Push the Study to the App Store: Evaluating Off-Screen Visualizations for Maps in the Android Market

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ABSTRACT

The introduction of publicly available application stores for mobile devices enables to publish research prototypes to a wide audience. This distribution channel can be used to conduct studies with participants from all over the world and diverse backgrounds. We report from a study that compares three visualization techniques for off-screen objects on digital maps. Usage data from 362 persons was collected and 105 persons completed an interactive tutorial. Significant differences between the three conditions were found. The results support previous findings but we conjecture that the results are affected by unintended influences.

Categories and Subject Descriptors

H.5.2 [**Interfaces and Presentation**]: User Interfaces - Evaluation/methodology

General Terms

Design, Human Factors, Experimentation

Keywords

Android Market, off-screen, map navigation, evaluation

1. BACKGROUND AND MOTIVATION

Conducting user studies is usually considered the corner stone of HCI research. Often these studies are limited by the lack of resources. In particular, the number of participants is often low (e.g. n<20), participants have the same background (because they are students and colleagues from the lab), and are of similar age. Furthermore, the mobile HCI community often conducts experiments in the lab [3] even though a mobile or natural context would often influence the studies outcome.

With the introduction of mobile application stores such as Apple's App Store and Google's Android Market a new way to conduct user studies became available to the average HCI researcher. The Android Market, in particular, enables to publish an application in a few minutes without any review process. By publishing applications in mobile application stores, researchers benefit from a worldwide audience. They gain access to participants with various cultural backgrounds and different contexts. By developing "Apps" with the aim to answer specific research questions and logging the user's behaviour it is possible to harvest a large amount of data samples. Just as controlled experiments in the lab are often limited, public studies using mobile application stores have their very own limitations which have not been explored yet. Gilbertson et al., for example, released a mobile game "to gather feedback for future publications" [2] but have not published any results and Pielot et al. report that they started the evaluation of a tactile navigation system by publishing the system in the Android market [4].

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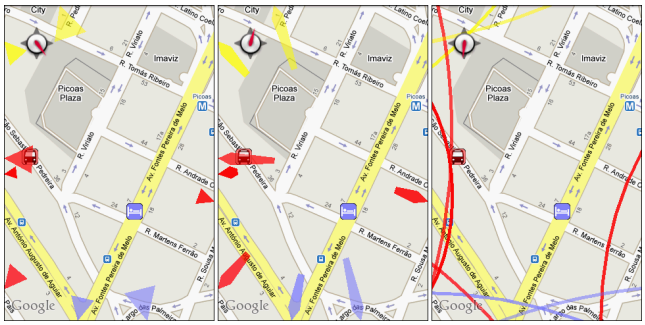

Figure 1: The three off-screen visualization techniques: scaled-arrows, stretched-arrows, and halos.

In the following we report preliminary results from a study conducted in the Android Market. The aim of the study is to explore the advantages and limitations of this kind of study. To be able to compare the results we study a question which has, at least partially, been studied by others. A typical restriction of mobile devices is the limited screen size. Different solutions have been proposed to visualize "off-screen" object for digital maps (see Figure 1). Burigat et al. compared three visualization techniques and showed that arrows encoding the distance and the directions of off-screen objects are more effective than the circle based approach Halo [1]. Even though Burigat presented an extensive study they did not consider tasks that involve panning the map.

2. DESIGN

To compare the three off-screen visualizations studied by Burigat et at. including panning of the map we implemented an according location based application for the Android platform. We considered two main requirements for the application: It must allow the comparison of the three visualizations techniques and it must at least pretend to be useful.

