

Proxemic Interactions with and around Digital Surfaces

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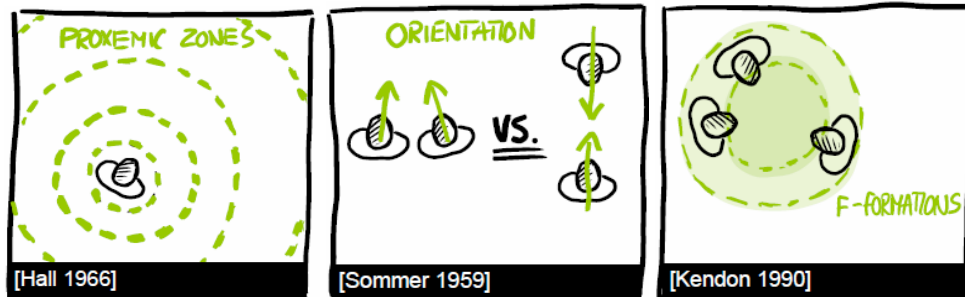


Figure 1. Three of the theories discussed in the tutorial (from left to right): Edward Hall’s proxemics [3], Robert Sommer’s task-dependent orientation [10], and Adam Kendon’s F-formations [5].

ABSTRACT

This tutorial introduces strategies how the knowledge of people’s and devices’ proxemic relationships can be applied to interaction design. The goal is to inform the design of future proxemic-aware devices that – similar to people’s natural expectations and use of proxemics – allow increasing connectivity and interaction possibilities when in proximity to people, other devices, or objects. Towards this goal, the tutorial introduces strategies how the fine-grained knowledge of proxemic relationships between entities can be exploited in interaction design for digital surfaces (e.g., large interactive displays, or portable tablets).

Author Keywords

Proxemic Interactions; Proxemics; Interactive Surfaces

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

OVERVIEW

Edward Hall’s proxemics theory [3] describes how people use spatial relationships – such as varying their distance or orientation – to mediate their interactions with other people around them. But in spite of the opportunities presented by

people’s natural understanding of proxemics, only a relatively small number of interactive systems incorporate proxemic information within design (e.g., [4,11]). This tutorial introduces strategies how the knowledge of people’s and devices’ proxemic relationships can be applied to interaction design. The goal is to inform the design of future proxemic-aware devices that – similar to people’s natural expectations and use of proxemics – allow increasing connectivity and interaction possibilities when in proximity to people, other devices, or objects. Towards this goal, I introduce strategies how the fine-grained knowledge of proxemic relationships between entities can be exploited in interaction design for digital surfaces (e.g., large interactive displays, or portable tablets).

TUTORIAL STRUCTURE

The tutorial is divided into the following five units:

(1) To provide a better shared understanding of what kinds of information about spatial relationships might be relevant for interaction design, I first review seminal theories in sociology, psychology, and ethnology about people’s interpretation and use of personal space and proxemics (e.g., [3,5,10], see Figure 1).

(2) I discuss the potential of applying nuances of these theories to address interaction design challenges, and describe our operationalization of proxemics for interaction design. The Proxemic Interactions framework serves to guide design thinking [2,8]. It describes how designers can consider fine-grained information of proxemics to mediate people’s interactions with digital devices (such as large digital surfaces or portable personal devices) by considering

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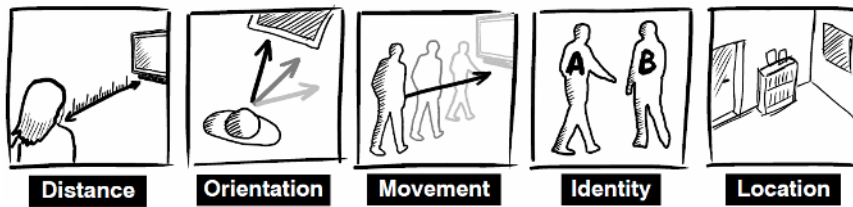


Figure 2. Five key proxemic dimensions for ubicomp interaction design.



Figure 3. Proxemic interactions: (left) mediating a person's interaction with a large display [1]; (center) progressive reveal of information on multiple devices [7]; (right) cross-device interactions determined by F-formations [9].

five key dimensions of proxemic measures (distance, orientation, movement, identity, and location; see Figure 2). I also introduce the gradual engagement design pattern as one particular strategy that allows designing system interactions that move from awareness, to reveal, to interaction.

(3) I provide an overview of technical approaches sensing proxemics along the low/high-fidelity spectrum. I briefly review the Proximity Toolkit [7] that allows rapidly prototyping of proxemic-aware systems by supplying higher-level proxemic information through an event-driven API and visual inspection tools. I also explain an alternative hybrid sensing approach [9] combining different sensing hardware to capture proxemic information.

(4) To demonstrate the potential of proxemics applied to interaction design, I then describe three case studies of proxemic-aware systems that react continuously to people's and devices' proxemic relationships (Figure 3). The case studies explore the application of proxemics in interaction design by considering first person-to-device [1], then device-to-device [6], and finally person-to-person & device-to-device proxemic relationships [9]. In this context, I also review other selected projects using proxemic interaction concepts to mediate people's interactions with digital surfaces and other digital devices.

(5) Last, I summarize a series of open research challenges for proxemic interactions, and discuss possible future research directions.

SHORT BIOGRAPHY

Nicolai Marquardt is Lecturer in Physical Computing at the University College London. At the UCL Interaction Centre he is working in the research areas of ubiquitous computing, physical user interfaces, proxemic interactions, and interactive surfaces. Nicolai did his

PhD in Computer Science at the University of Calgary working with his advisor Saul Greenberg. He is a former intern at Microsoft Research Cambridge/UK and Redmond/USA and received an MSc/diplom degree in Media Systems from the Bauhaus-University Weimar. Nicolai is co-author of the book *Sketching User Experiences: The Workbook* (Morgan Kaufmann 2012) with Saul Greenberg, Sheelagh Carpendale, and Bill Buxton.

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