Cross-Surface: Workshop on Interacting with Multi-Device Ecologies in the Wild

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Abstract
In this workshop, we will review and discuss opportunities, technical challenges and problems with cross-device interactions in interactive multi-surface and multi-device ecologies. We aim to bring together researchers and practitioners currently working on novel techniques for cross-surface interactions, focusing both on technical as well as interaction challenges for introducing these technologies *into the wild*, and highlighting opportunities for further research. The workshop will help to facilitate knowledge exchange on the inherent challenges of building robust and intuitive cross-surface interactions, identify application domains and enabling technologies for cross-surface interactions in the wild, and establish a research community to develop effective strategies for successful design of cross-device interactions.

Keywords
Cross-surface interaction, ubicomp ecologies, multi-surface interactions, multi-device interactions, spatial reconfigurations of displays, spatially distributed interfaces, multi-screen workplaces, wearable devices.

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

Introduction

People are increasingly interacting with their personal information through different types of devices, ranging from large interactive surfaces, tablets, smartphones to wearable technologies such as smartwatches and head-mounted displays. This *device multiplicity* has led to situations in which users are employing multiple devices at the same time. The choice of which set of devices to use is governed by the affordances, capabilities, and properties of these devices and the context of use. To support this device multiplicity, prior work has introduced a wide range of techniques and infrastructures to facilitate cross-surface[1] interaction. These include sensing of nearby devices [7, 11] device pairing [3, 5, 10, 11], information exchange [9, 11] and configuration of cross-device ecologies [4].

Despite the success of these approaches, many cross-surface interaction techniques and systems require advanced sensing and infrastructure, which are impractical in real-world scenarios outside of the lab. There are still fundamental challenges that prevent the full potential of cross-surface interactions in the wild. Workplace and field studies (e.g., [1,5]) highlight these issues, revealing how users struggle with how devices can communicate, what content can be exchanged, how to opt-out from connecting devices together [2], and how to configure devices to cooperate in one seamless workspace. We need a better understanding of how to move cross-surface and spatial interaction techniques and systems into the wild, in terms of technologies, real-world use cases, and making sense of the available interactions and their impact on human activities.

[1] Also referred to as multi-device, multi-surface or cross-device.

Objectives

The *Cross-Surface* workshop aims to provide a practical, creative and structured forum for designers, practitioners and researchers to discuss the opportunities for and challenges of *in the wild* cross-surface interactions. The objective of the workshop is to *map out a design space* and *describe an interaction vocabulary* for cross-surface interactions outside of lab settings. These include multi-surface techniques and applications, spatially distributed interfaces and displays, multi-screen workspaces and wearable displays and interfaces. The workshop is structured around three topics:

1. **Use cases in the real world**
   What are the use cases and application domains for cross-surface interactions? Which concrete challenges do these pose (e.g., public vs. private settings) and which types of device and spatial configurations do they provide (e.g., opportunistic vs. fixed device ecologies)?
2. **From lab technologies to real-world solutions**
   Which enabling technologies can allow users to interact with complex device ecologies in the wild? How can these technologies be deployed, democratized and shared with a broader audience?
3. **Beyond interaction techniques**
   How do people make sense of cross-surface ecologies? How can we support discoverability and learnability of interactions, inform users of action possibilities and provide feedback about cross-surface connections? How can users configure cross-surface setups that support their activities?

Participants

We aim to bring together 15–20 participants from academia and industry that are working on cross-surface systems and related areas. In addition to an open Call for Participation, the organizers will personally invite researchers to submit their work and participate in the workshop. Participants will be selected by the organizers based on the submitted position papers and their relevance to the scope and goal of the workshop. We aim to gather a multi-disciplinary group of participants consisting of academic researchers, designers and practitioners from industry. Accepted workshop papers will be distributed among participants before the workshop and published on the workshop website.

Workshop Format and Activities

Before the workshop

We will setup a website and distribute a call for position papers in all relevant communities. In addition to being listed on the ITS 2015 website, we will announce the Call for Participation at popular mailing lists and calendars (e.g., ACM, CHI-announcements, Interaction-Design.org, WikiCFP) and social media (e.g., Twitter, Facebook). Workshop flyers will be distributed at related conferences and workshops that take place before ITS 2015. The calls will be posted on the workshop website, along with other details about the workshop. Furthermore, we will directly contact researchers and practitioners who are likely to be interested in the workshop and write to relevant institutions, projects or activities. We will continue our efforts of promoting the workshop and getting in touch with potential participants during the period leading up to the workshop deadline.

