction) from their mobile device. We show, via a survey of 929 mobile searchers at a large software company, that local searches tend to be highly contextual, influenced by geographic features, temporal aspects, and the searcher's social context. While location was reported to be very important, respondents looked for information about places close to their current location only 40% of the time. Instead, they were often in transit (68% of our searchers) and wanted information related to their destination (27% of searchers), en route to their destination (12%), or near their destination (12%). Additionally, 63% of our participants' mobile local searches took place within a social context and were discussed with someone else. We discuss these findings to present a picture of how location, time, and social context impact mobile local searches.

## Author Keywords

Mobile local search, location-enhanced services, mobile systems, location prediction, location-based services.

## ACM Classification Keywords

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

## General Terms

Measurement, Design, Human Factors.

## INTRODUCTION

*Local searches* are searches for places with a regionalized geographic location; common examples include restaurants, gas stations, stores, or area attractions. Many of the queries that people issue to search engines contain location information. Gan et al. [4] found, via a study of Web search engine logs, that at least 13% of all queries pursue a geographically focused task. Gravano et al. [5] suggest several ways to categorize queries based on whether they refer to a location, explicitly (e.g., *restaurant in boston*) or implicitly (e.g., *pizza restaurant*). *Mobile searches* are those done on mobile devices, and such searches are becoming more common. Church et al. [2] looked at 30 million mobile internet requests in Europe and found that search, as opposed to browsing, is becoming more popular

for mobile information access. A 2008 Nielsen study [10] revealed 40% of mobile Internet users use search engines.

*Mobile local search* is an important component of general mobile search. Sohn et al. [11] found that 38% of mobile information needs are local (directions, points of interest, friend info, and traffic). Kamvar et al. [7] showed iPhone Maps users use their maps application, on average, 1.6 times more days per week than maps.google.com users (presumably on a desktop computer) and issue 1.3 times more queries per day. And Kamvar and Baluja [6] found, via analysis of over one million hits on Google's mobile Web search sites, that "local services" are the fourth most popular search category on cell phones.

One consistent conclusion of prior research is that the mobile local search experience differs significantly from the desktop experience, impacted in part by the limitations of mobile devices. Church et al. [2] showed that mobile search queries are shorter, less advanced, and usually not unique. As such, any optimization that reduces the user's burden with respect to query entry and the ability to understand and use results has the potential to significantly enhance the mobile search experience. Instead of concentrating on the limitations of mobile search, our study extends the results of previous search studies by exploring what additional information might be available in a mobile setting that could potentially improve the experience. For this reason, rather than looking at search logs, we asked people to share with us details of the circumstances surrounding their mobile local searches.

We present the results of a survey of 929 employees at Microsoft that asked participants to report their most recent mobile local search. After an account of the survey methodology, we describe three important pieces of context that emerged: time, location, and social context. We include discussions of how what we have learned might be used to further improve mobile applications and services.

## METHODOLOGY

We conducted a survey to build a picture of people's mobile local search behavior. Survey participants were provided with a definition of local search and asked, "What was the last local search on a mobile device that you performed?" After providing a free text response, they were asked to remember specific details about the search, including what they had searched for, why they were searching, what

Where were you?	#	%	Where did you want your result to be?	#	%
Home	108	12%	Near current location	374	40%
Work	23	2%	Near destination	108	12%
Car/Bus	592	64%	Target was destination	250	27%
Walking	104	11%	En route to destination	110	12%
Other	102	11%	Other	87	9%

**Table 1: The location of the searcher and the location of the place they were looking to relative to them.**

geographic constraints they had on their result set (e.g., near them, near somewhere else), when they planned to visit the place they searched for, and whether they were moving (e.g., car, bus, walking) at the time of the search.

The survey questions and response options were developed based on free-text responses from 31 colleagues about their most recent local search. We chose to focus on respondents' most recent local search experience rather than asking about general local search behavior because we felt they could provide more reliable and representative answers this way. However, retrospective self-reported data is not necessarily as accurate as in situ feedback, such as was collected by Sohn et al. [11]. Our approach attempted to balance reliability with ability to collect a large amount of data from many different individuals.

We received 929 survey responses from Microsoft employees in summer 2010. Most respondents were regular users of mobile local search, performing such searches either daily (22%) or weekly (59%). Most (81%) fell within a uniform distribution of ages from 26 and 45. Given the technical nature of the company and the fact that 50% of respondents held a technical role (i.e., testing, software development, or program management), respondents were likely early adopters of mobile local search and probably used it more frequently than the general population. Their responses provide a picture of mobile local search behavior that may represent the near future of mobile search for many others. However, early adopters are generally more active mobile citizens, so responses may not generalize.

