

Designing Visual User Interfaces for Mobile Applications

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ABSTRACT

People want to do more with their mobile phones and every day new mobile applications are launched in an increasingly wide number of domains. However, traditional UI knowledge is not sufficient to design effective interfaces for mobile applications because the mobility context presents developers with several peculiarities and new challenges. This tutorial will introduce participants to the design of visual interfaces for mobile applications. In particular, it will: (i) illustrate the peculiar aspects of mobile interaction that make it more difficult to build effective user interfaces for mobile users, (ii) show how the powerful graphics capabilities of today's mobile devices can be exploited to create interfaces that help users on the move do more with their phones, requiring less time and attention, (iii) look at recent developments in the engineering of mobile UIs such as tool support for mobile interface development, including mobile end-user programming.

Author Keywords

Mobile devices, mobile phones, user interface design, visual interfaces, multimodal interfaces, design constraints

ACM Classification Keywords

H.5.2 User Interfaces: Graphical user interfaces (GUI),
H.5.2 User Interfaces: Evaluation/methodology,
D.2.2. Design Tools and Techniques: User interfaces.

General Terms

Design, Human Factors

INTRODUCTION

People want to do more with their mobile phones and every day new mobile applications are launched in an increasingly wide number of domains ranging from games to personal productivity, from navigation systems to health and fitness. Moreover, some mobile applications exploit the in-built sensors of recent phones to enrich the interaction with features such as context-awareness and augmented reality.

Unfortunately, traditional UI knowledge is not sufficient to design effective interfaces for mobile applications because the mobility context presents developers with several peculiarities and new challenges. This invited tutorial introduces participants to mobile UI design, focusing

especially on visual interfaces, because sight is the dominant sense exploited by most mobile interfaces. More specifically, the tutorial will reach its goal by analyzing the topic from three points of views: (i) understanding the peculiar aspects of mobile interaction that distinguish it from interaction with desktop systems and make it difficult to build effective user interfaces for mobile users, (ii) facing the design constraints and issues that affect visual mobile UIs, also examining the different techniques proposed to this purpose in the literature, (iii) looking at recent developments in the engineering of mobile UIs such as tool support for UI development, including mobile end-user programming.

Distinctive aspects of mobile HCI

A first set of aspects that distinguishes mobile from desktop interfaces is device-related. For example, while recent years have seen significant increases in the size of the displays we use in the office or at home, allowing us to organize our tasks better and carry out more complex task with less effort, nothing similar has happened on mobile phones: their screens remain small and the size and resolution gaps with respect to desktop screens is widening.

A second set of aspects concerns the context of use. For example, mobile applications must take into account that people can devote only a very limited attention to the device while they are on the move. Unlike office environments, when we are in a street or at the airport or in a bar, we have to attend to a constant flow of events and stimuli that come from the environment, and respond to those events with proper actions. Some of these events can affect the accomplishment of our goals (e.g., hearing a gate change announcement concerning our flight), others our social relations (e.g., properly listening and responding to what people who are with us are saying), others even our personal safety (e.g., noticing and avoiding potential dangers while we are in a street). This makes using the mobile device a secondary rather than a primary task.

The tutorial will consider all distinctive aspects related to the device, its hardware, software and programming, as well as those related to the context, which comprise perceptual, motor, cognitive and social aspects [10].

Designing mobile GUIs and mobile visualizations

The tutorial will illustrate how a proper design of mobile GUIs can help people do more with their mobile phones,

requiring them less time and attention. The availability of devices with increasingly powerful graphics capabilities is indeed making it possible to develop novel interfaces, based on interactive 2D (or even 3D) graphics, to help mobile users in dealing more quickly and easily with larger amounts of information. Moreover, to address issues of limited cognitive resources and safety of mobile users, mobile graphics can be effectively exploited to provide information at-a-glance that is understood with less cognitive resources and distracts less the user from her surrounding environment.

Mobile visual interfaces become even more interesting and provide functionalities that were unavailable on desktop systems when they exploit various sensors (e.g., GPS, NFC, accelerometers, physiological sensors,...) that allow one to adapt the behavior of the application to position in space (location-awareness) and other parameters (context-awareness). This way, the mobile UI becomes able to automatically choose what to show and how to show it on the display based on what is happening to the user as well as the surrounding environment. Besides further contributing to decrease user's cognitive load, this supports the creation of new kinds of interactive applications, e.g. personal trainers [6] and persuasive fitness games [7].

Several advanced techniques have been tested in mobile HCI to improve the effectiveness of mobile GUIs, e.g. visual dynamic queries [3], new navigation widgets [1], 3D visual instructions [11], zoomable user interfaces [5], visual references to off-screen content [4]. The tutorial will examine these techniques and also several other techniques proposed by various authors, concentrating especially on the design issues which are harder to face on mobile devices, such as the presentation problem [9].

Engineering mobile visual (and multimodal) interfaces

Finally, the tutorial will consider relations between the visual modality and other modalities in the wider context of engineering mobile multimodal interfaces. A useful class of tools concentrates on rapid development of mobile UIs, even based on end-user programming methodologies. This also supports an easy exploration of different modalities and their combinations as well as on-the-fly tuning of the parameters of each modality. Tools for rapid development of multimodal mobile interfaces will allow the designer to make changes to the interface in the field without requiring much time or having to go back and forth from the lab as it often happens today. From this perspective, these tools should also consider content besides interaction, e.g. making quick in-the-field changes to the database of points of interests or the maps of a location-based application.

Engineering visual (and multimodal) mobile UIs would also benefit from new tools that could help to understand better how mobile users exploit or respond to different modalities. For example, automatically logged usage data concerning the various modalities could be analyzed by tools that

present the designer with informative visualizations of that data at different levels of detail. The collected data can include actions on the phone touchscreen [2], user's position in the environment [8], physiological parameters [12], studied using detailed (e.g., VCR-like replay) or abstract (e.g., heat maps) visual analytics techniques.

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