At the workshop

We propose a one-day, 8-hour workshop. The workshop will be a combination of brainstorming, discussions and design activities in groups of 4 or 5 people.

1. Preparation before the workshop

To reduce cold start problems, we will ask each participant to read and synthesize an assigned position paper before the workshop into research insights and design patterns, based on Kolko's method [8]. The collection of ideas gathered from this will seed into the brainstorming activities during the workshop.

2. Kick-off madness and keynote

We will kick off the workshop by asking all participants to introduce themselves and their position paper in a 1-minute madness presentation. We will also ask each participant to end with a bold, controversial or forward-looking statement about their work or the state of the field. After the kick-off, Professor Yvonne Rogers will give a keynote on cross-device interaction in the wild.

3. *Design solution*

Participants will select one of three subgroups based on the three workshop objectives (use cases, real-world technologies and making sense of cross-surface interactions). We will facilitate idea generation within each subgroup with a brainstorming exercise to generate ideas from random combinations of seed insights and design patterns from the pre-workshop activity. In follow-up break-out sessions, subgroups will select their top ideas, and discuss and work out these ideas using sketching, storyboarding or paper prototyping techniques. To limit the solution and brainstorm space, we will provide a design brief detailing a specific problem space and potential application domains.

4. Mapping out problem and design space
After lunch, each group will present their ideas, after which we move towards in-depth discussions of specific challenges of designing cross-surface interactions, and identify common themes from the earlier breakout sessions. As a group activity, we intend to use the generated ideas and prototypes to map out the design space of application domains, enabling technologies as well as cross-surface interaction techniques that can be deployed in the wild. For these discussions, we will switch between focused breakout groups and whole group discussions (and also adapt these activities depending on the size of the group).

5. Group reflections
As a final outcome, we will create a large collage/map visualizing the scope, overlap, and relations between different groups to allow for broader reflection and topical conclusions.

Time	*Activity*
09:00	Madness session
09:30	Keynote by Professor Yvonne Rogers
10:00	Brainstorm in 3 subgroups + design brief
10:30	Coffee break
11:00	Continue brainstorm Sketch/storyboard/prototype designs
13:00	Lunch
14:00	Present ideas + map out design space
16:00	Coffee break
16:30	Group reflections
17:30	Close

Table 1. Timeline of the workshop day

After the Workshop
Materials produced during the workshop will be posted on the workshop web site (http://www.cross-surface.io/). We will continue to maintain the site to serve both the participants and the broader community developing around this topic.

Soliciting Submissions
We will solicit position papers of up to 4 pages in the ACM SIGCHI Extended Abstract format that describe original research and outline a person's interest and experience in the topic of the workshop. Selected papers will serve as introductions for discussions and will be made available to the participants on the workshop website. Submissions will be juried by the organizing committee based on originality and relevance.

Publication Venue
The results of the workshop will be communicated to the larger HCI community by submitting an article to a magazine (e.g., *ACM interactions*). In this article, we hope to define future design spaces for cross-surface interactions in Ubicomp ecologies based on the collage of topics discussed and challenges identified in the different breakout groups.

We will also invite all workshop participants to submit an extended article of their submission for a special issue on "*Interaction with Device Ecologies in the Wild*" in the Personal and Ubiquitous Computing journal that will appear mid-2016. This information and call for papers will also be shared on the http://www.cross-surface.io/ website and will be open to other interested researchers in the community.

Organizers and Program Committee

Steven Houben *is a Research Associate at University College London. He works at the Intel Collaborative Research Institute on Sustainable and Connected Cities (ICRI-Cities) and UCL Interaction Centre on projects related to multi-device environments, physical computing and sensor-based systems.*

Jo Vermeulen *is a Research Fellow at the HCI Centre of the University of Birmingham. He is interested in addressing interaction challenges within ubicomp spaces, including providing intelligibility, discoverability, feedback and feedforward for cross-device interactions.*

Clemens Klokmose *is a Post Doc at the Computer Science department at Aarhus University and is associated with the center for Participatory Information Technology. His main interest is human-computer interaction that goes beyond personal computing.*

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Johannes Schöning *is Professor of computer science at Hasselt University working at the Expertise centre for Digital Media (EDM). His main research interests lie at the intersection between human-computer interaction (HCI), geographic information science and ubiquitous interface technologies.*

Harald Reiterer *is Professor at the Computer and Information Science Department of the University of Konstanz. His main research interests include different fields of Human-Computer Interaction, like Interaction Design, Usability Engineering, and Information Visualization.*

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