View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by International SERIES on Information Systems and Management in Creative eMedia...

Investigating the Usability of a Mobile App for Finding and Exploring Places and Events

Florian Knip, Christian Bikar, Bernd Pfister, Bernd Opitz, Timo Sztyler, Michael Jess
University of Mannheim, Mannheim, Germany
fknip, cbikar, bpfister, jopitz, tsztyler, mijess@mail.uni-mannheim.de

Ansgar Scherp
Leibniz Information Center for Economics, Kiel
a.scherp@zbw.eu

ABSTRACT
In our two-step field study, we developed and evaluated mobEx, a mobile app for faceted exploration of social media data on Android phones. mobEx unifies the data sources of related commercial apps in the market by retrieving information from various providers. The goal of our study was to find out, if the subjects understood the metaphor of a time-wheel as novel user interface feature for finding and exploring places and events and how they use it. In addition, mobEx offers a grid-based navigation menu and a list-based navigation menu for exploring the data. Here, we were interested in gaining some qualitative insights about which type of navigation approach the users prefer when they can choose between them. In this paper, we present the design and a preliminary analysis of the results of our study.

Author Keywords
field study, mobile exploration, faceted navigation

ACM Classification Keywords
H.3.3 INFORMATION STORAGE AND RETRIEVAL : Information Search and Retrieval; H.5.2 INFORMATION INTERFACES AND PRESENTATION (e.g., HCI): User Interfaces

General Terms
Design, Experimentation, Human Factors

INTRODUCTION
We developed mobEx, a mobile application for Android phones that retrieves social media data from different data providers such as Qype, Twitter, LastFM, Eventful, and Google Places as well as other open web sources such as DBpedia and OpenPOI. The data provided by these sources is organized along different, hierarchical facets, i. e., categories such as people, locations, organizations, and events as well as subcategories of these facets [1]. The facets are obtained from the meta-data fields of the retrieved resources and encourage users to search in an exploratory manner [5]. The mobile app mobEx offers unique search features that enable the user to find nearby resources along these facets. An entity-resolution-concept merges the received resources in real-time, i. e., when a request is issued by the user [6].

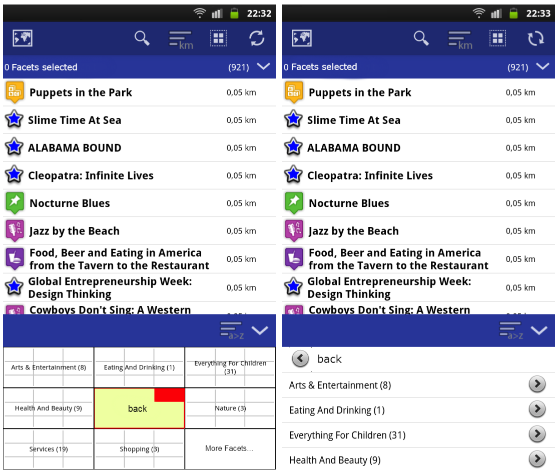
The main research question addresses in this paper is to understand how people use and interact with applications such as mobEx in order to improve the functionality and the user interface (UI) design. For the exploration of time-dependent resources such as events or shops with opening hours, mobEx offers the UI widget of a time-wheel [7]. It allows the users to filter time-dependent resources according to his or her preferred time (example screenhots of the time-wheel widget are shown in Figure 2). Furthermore, mobEx offers two different approaches for faceted navigation. A classical list-based approach and an alternative grid-based approach. Both navigation approaches have been compared in a quantitative user study [8], where each subject had only seen one of the two UI options. The result of this study is that the grid-based approach requires significantly more clicks and more time. However, it has a higher user satisfaction. The goal of this paper is to find out, if (1) the subjects understand the metaphor of the novel time-wheel and how they use it. Second, (2) what type of navigation approach for faceted search do the users prefer when they can choose between a grid-based navigation menu and a list-based navigation menu.

We structured the study into two steps: In the first step, we conduct a qualitative user study with a beta version of mobEx. This qualitative study served as feedback to improve the UI design. Hence, the evaluation of the qualitative feedback was followed by another implementation phase where we added additional features suggested by the users and at the same time improved existing features. After conducting the changes, we conducted in the second step a quantitative study with a final version of mobEx. Here, we collected and analyzed user-generated logging data of 18 subjects over a period of three weeks. In this paper, we present the design of our experiment and the two phases of evaluation. In addition, we conducted a preliminary analysis of the results of our study.

