

## MOBILE SEARCH

# Search on Mobile Phones

Virpi Roto

Nokia Research Center, P.O. Box 407, 00045 Nokia Group, Finland. E-mail: [virpi.roto@nokia.com](mailto:virpi.roto@nokia.com)

**The search tools familiar from the personal computer are propagating to mobile devices. Are users willing to type keywords with the limited keypad of an ordinary mobile phone? How does mobile search differ from stationary search? The author found that users are surprisingly willing to use search also with the traditional phone keypad, and foresees a search revolution as mobile devices enable location-based search.**

### Introduction

Most people know keyword-based search functionality from the Web. Generally, people also may have tested file search in Microsoft Windows, or text search in a word processor. In the future, most people will be familiar with search functions on their mobile devices as well. The search functions on a mobile device may differ radically from the search functions on a personal computer (PC) because some day the mobile phone will provide us location-dependent search.

First, I present the findings of a study on mobile Internet sites with and without search. Second, I discuss how search on a mobile phone differs from search on a PC.

### Search the Mobile Internet

Currently, the search functions executed with a mobile phone are mainly searches from the mobile Internet. Google provides an excellent search tool for the mobile Internet. Also, the sites available for mobile users often provide search within the site (Figure 1). Short pages tailored for mobile devices do not need a search tool for finding keywords within the page but when HTML pages are viewed via small displays, search within the page becomes an important tool. So, all levels of Internet search are also needed on the mobile Internet: search the Internet, search the site, and search the page.

Nokia Research Center conducted a comparative usability evaluation on two mobile Internet sites (Kaikkonen & Roto, 2003): a news site for information retrieval tasks and an auction site for transaction tasks. The sites were specified and developed just for this evaluation. Only the parts needed to carry out the test tasks were implemented.

To compare different navigation methods and to find the preferred user interfaces, the services were implemented in three different user interface styles (Figure 2). All user interfaces contained the same data but the way the data was presented, navigation, and the usage of the elements varied in each user interface style. To avoid associations that would make one style better than another, we named the styles according to fruits. The structures of the three styles are presented in Figures 3, 4, and 5. The number of users' steps for one test task—finding information about a basketball game—can also be seen in the figures.

### Method

We conducted two test rounds. The first test was carried out with Nokia 6510 (Europe) and 6590 (USA) mobile phones and the second test with Nokia 7650 (Europe). All phones were running a prototype version of the Nokia mobile XHTML (Extensible Hypertext Markup Language) browser. The applications were used via GPRS (General Packet Radio Service) connection as WAP (Wireless Application Protocol) services, and the implementation was pure XHTML Mobile Profile.

In the first test, the number of participants was 20: 12 in Helsinki, Finland, and 8 in Boston, Massachusetts. The participants in Finland were from various European countries and from Japan. The subjects varied from active users of the current mobile Internet to those who had never used it. All but one user was familiar with either WAP in Europe/USA or Japanese mobile Internet (i-mode, J-sky, or EZ-web). In the second test with the Nokia 7650, we had 10 participants: There were eight Finnish users, one Romanian and one Indian user.

All subjects in both tests used a mobile phone daily and they knew how to type with a mobile phone keypad: they



FIG. 1. Keyword search in the mobile Internet.

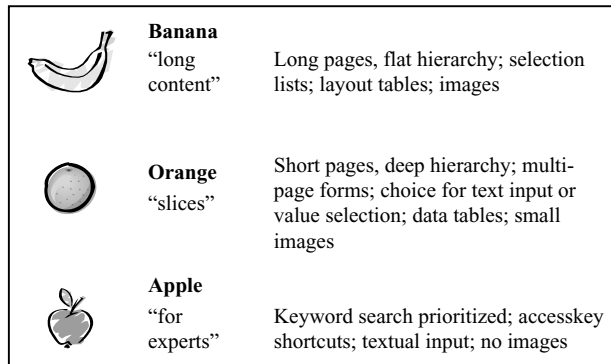


FIG. 2. The user interface styles used for comparison.

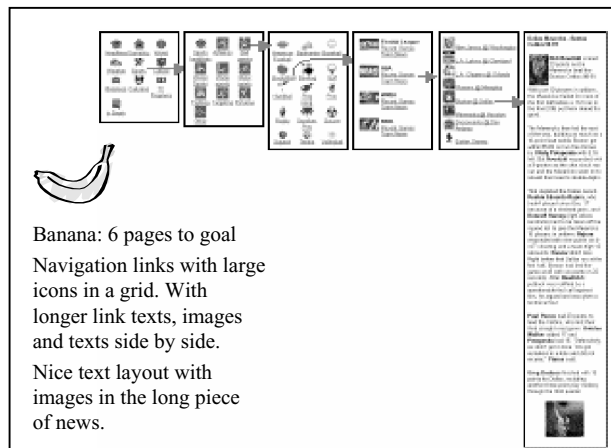


FIG. 3. Banana style for finding sports news.

