Visualization and Interaction with Mobile Technology

Sebastian Knödel
INRIA
knoedel@labri.fr
351 cours de la Libération, 33405
Talence, France

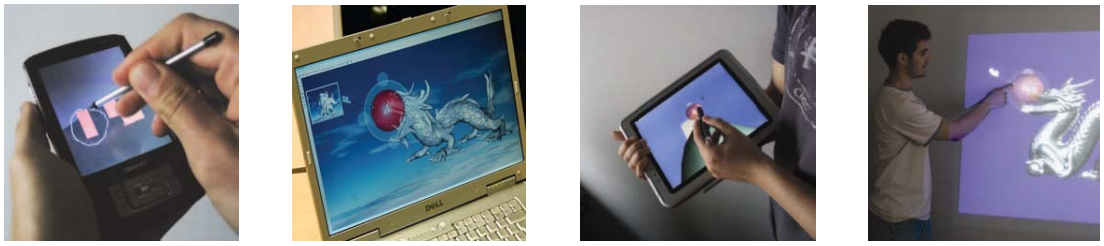

Figure 1: Mobile interaction and visualization on various platforms

ABSTRACT
Our research in Mobile HCI concerns the exploration of new interaction and visualization techniques for 3D data on mobile devices. Furthermore, we want to examine new forms of collaboration supporting groups of people, who interact together with diverse data using heterogeneous hardware, from small mobile devices to large projection screens. Hence, in our investigations we propose adapted visual representations and efficient interaction techniques that take in account the human factor, as well as technical terms of mobile technology.

Categories and Subject Descriptors
I.3.6 [Computing methodologies]: Computer graphics— Methodologies and techniques; H.5.2 [Information interfaces and presentation]: User interfaces— Interaction styles

General Terms
Human Factors

Keywords
Interaction techniques, navigation, pen-input, sketching, virtual and mixed reality, rendering techniques, mobile devices

1. INTRODUCTION
Desktop workstations or personal computers are able to provide sophisticated and expressive rendered 3D scenery with information acquired from the real world for mixed reality applications. But the hardware is often heavy, awkward or even fixed and therefore not qualified for the use in an outdoor environment. On the contrary, mobile devices are designed for a flexible use. But they suffer from both hardware and usability constraints. Despite these limitations, we think recent improvements make the development of applications for expressive visualization and sophisticated interaction with mobile devices worthwhile, as illustrated in Figure 1.

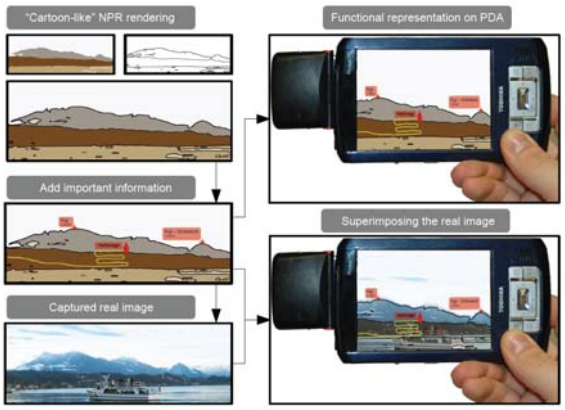

Figure 2: Initially the data is rendered with ”cartoon-like” NPR rendering techniques. After that further information is added and displayed on the mobile device. Finally the virtual data is combined with the real captured image.

2. APPROACH
2.1 Visualization
The challenge is to use adapted and efficient rendering techniques, like remote rendering, expressive and non-photo realistic shading, which support the interaction with the underlying data. We investigate as well the possibility to merge virtual with real world information to create a mixed reality that let the user interact with the surrounding environment. Therefore we present a special remote rendering technique in the context of a 3D panorama service for mobile devices [1], which is presented in Figure 3. The server provides geo referenced data, e.g. non-photorealistic rendering of 3D terrains with additional information.

MobileHCI 2008, September 2–5, 2008, Amsterdam, the Netherlands.

Beyond that, we explore the possibility to merge virtual and real information to enhance the user interaction [2], by regarding human factors. This method is illustrated in Figure 2.

a) b)

Figure 3: a) shows a city center seen from above; selecting a location by a pointing interaction creates a combined street and aerial view b)

2.2 Interaction

On the other side we search for interaction techniques that match the requirements of mobile users. One of our prime principles is to exploit the advantages of recent development in mobile technology, like the multi-touch interface. But we also try to overcome the limitations and problems of present interfaces, like e.g. small buttons and displays. Therefore we focus on investigating 2D sketch or touch-based interaction using gestures as well as additional widgets. Figure 4 shows one example application where the user can use a mobile to interact with presented 3D data.

We propose also a new 3D user interface [4] that is totally based on 2D inputs and consequently appropriate for a wide variety of visualization systems, from small handheld devices to large interactive displays. We designed this Point-of-Interest interaction technique for fast and easy interactive camera positioning in 3D environments

Figure 4: The mobile device acts as a touchable 3D user interface that allows rotating and translating the car in 6 DoF

2.3 Collaboration

With these new visualization and interaction techniques, new possibilities in distant collaboration emerge, which have to be investigated. In one of our work we present a novel sketch-based route planning technique [3], which supports the collaborative work of a group of people navigating through a virtual environment using mobile devices. With this approach, route planning tasks, like creating camera animation paths, can be generated very efficient on a mobile device, while performing the visualization of the complex data on a large screen, as illustrated in Figure 5.

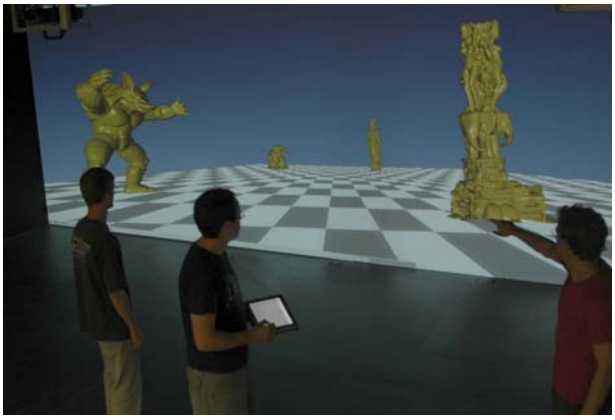

Figure 5: Exploring the virtual environment in collaboration with a group of people

3. CONCLUSION

Our contribution in the research field of mobile HCI is the exploration of new efficient visualization and interaction techniques that create new forms of collaborative work for mobile users. These techniques have to take in account the limitations as well as the advantages of mobile technology.

In particular, there is a demand for more advanced but still efficient visualization and interaction techniques, which let the user interact, explore, modify, emphasize, cut and transform complex 3D data using a mobile device. Furthermore we have to prove the direct applicability of the results of our research with user studies in the context of a collaborative scenario.

Acknowledgment

I would like to thank Martin Hachet and Pascal Guitton for their helpful comments.

4. REFERENCES

[1] 3D Panorama Service on Mobile Device for Hiking. M. Hachet, J. Pouderoux, S. Knödel, P. Guitton, CHI Workshop, 2007

[2] Enhancing the Mapping between Real and Virtual World on Mobile Devices through efficient Rendering S. Knödel, M. Hachet, P. Guitton MRUI 2007

[3] Sketch-based Route Planning with Mobile Devices in immersive Virtual Environments S. Knödel, M. Hachet, P. Guitton, AFRV 2007

[4] Navidget for Easy 3D Camera Positioning from 2D Inputs M. Hachet, F. Dècle, S. Knödel, P. Guitton Symposium on 3D User Interfaces - 2008