

# Occlusion-Aware Menu Design for Digital Tabletops

Peter Brandl<sup>1</sup>, Thomas Seifried<sup>1</sup>, Jakob Leitner<sup>1</sup>, Michael Haller<sup>1</sup>, Bernard Doray<sup>2</sup>, Paul To<sup>2</sup>

<sup>1</sup>Media Interaction Lab, Upper Austria University of Applied Sciences, Hagenberg, Austria  
<sup>2</sup>Nortel Networks, 3500 Carling Avenue, Ottawa, Canada

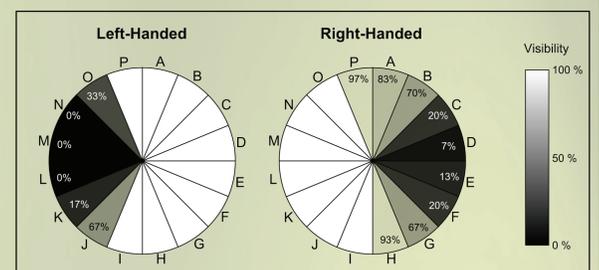
## Abstract

On direct input surfaces, occlusions created by the user's hand decrease interaction performance with menus. The key design criteria are to avoid these occlusions and to adapt the menu placement to the user's handedness and position on the tabletop. We present an adaptive menu placement method based on direct touch and pen tracking that allows correct menu placement around the table. As an extension, we propose adding a gesture input area for fast interaction which can be partly occluded by the user's hand.



## Occlusion Observation

In order to be able to design a menu that avoids occlusions, we invited 18 participants and observed differences of occlusions for left and right-handed users on horizontal surfaces (3 left-handed, 15 right-handed). The mirror effect of occlusions for left and right-handed participants is clearly visible. The average number of visible segments was 11.70 (SD=0.99) out of 16 segments for right-handed users and 11.17 (SD=0.56) for left-handed users. Referring to a full 360° circle of possible item placements around an invocation point, we found that 92° of the circle are occluded on average.



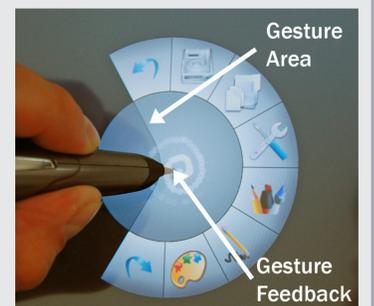
## Occlusion-Aware Menu Design



Based on our observations of occlusions we developed a menu for tabletops with direct pen input that is always visible to the user. The design of the menu avoids placing items in occluded areas, thus improving the interaction with the menu. Our design is inspired by the layout of circular menus.

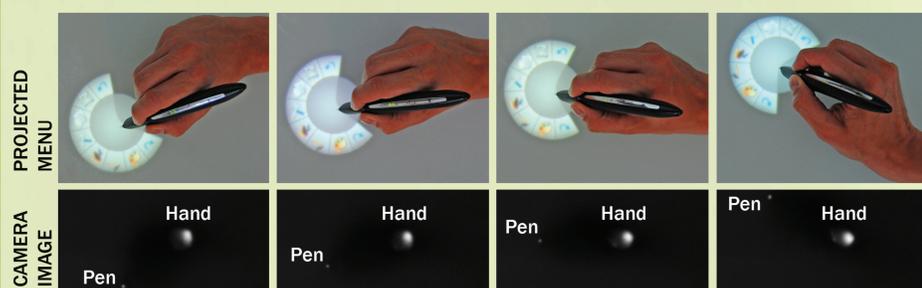
## Point-and-Click vs. Gesture Area

We propose to use the occluded area as part of an interactive area for gesture input inside the menu. Our observations showed that occlusions are not a problem in this case if the area can be recognized and the user knows where he can start a gesture and which gestures he can use.



## Adaptive Menu Placement

To solve the problem of left and right handedness, different methods for adaptive menu placements have been explored [3]. We use a combination of FTIR multi-touch tracking [2] and Anoto pen tracking [1] to determine the user's hand position and the current pen position. We demonstrate only one possible solution that shows how adaptive menu placement in combination with our occlusion avoiding menu design works. Other methods like shadow tracking could provide a more general solution.



## References

- [1] Brandl, P., Haller, M., Hurnaus, M., Lugmayr, V., Oberngruber, J., Oster, C., Schafleitner, C., Billinghamurst, M., 2007. **An Adaptable Rear-Projection Screen Using Digital Pens And Hand Gestures.** In Proc. of ICAT '07, 49-54.
- [2] Han, J. Y. 2005. **Low-cost multi-touch sensing through frustrated total internal reflection.** Proc. of UIST '05, 115-118.
- [3] Hancock, M. S. and Booth, K. S.: **Improving Menu Placement Strategies for Pen Input.** In Proc. of GI '04, 221-230.