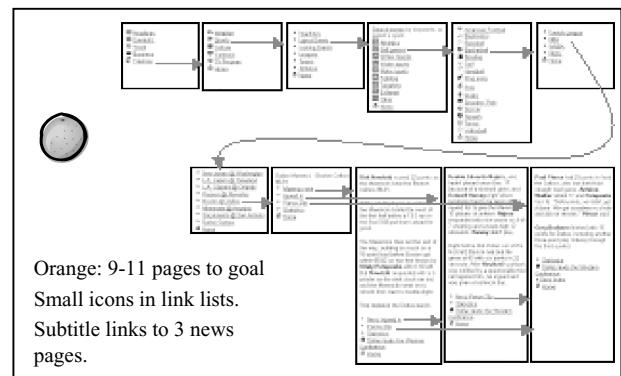


FIG. 4. Orange style for finding sports news.

had inserted names to the phonebook of the phone or written text messages. Users were asked to think aloud, and their comments were recorded together with the video image on a digital video camera. The testing order of the services and user interface styles were counterbalanced.

The tasks users were able to perform in the news service were relatively complicated:

1. Finding the weather forecast for a specified location and a specified period.
2. Finding information about the performance of one basketball player in a specified match.

The tasks users were asked to perform in the Auction service were:

1. Deleting an offering from the list of own offerings.
2. Modifying an offering on the list of own offerings.

Each user performed each task three times, once per user interface style. They were allowed to use the time they needed to execute the task; there was no time limit. Most users performed all the tasks with all the user interface styles within 2 hours but some users did not have the time to complete all the tasks.

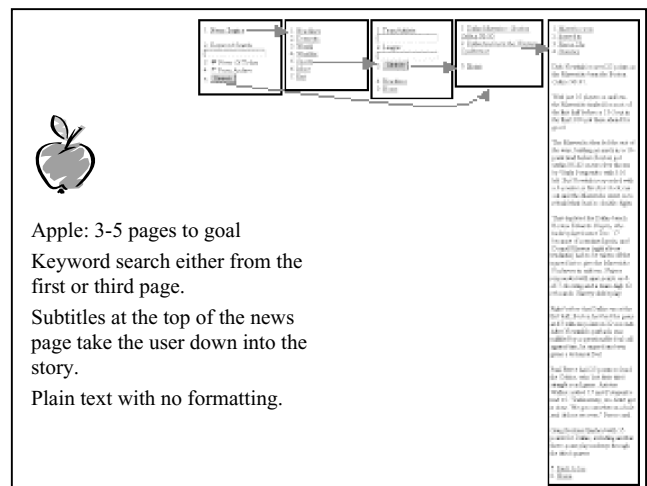


FIG. 5. Apple style for finding sports news.

After testing each service with one user interface style, users were asked to rate the user interface style on a scale of 1 to 5 (1 = *very bad/difficult* and 5 = *very good/easy*).

The questions were:

1. Did you always know how to proceed?
2. How easy was it to locate/recognize components?
3. How quickly did the system let you execute the task?
4. Did you like the visual outlook of the system?

We analyzed the times for specified tasks and user satisfaction ratings. We also performed a qualitative analysis of user performance in test tasks.

## Results and Discussion

In the first test, the Apple style with search function was the preferred user interface style. The most significant differences ( $p < 0.001$ ) were in finding the way to proceed and in item locating, compared to the Orange News (Figure 6).

In the second test, the phone display was bigger, and the Orange user interface was redesigned so that the too short pages were combined into longer ones. These changes made the Orange style more successful, and there were no statistically significant differences between the styles (Figure 7).

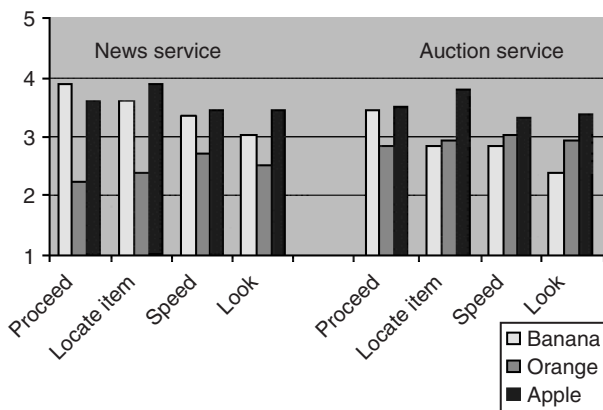


FIG. 6. Subjective ratings of the styles (first test).

