Integrating spatial information in a user interface

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Abstract. Indoor location systems enable mobile devices to gather location information of other devices or services. Applications such as the Relate Meeting Tool [2] have been built that support cross-device interaction without explicitly knowing an address for the target device. However, little is known about how to integrate this spatial information into the user interface in an effective way. This poster introduces our approach and presents preliminary results.

1 Introduction

In many projects, users meet regularly or spontaneously to exchange information and it is common that they take their devices with them, such as laptops or personal digital assistants (PDAs). These contain reports and presentations much in the same way as we carried paper documents in the past. An obvious advantage of the digital format is the ease of producing a copy of a document, but it is still difficult to exchange a digital document between two mobile devices although they are connected through a network. Interaction across devices such as file sharing involves explicit configuration for the user: to exchange a document, the user needs to know the address of the recipient (email or IP address) while a paper document needs only to be handed in the direction of the recipient.

Instead of expecting the user to perform the configuration manually, we can perform this automatically by using context. During a meeting mobile devices are on a table and users perceive the spatial arrangement of the devices, gaining spatial knowledge of the meeting situation. Mobile devices are capable of computing spatial relationships between devices similar to the one a user perceives in the real world. One example implementation of this is using the Relate Dongles [1]. If spatial knowledge is integrated and visualized in the user interface we call this a spatially aware interface.

Little is known about what helps the user to match a spatially aware user interface with the spatial knowledge he has gathered about a real world situation. Three research questions have emerged from an earlier study [3]: 1) What is the relationship between the real world, the visualization and the user's understanding, i.e. what factors influence his understanding. 2) How best to represent and visualize spatial relationships to the user? 3) How efficient is the integration of spatial information for specific tasks?

2 First Experiment Set

We are conducting three different sets of experiments to address these research questions. In the first set, we look at different factors such as viewpoint, orientation, topology, delay and abstraction. In the viewpoint experiment we built three interfaces with different views of a series of objects (see Fig. 1). 18 participants

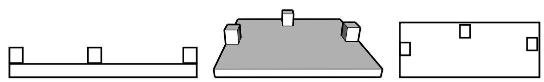

Fig. 1. a) frontal view, b) perspective view, c) overhead view

performed timed object selection tasks with the three different spatially aware interfaces. The spatially aware interfaces mirrored the object arrangement of the physical world. Participants had to match a labeled object in the physical world to the corresponding unlabeled object in the interface. Time was measured for the selecting process. Then, they had to rank the interfaces according to their of ease of use.

We had two different arrangements for the cubes, first ordered around the table (similar to the meeting scenario) and secondly, a random arrangement across the table. Viewpoint had a significant effect on task completion time for both arrangements, $F(2, 34) = 5.44, p < .009$ and $F(2, 34) = 8.47, p < .001$, indicating that there were significant completion time difference when comparing the three different interfaces.

The ranking result show that 11 subjects ranked perspective view as the easiest, while 5 chose overhead view and 2 frontal view. For second place, 12 participants ranked overhead view, followed by 5 who chose perspective view and 1 frontal view. Finally, 15 saw the frontal view as the hardest, while 2 voted for perspective view and one for overhead view. The results suggest that the interface type influenced the ranking. Further analysis of the collected time and answers is needed to better understand to what degree this factor influenced performance and accuracy in the selection task.

References

1. Hazas, M., Kray, C., Gellersen, H., Agobta, H., Kortuem, G., Krohn, A.: A relative positioning system for co-located mobile devices. In Proc. of MobiSys 05, ACM Press (2005), pp. 177–190.
2. Kortuem, G., Kray, C., Gellersen H.: Sensing and visualizing spatial relations of mobile devices. In Proc of UIST '05, ACM Press (2005), pp. 93–102.
3. Mayrhofer, R., Gostner, R.: Using a Spatial Context Authentication Proxy for Establishing Secure Wireless Connections. In Journal of Mobile Multimedia, vol. 3, pp. 198–217, March 2007.