To make the visualizations comparable we decided for a

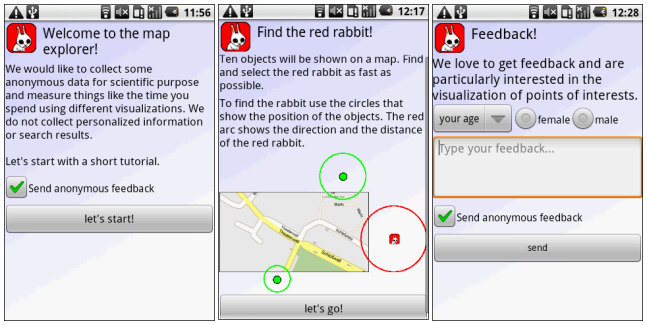

Figure 2: Tutorial instructions and feedback form.

tutorial which mimics the well defined tasks usually found in lab experiments. Using defined tasks should improve the repeatability and reduce the effect of other influences. The tutorial starts with an introductory text and consist of a simple find-an-select task for each visualization afterwards (see Figure 2). While executing the task a map is shown in full screen. The map contains 10 POIs that are randomly distributed around the user's position. The maximal distance of the POIs from the centre of the display is 2.5 times the height and width of the screen. One POI is the target (the only red object) that should be selected. This POI is not initially visible on the screen to ensure that all users must pan the map at least once. The map can be explored by panning it with the finger just as the standard Google Maps on Android. POIs are selected by tapping on its icons. The tutorial is automatically started if the application is started for the first time. To reduce sequence effects the order of the visualization techniques is randomized. The times spend for each of the tutorial steps and how often users pan the map is measured. The collected data is send to our server every 30 seconds and after a user finished the tutorial.

To attract an adequate number of users the application must be downloaded and installed at own will. From our previous experience with applications in the Android Market we assumed that an important factor is the user ratings of the application. Thus we intended to make the application "good enough" to not receive terrible ratings from users. The application offers the standard functionalities of a location-based application. Users can search for nearby POIs and access details about the POI including reviews, ratings, and imagesusing either "Qype" or "Yahoo! local" as the data source. While the application is used the time using each off-screen visualization is measured. We also measure if the user interacts with the application or not. Furthermore, users can fill the feedback form shown in Figure 2.

3. EVALUATION

We expected that our results will be consistent with the results described by Burigat et al. [1] and hypothesized that users will be slower and need to pan the map more often with Halo. Because of their similarity we expected only negligible differences between the two types of arrows. We report the preliminary results obtained after the application was publicly available in the Market for one week. The application was installed 585 times and we collected data samples from 362 accounts. 105 participants from 17 different locales and 20 different devices completed the tutorial.

Participants panned significantly more often using Halos (M=9.72) than using stretched-arrows (M=6.76, p=0.007) or using scaled-arrows (M=6.30, p=0.002). Consequently, participants also spend significantly more time using Halos (M=16.81s) than using stretched-arrows (M=12.91s, p=0.04) or using scaled-arrows (M=11.74s, p=0.01). Even though the error-rate was slightly higher for Halo we did not find significant differences. The differences between the two arrow based visualizations were very small for all depended variables and we did not find any significant effects. We did not receive useful comment with the feedback form.

The obtained results seem to support our hypothesis. Furthermore, the results are consistent with previous work and seem to be plausible at first sight. However, further investigation of the collected shows that a number of users needed much more time than one would expect (e.g. longest time spend using Halos was 100 seconds). Reconsidering our design it might be assumed that instead of measuring the pure task completion time the results are affected by the "interestingness" of the visualizations. From informal tests we can report that some users explore the map much longer using Halos than using the other visualizations. Furthermore, our results are limited because users had no previous training and performed the tasks only once with each visualization.

4. CONCLUSIONS AND FUTURE WORK

We reported preliminary results collected by publishing a prototype in the Android Market. It could be shown that it is possible to attract hundreds of participants and collect data from all over the world. Even though our results support previous findings it can be assumed that they are limited because it is difficult to ensure that what we measure is what we intend to measure. One should therefore ensure that participants' goals are the intended ones if conducting public unsupervised studies.

Our next step is to analyse the collected data in more detail. In particular, we will analyze the conversion rate if different visualizations are used and try to derive conclusions from usage data after finishing the tutorial. In our future work we will explore using simple games published to the Android market to further investigate the "off-screen problem" and other interaction principles.

5. ACKNOWLEDGMENTS

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