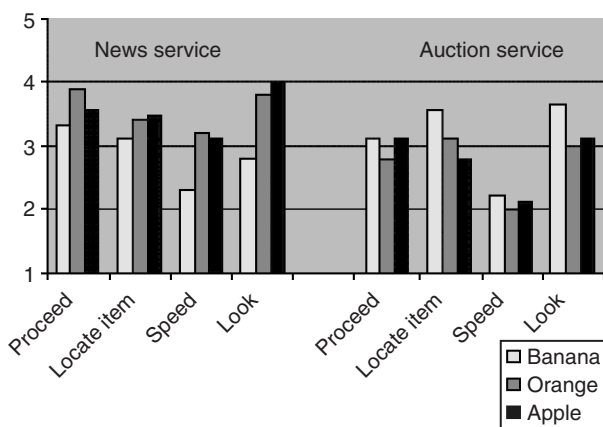


FIG. 7. Subjective ratings of the styles (second test).

## Navigating in a List of Items

When we asked the user to delete a named item from a list of offerings in the Auction service, the best interface provided the offerings on one compact list. When the interface required extensive scrolling to find the item, 21 of the 30 participants used keyword search to locate the named offering.

For the price-halving task, keyword search was not possible. We provided sorting option for the users in the Apple style, but only 7 of the 30 participants realized that they could use sorting. We did not find a working method to search for items with a specific set of parameter values on a small screen, because the data table interface is hard to perceive through a keyhole view.

## Discussion on the Search-Related Results

We provided two basic methods for the users to find the target page from the News site: Either follow hyperlinks or use keyword search. Our hypothesis was that users would prefer the hyperlinks to the keyword search because it is relatively difficult to write text with a normal phone keypad. There also exists a WAP design rule: "Minimize the need for text entry in mobile services" (Nokia, 2002).

In our test service, the system always provided two matches for a keyword search. That gave the impression of efficiency. In some cases, users could alternatively make selections and go forward by selecting items with a radio button or check box.

Users were pleased in using the efficient search function, and complained about the Banana style that did not offer such a tool. Surprisingly, many users selected search function and wrote multiple keywords to the search field. The way the search function was provided greatly affected its popularity: If the keyword field was right on the page and not behind a link, users selected it much more often.

## Location-Dependent Search

Mobile devices move with the users; hence, new kinds of search functions are possible. Many applications check the location of a mobile phone, and can help the user to find locations such as the nearest gas station or hamburger restaurant (e.g., Finder WAP service by Sonera in Finland).

The Bluetooth technology in modern mobile phones enables phones to communicate with other Bluetooth devices nearby, within about 10 meters. This will be a revolutionary change for mobile phone usage. The opportunity to find and communicate with the people and businesses nearby will provide a new way of communication.

Whatever the technology behind the location-based communication is, it will also affect the ways in which a search function is used. We see two new types of search coming:

- Real-time search for nearby objects.
- Predefined search for objects the user may pass by.

In Case 1, real-time search for nearby objects, the typical use cases are restaurant or automated teller machine

searches when the user is at a place that she or he does not know. In these cases, entering search criteria should be very easy because it is likely that the user is on the street or in a car.

Case 2, predefined search, is interesting because it is a completely new way of searching. A typical case would be to find offers for the items on a shopping list. If a user needs to buy a specific item, e.g., a Nokia 7650 mobile phone, he or she enters this item on a shopping list in his or her mobile device. When passing by a shop that offers this phone model, the user gets a notification with the price information.

Another use case for predefined search is more like a reminder: The user carries a letter to be mailed but knows he or she may not remember to do it. He or she enters a predefined search for a post box into the mobile device. When the user passes by one, he or she is notified.

If the search criteria definition is too difficult, these location-dependent search actions may not become popular. However, if it is easy to use these search functions, they will have an effect on our everyday life.

## Best Practices

When designing Internet sites for mobile use, do not forget the need for keyword search. Users are willing to type keywords to minimize the need for page downloads over a narrow bandwidth connection. Keyword search is often the quickest way to find if the site includes a certain piece of information.

When designing location-based systems for mobile devices, it is essential to provide a quick way to search information about objects, people, or services nearby. Offline search query with online notifications will be a powerful tool for location-based services.

## References

- Kaikkonen, A., & Roto, V. (2003). Navigating in a mobile XHTML application. In *Proceedings of the Conference on Human Factors in Computing Systems (CHI) 2003: New Horizons* (pp. 329–336). New York: ACM.
- Nokia Corporation. (2002). *Mobile application development guidelines*. Retrieved January 20, 2003, from <http://www.forum.nokia.com>