INVESTIGATED OBJECT: MOBEX
The UI of mobEx can be divided into two major parts, one is the map view where the web resources are visualized on the map, the other one is the facet view where the sources can be filtered and searched according to categories or search terms. The following sections describe the mobEx application and its features in detail. We start with the two types of navigation menu, followed by a description of the time-wheel UI widget.

Navigation Type
The mobEx navigation menu is inspired by FaThumb, a search application for large data sets on mobile phones [4]. In contrast to FaThumb, which was designed for phones with a physical numerical pad, mobEx makes use of today's touchscreen

technology and mobile web access. MobEx provides two different kinds of navigation menus that both display the same content, but offer a different layout and navigation functions. The navigation types are a grid menu and a list menu as shown in Figure 1. In both cases, the navigation menu takes the bottom third of the space on the touchscreen. The details of the list navigation and grid navigation for faceted search are described in the subsections below.



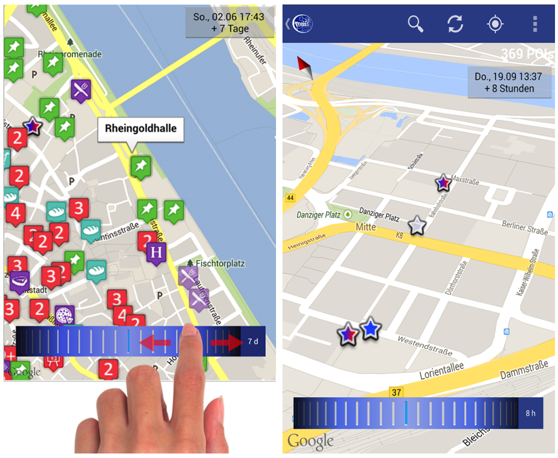
(a) Grid Navigation Menu (b) List Navigation Menu

Figure 1: Comparison of Grid vs. List Navigation

Grid Navigation The grid navigation menu (Figure 1a) visualizes the facets in form of rectangles and arranges them as 3x3 matrix with the middle one as the back button. A rectangle contains the name of the facet aside with the amount of retrieved resources in brackets. If there are more than seven facets, an additional field on the bottom right corner is shown entitled "More facets" and allows the users to reach a screen with further facets. The result list shows the resources of the selected facets, i. e., those entities that belong to the selected categories. If no facet is selected, all resources are shown. The result list can be filtered by activating facets via long-press on a facet. With short-press on a facet, the user can navigate deeper into the facet structure and explore its sub-facets. To select facets without sub-facets, a short press is sufficient. Facets can be selected and unselected in an arbitrary combination. By default, all facets are unselected and only the resources from the selected facets show up in the result list. For example, when selecting the facet "Shopping", only resources that are under this facet are displayed.

A characteristics of the grid navigation is the colored rectangles, which are integrated into the back button. These rectangles work like a breadcrumb trail and allow to keep track of the current navigation path within the facet structure. For example, as shown in Figure 1a, the red border indicates that the current position is one layer beneath the top layer and the red rectangle on the top right states that on the first level, the top right facet was selected.

List Navigation In comparison to the grid menu, the list navigation menu (Figure 1b) visualizes the facets as entries in a scrollable list. The gray arrow at the right of each entry indicates that the facet has at least one more sub-facet. The back-button is at the top of the list. Depending on the screen size, the user sees a couple of facets and can scroll down the list to see the rest. In contrast to the grid menu, the list menu does not provide any information about the current position in the facet structure.



(a) Exploring time-dependent resources using the time-wheel (b) Spinning the time-wheel changes the opacity of the icons

Figure 2: The time-wheel can be used to look for events and resources with opening hours within a specific time frame

Time-wheel

The time-wheel allows the users to filter events and other time-dependent POIs such as locations with opening hours by time as shown in Figure 2a. While the users spin the time-wheel, the time frame changes and the events on the map appear or disappear accordingly. Events and other POIs such as shops with opening hours within the chosen time frame are displayed and events/POIs outside of the time frame are transparent as shown in Figure 2b. The larger the time distance, the lower the opacity of the icons. Turning the time-wheel to the right shifts the time interval towards the future while turning left shifts it backwards to the present. The users can also adjust the time interval (i. e., the period in which events will be shown) via the switch on the right edge of the time-wheel widget. Here, the user can choose intervals ranging from single hours up to several weeks. With these interval sizes, we aim at covering typical use cases such as "Looking for today's nightlife events" (interval of few hours needed) or "Planning a two week vacation in New York" (longer intervals needed). The current date and time including the current duration of the interval is displayed in the upper right corner as shown in Figure 2b.