Respondents primarily used Windows Mobile devices (62%) to perform their searches, followed by iPhone (27%), Android (5%) and other types (6%) of mobile devices. While different phone models may be more or less suited to different search tasks, our Windows Mobile and iPhone respondents reported similar distributions in the types of local targets they searched for across the major categories of stores, restaurants and attractions. This suggests our findings are independent of the participant's phone model. However, as the majority of survey participants used smart phones, our results may better describe the behavior of early adopters and users with access to more sophisticated devices, similar to the work by Church et al. [2].

## RESULTS

After a brief overview of the local search behavior in our sample, we highlight three important aspects that emerged

from our data: geographic characteristics, temporal features, and social context.

### Overview

All of the searches described in our survey data were local searches, meaning participants were looking for places with a regionalized geographic location. Respondents were most likely to be looking for restaurants (48% of the queries), followed by stores (21%) and attractions (10%). Requests for movie-related information were also common in the free-form responses. It is notable, however, that almost half of the participants did not have a specific place in mind prior to the search. Respondents reported searching for a specific place or establishment (e.g., *Best Buy*) only 47% of the time. They were as likely (49% of the time) to be looking for a result that met some general criteria (e.g., *movie theater*). This suggests that mobile local searchers may often be interested in finding a range of results that meet general criteria (e.g., *an Italian restaurant*) instead of something more specific (e.g., *Mario's Ristorante*).

The most common reason participants reported for performing a local search was to get directions to their target location (52%), followed by the desire to go somewhere (43%), to get a phone number (28%), and to choose a specific place to go (21%). (Percentages sum to more than 100% because multiple motivations could be selected). People's searches were triggered by many different causes, ranging from an "empty gas tank light" to unexpected obstacles (e.g., "the place we had picked out previously was closed"). Most of the triggers appeared highly contextual. For example, many searches were initiated because of physical needs (e.g., "felt (very!) hungry," or "bored"). Consistent with the rest of the survey data, common triggers were often location based ("we were lost"), time based ("breakfast time") or social ("kids were hungry"). We discuss these three aspects of mobile local search in greater detail next.

### Location

Location is clearly important in mobile local search, both because people are often mobile while searching and because they are searching for places with a geographic location. As mentioned above, Sohn et al. [11] found that 38% of mobile information needs were local. Table 1 shows that most participants were out and about during their most recent mobile local search. Only 12% of the searches occurred at home and 2% at work, the two places where desktop computers typically reside. Most of the "other" responses represent some other location, like a restaurant, store or friend's house. However, participants were more likely to be in transit while conducting their search than at a specific location. They reported searching in a car or bus 64% of the time, searching while walking 11% of the time, and 68% of the time respondents said they were actually in motion when they conducted their search. This result matches that of Church and Smyth [3], who found that about 67% of mobile information needs occur when the

Response	Count	Percent
As soon as possible	409	44%
As part of my trip at the time	272	29%
Sometime that day	144	16%
At a specific time in the future	51	5%
At some unknown time in the future	40	4%
Never	5	1%
Other	8	1%

**Table 2: When searchers planned to visit the place they sought.**

user is mobile. Respondents who were moving as they searched were nearly evenly split between those looking for a specific target (34%) and those who were looking for a place that met more general criteria (31%).

In addition to the searcher’s mobility, the physical locality of the target was also clearly important. As mentioned earlier, the most common reason people conducted a local search was to find directions to a place or to go there. People often wanted local results near where they were. As shown in Table 1, 40% of respondents were looking for a place near their current location. However, nearly as many respondents wanted to find a place at or near their destination (39%) or en route to their destination (12%). This suggests that in addition to current location, destination information is of particular value. The target was to be the individual’s destination 27% of the time.

Respondents reported conducting local searches even when they were familiar with the area, often living or working near where they were searching (24%), or having visited the area many times before (23%). Nonetheless, the place that participants found as a result of their local search was often (46%) somewhere new that they had never been to before. The more familiar a person was with the area of their search, the more likely they were to be looking for a specific location, such as a particular restaurant. For example, 55% of the people who were very familiar with the area were looking for a specific location, while only 38% of the people who were completely unfamiliar were.

Our discovery that it is common for mobile searchers to be looking for a target at, near, or en route to their destination suggests that beyond an individual’s current location, search services should consider a person’s trajectory and destination, both of which are possible to predict [8].

### Time

Aspects related to time also consistently showed up as important in the survey. Researchers have found time to be an important factor in Web search, with, for example, the time of day strongly influencing the topics people search for [1]. Church and Smyth found that 8% of mobile queries mentioned time explicitly [3]. In our survey, time impacted the search experiences in several interesting but underexplored ways. Respondents were generally anxious to get to the place they searched for. One of the questions we asked was, “When did you plan to go to the place you were looking for?” The responses in Table 2 show that

Response	Count	Percent
It was my destination	311	33%
As close as possible	237	26%
Within 5 minutes	114	12%
Within 15 minutes	140	15%
Within 30 minutes	44	5%
Proximity did not matter	83	9%

**Table 3: Responses to how close the place being sought should be to its ideal location.**

mobile local searches are overwhelmingly aimed at visits in the near term future. Specifically, 89% of respondents planned to visit the place on the same day as the search, including 44% who planned to visit as soon as possible and 29% as part of their current trip.

People also wanted their search result to be near them in terms of time. As a follow-up to the previous question, we asked how close participants wanted the place they found to be to its ideal location. The results in Table 3 show that only 9% of respondents did not care how long it would take to reach the destination, while 26% wanted it to be as close as possible. These results suggest that mobile local searchers are interested in getting to their newfound destination quickly. We asked how important it would be for a search engine to estimate the arrival time, and this was judged to be of high importance by 26% of all respondents.

In general, participants wanted time related information about their search result. Of the 173 responses we got to the question, “What would have made your search experience better?” 12% said they wanted information on when the business would be open, 5% wanted movie times, and 2% wanted to know the wait time. Similarly, when we asked why our respondents did their search, 28 (3%) wanted the business’ operating hours (e.g., “I wanted the hours that they were open so I could decide if I should drive there”), and 21 (2%) wanted movie times (e.g., “to know what time to get to the movie”). This agrees with the Sohn et al. study [11] where 7% of information needs concerned business hours and 2% concerned movie times. Our results suggest an advantage to biasing mobile local search results toward establishments that will be open when the person arrives and showing business hours and movie times.

Lastly, the time of day was often likely to trigger the query. Fourteen percent of the time when participants described why they initiated a mobile local search, time played an important factor (e.g., “breakfast time” or “dinner time”).

### Social

Social aspects appeared to be surprisingly important for mobile local search. Search engines are sometimes used collaboratively to find information. Morris [9] found 53% of people had searched the Web with another person at least one point in the past. In contrast to searching at some point in the past with another, a large majority of respondents said their *most recent* mobile search was discussed with someone else. As shown in Table 4, 63% of the searches we

studied were conducted with another person. Although the respondent was the one controlling the mobile device in 85% of these cases, someone else controlled the device in the remaining 15%. For several of the “other” responses, the participant mentioned more than one person searched on a mobile device at the same time. As smart phones become more prevalent, these multiparty search scenarios are likely to become more popular. In one instance, the mobile device changed hands during the search.

These collaborative searches appear to often have been triggered by social means, such as a conversation or group need. Of the reasons reported for starting a mobile local search, 24% of them involved another person. For example, one participant reported conducting mobile local searches because of a “conversation with [their] spouse in the car.” A number of respondents reported searches inspired by children (e.g., “cranky kids needed an activity”), friends (e.g., “friends decided to go to a restaurant”), and spouses (e.g., “wife wanted to have some sizzlers”).

Even when triggered by an individual’s need (e.g., “I wanted a coffee”), individual searches were still sometimes conducted collaboratively. And not all searches triggered by other people resulted in a collaborative search experience. For example, a participant who reported, “A friend called and wanted me to pick something up that had to be purchased at a Safeway store,” proceeded to search for Safeway on his own, as did the participant who received an “email about dinner” and then searched for a restaurant.

People were significantly more social in their searches while out and about. Of the searches conducted while in transit, 67% were social, while only 53% of the searches conducted while stationary were social ( $t(921) = -4.07, p < .001$ ). People were also significantly more social when out of the house. Of the searches conducted while at home, 45% were social, while 66% of those conducted in a car or bus were ( $t(698) = -4.06, p < .001$ ). One explanation for this finding could be that the places our searchers frequently looked for, including restaurants, attractions, and movie theaters, are places often visited in groups.

People also were much more likely to want to go to a place they found immediately when searching socially than when searching alone. Social searches accounted for 65% of those that were conducted to go to the target the same day, versus only 41% of those conducted to go to the target at some time in the future ( $t(109.37) = 4.47, p < .001$ ). Further study would be valuable to explore the relationship between mobility and social interaction, as well as designs that support collaborative mobile search.

## CONCLUSION

We have presented a survey study of mobile local search focused on understanding the contextual factors that are part of such search experiences. We showed that location, time, and social context are all important. Although it has been assumed that location is important when mobile, we

Response	Count	Percent
Yes, I controlled the mobile device	496	53.3%
Yes, they controlled the device	86	9.3%
No	342	36.8%
Other	5	1%

**Table 4: Responses to whether the participant discussed the search with someone else as they searched.**

have seen that it is not just a person’s current location but also their destination and route there that matter. We found that people are usually interested in immediately using the information they find during mobile local searches, and thus the availability of the local search results is very important. Additionally, most mobile local searches involve multiple people and social triggers. We believe that a rich consideration of location, time, and social context will lead to an improved mobile local search experience, and hope our findings can help inform such improvements.

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