USER STUDIES

We conducted a qualitative and quantitative user study for evaluating the usage of mobEx. The subjects and the overall process of the two studies are explained in this section.

Eighteen subjects (six female) used mobEx over the entire evaluation period, i. e., both evaluation parts. All subjects were required to own an Android phone with the version 2.3.3

Gingerbread or higher. The ages ranged from 18 to 31 (M= 25.5, SD= 3.03). Seven subjects studied business informatics, five others studied other subjects. The other six subjects did an apprenticeship. Over 90% of the subjects were German natives.

The evaluation was planned over two steps. First, a qualitative user study was conducted followed by a quantitative user study. As shown in Figure 3, we started with the first, qualitative study at the end of April 2013 and finished this phase on May 5th, 2013. Within this time, we asked the subjects to apply the mobEx application and try to understand how it works. The results of the qualitative user study were captured using a questionnaire and served as feedback at an early stage of the development process.

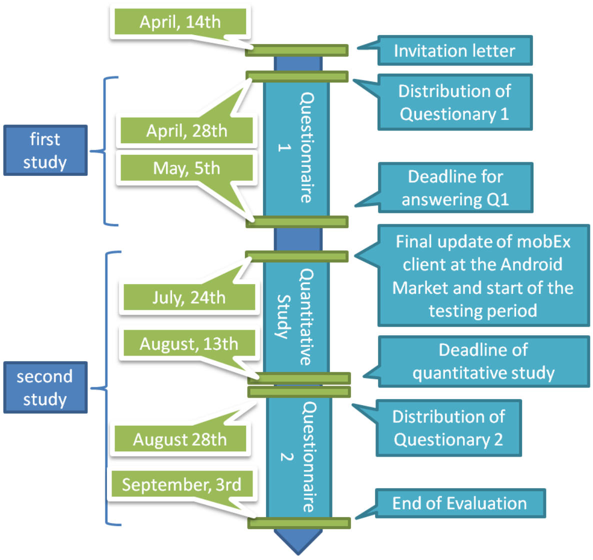


Figure 3: Overview of the time line of the two studies

Subsequently, we conducted the second step of the evaluation, the quantitative analysis. Within this part, we asked the subjects to use the app on a regular basis and to conduct tasks of their daily life. As it can be seen from Figure 3, we launched the second questionnaire, the last part of the second study, two weeks after the quantitative study was finished. Similar to the first questionnaire, this part was also completed within a period of one week and and marked the end of the entire evaluation period.

STEP 1: QUALITATIVE USER STUDY

The goal of the first study was to find out if the users understood the application, what the users liked about mobEx, what they did not like, and what further improvements or changes they suggest.

Briefing of the Subjects

In the first study, starting from April 14th, we asked the subjects to download the first version of mobEx from the Google-Market and use it over a period of one week to familiarize with the application. We contacted the subjects via email that briefly introduced the study and also contained a download link to mobEx. In addition to the official email, each subject was assigned to one of our team members which served as personal contact person. In an initial briefing, the contact person explained the basic idea and concept of mobEx, the overall structure of our study, and what we expected from the subject within the next couple of weeks. Furthermore, the contact person provided support in case of questions or technical problems during the entire evaluation process.

Results

The first question was about whether the subjects would describe the app as innovative or not. This question was answered with more than 70% as innovative ("it is innovative" = thirteen subjects; "it is not innovative" = five subjects). The second question was about whether the subjects liked the layout of the app. Here, the subjects answered eleven times with "yes" and seven times with "no". The subjects were also asked to express their opinion about the functionality of the time-wheel and describe the purpose of the time-wheel. The time-wheel was correctly described eleven times and wrongly described two times. The remaining five subjects did not have any particular opinion about the time-wheel.

The satisfaction with the loading time ("Were you satisfied with the loading time?") results on average with a score of 2.4 on a 5-point-Likert scale and a standard deviation (SD) with 1.0. The 5-point-Likert-scale in the entire study means 1 for strongly agree (which is in all cases a positive statement) and 5 for strongly disagree (that is in all cases a negative statement). The mean of the satisfaction with the overall reactivity of the app ("Have you been satisfied with the reactiveness?") was 1.7 and a SD of 0.8. We also asked about the usability of the time-wheel ("Was the time wheel in the map mode helpful?"). Out of 18 subjects, this question was answered ten times with a value 4 or worse (M= 3.4, SD= 1.2). Just one subject was totally satisfied with the usability of the time-wheel and three of our subjects rated the usability with 2. 50% of the subjects who rated the time-wheel negative (with a Likert-scale value of 4 or higher) did not fully understand the advantages of it. The question whether the subjects would recommend mobEx to friends was answered on average with 2.7 and a SD of 0.6. Thus, a little worse than the overall opinion about the app ("Generally, I like the app.") with a mean of 2.2 and SD of 0.6.

Discussion of Results

The user suggestions were very helpful to make improvements and add features to the application. Some subjects had difficulties to understand the purpose of the time-wheel feature, which may be due to insufficient and incomplete data sources. Especially fields such as opening hours, which are essential for making full usage of the time-wheel, were often missing. So, it could happen that in the map view nothing changed when turning the time-wheel. Better information about opening hours could tremendously improve the user satisfaction in the future.

STEP 2: QUANTITATIVE USER STUDY

In the second step, we conducted a user study where the subjects were asked to use the app regularly, in the best case daily, for their own searches that usually arise. Within a phase of three weeks, we collected user events like starting or closing the application, using the time-wheel, or interactions with the facet navigation. Based on this collected data, we were able to analyze the user behavior. In order to verify some of the conclusions we drew from the logging data, we asked the subjects to answer a (second) questionnaire after the three week logging period.

The goal of this study was to get insights about how mobEx is used. We focused especially on how users interacted with the time-wheel and the grid or list navigation. The primary questions we wanted to answer were firstly, if the time-wheel was used regularly to filter events and secondly, if list or grid navigation mode was preferred. For logging the user's activity, we used Google Analytics[1].

Briefing of the Subjects

On July 21st, we started the quantitative part of our evaluation by sending a notification to our subjects. We asked them to update the app from the Android Market and place a shortcut of the app on their home screen. We motivated the subjects to generate continuous and reliable, non-artificial data and asked them to use our application instead of Google Maps during the three weeks. As introduction to the quantitative study, we provided an overview of the enhancements that were made after the first study.

Measurements

Common Usage Statistics By using Google Analytics as a tool to capture user activity, we can get detailed insights about the usage of mobEx during the user study. During three weeks, 18 subjects produced over 3000 single events in 179 sessions. A session is defined as active usage of the application until it is closed or after 30 seconds of inactivity. A session lasted on average 3:57 minutes. In Figure 4, the number of sessions during the three week period is plotted. 55% of the subjects used the application daily, 72% every second day or more.

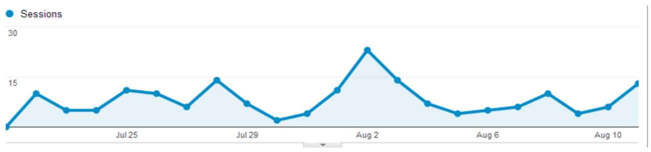


Figure 4: Sessions during the three week evaluation period

Grid and List Navigation For investigating the acceptance of the grid and list navigation, we took two different measurements. First, the amount of sessions in which grid or list navigation was used and second, how many subjects switched from grid to list or from list to grid navigation using the preferences menu. In the first case, we measured 94 sessions with list and 85 sessions with grid navigation enabled. Secondly, we observed seven times that subjects switched to grid navigation whereas four times subjects switched to list. The initial setting, grid or list, was decided by random. We counted ten subjects having list navigation enabled and eight subjects having grid navigation enabled at the beginning of the study.

[1] http://www.google.com/analytics

Time Wheel The time wheel has been used in 25 of 179 sessions. In those 25 sessions, we measured on average 3.4 interactions per session with the time wheel (e. g., scrolling or changing the time interval). After switching to the map screen on which the time wheel is situated, 7% of the subjects used the time wheel as first action. Other possible actions were a click on the buttons of the action bar, a click on an event on the map, or a change of the time interval. 65% of all users who used the time wheel opened the detail screen for an event as subsequent action.

Discussion of Results

Over the three weeks of logging user data, we could observe a balanced distribution of usage. The subjects used the application regularly. It produced enough data to create measurements about the behavior of the users. Regarding the navigation type, we observed that more subjects were using the grid navigation type at the end of the study. Although there were slightly more sessions with list navigation enabled, we think that the grid navigation was the approach that had a better acceptance among the users. This statement can be supported by the answers of the second questionnaire where nine subjects indicated a preference for the grid navigation, in contrast to seven subjects who preferred the list view. The measurements for the time wheel show relatively low usage numbers throughout the evaluation. In only 14% of all sessions, the time wheel has been used. Thus, the number of logged events is quite low and representative conclusions are difficult to draw.

RELATED WORK

The idea of a grid-based faceted navigation on mobile phones was initially presented in 2006 by Karlson et al. [4]. The authors describe a novel approach for searching large data sets via a 3x3 grid containing facets under which the data is classified. In a user study with 17 subjects, they gained insights about the performance of the grid-based approach in comparison to a text-based one. The results showed that for tasks where only certain characteristics of the data is known, facet navigation is faster. If some specific aspects of the data, like a describing name is known, text-based search performs better. Another finding of the study was that although users like the faceted navigation, they were frustrated when data was not classified as expected. Another approach for faceted browsing is FacetZoom [2]. FacetZoom is a UI widget that scales well in terms of different screen sizes and allows to browse through different levels of structured data. This approach is different from the grid navigation used in mobEx in a way that every hierarchical level is presented as horizontal bar that is subdivided in as many cells as nodes are available on that level. The bar can be scrolled horizontally and nodes can be selected with a click in order to navigate to the next level. The authors also conducted a user study that showed that different screen sizes had no effect on the performance when solving different tasks.

The procedure of our quantitative field study was based on the experience of Sohn et. al [9]. The authors describe a two-week diary study with 20 subjects about mobile information needs. During the experiment period, the subjects were asked to keep track about their information needs when being on the go with a mobile phone. Similar to our study, the subjects were briefed regularly and allowed to use their own cell phones. The study helped us in designing the briefing sessions as well as the rewarding system for the focus group. Since our research goal was also related to mobile information needs, we also decided to conduct a field study in order to have a high external validity and to find out how the subjects use mobEx in their 'natural habitat'. Another field study that was conducted with users in their 'natural habitat' was done by Niels Henze [3]. They describe how they used a mobile app as a tool to conduct a number of HCI studies with a large user group. In comparison to most other studies which are conducted in a highly controlled area, this work provides - with over 400,000 installations - a very high external validity. Since we also conducted a field study with subjects in a non-laboratory environment, our process of publishing the mobEx app was very similar.

CONCLUSION

The qualitative study revealed that the purpose of the time-wheel was not well understood at the beginning. We also observed that the usage of the time-wheel during the quantitative study was not very high. The low usage may be either because the users still found it uncommon to use the time-while or due to a lack of more time-dependent resources such as events and places with opening hours. Regarding the navigation type, we can conclude from the findings of the quantitative study and qualitative study that the grid navigation seems to be the better option when exploring large faceted data spaces. However, it has to be kept in mind that the list navigation is faster and requires less clicks [8].

REFERENCES

1. Callender, P. M. . J. *Search Patterns*. O'Reilly, 2010.
2. Dachselt, R., Frisch, M., and Weiland, M. Facetzoom: a continuous multi-scale widget for navigating hierarchical metadata. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM (2008), 1353–1356.
3. Henze, N. Hit it!: an apparatus for upscaling mobile hci studies. In *CHI'12 Extended Abstracts on Human Factors in Computing Systems*, ACM (2012), 1333–1338.
4. 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 of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '06, ACM (New York, NY, USA, 2006), 711–720.
5. Marchionini, G. Exploratory search: from finding to understanding. *Commun. ACM 49*, 4 (Apr. 2006), 41–46.
6. Opitz, B., Sztyler, T., Jess, M., Knip, F., Bikar, C., Pfister, B., and Scherp, A. An approach for incremental entity resolution at the example of social media data. In *Proceedings of the AI Mashup Challenge 2014 co-located with 11th Extended Semantic Web Conference (ESWC 2014); Crete, Greece*, CEUR-WS (2014). http://ceur-ws.org/Vol-1200/.
7. Schmeiß, D., Scherp, A., and Staab, S. Integrated mobile visualization and interaction of events and pois. In *Proceedings of the 18th International Conference on Multimedia 2010, Firenze, Italy, October 25-29, 2010*, ACM (2010), 1567–1570.
8. Schneider, M., Scherp, A., and Hunz, J. A comparative user study of faceted search in large data hierarchies on mobile devices. In *12th International Conference on Mobile and Ubiquitous Multimedia, MUM '13, Luleå, Sweden - December 02 - 05, 2013* (2013), 28.
9. Sohn, T., Li, K. A., Griswold, W. G., and Hollan, J. D. A diary study of mobile information needs. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM (2008), 433–442.