
Supporting Collaborative Curation of Historic Documents with Mobile Ad Hoc Cross-Device Interactions

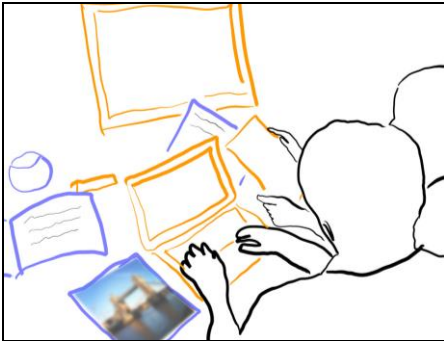


Figure 1: Ad hoc federations of people's personal mobile devices to provide cross-device interactions supporting small group-collaboration when curating digital and non-digital historic documents.

Frederik Brudy

University College London
UCL Interaction Centre
Gower Street London, UK
f.brudy@cs.ucl.ac.uk

Nicolai Marquardt

University College London
UCL Interaction Centre
Gower Street London, UK
n.marquardt@ucl.ac.uk

Hans-Christian Jetter

University of Applied
Sciences Upper Austria
Hagenberg
hans-christian.jetter@fh-hagenberg.at

Steven Houben

Intel ICRI Cities
University College London
Gower Street London, UK
s.houben@ucl.ac.uk

Abigail Sellen

Microsoft Research
Cambridge
Station Road, Cambridge
asellen@microsoft.com

Yvonne Rogers

University College London
UCL Interaction Centre
Gower Street London, UK
y.rogers@ucl.ac.uk

Abstract

Curating historic documents and artefacts is a demanding historic task, requiring collecting, reviewing, and combining a large collection of raw material from different sources. While digital technologies can support such curation activities, the devices often work in isolation and do not well support the dynamic nature of collaborative curation activities. We envision ad hoc cross-device interactions with existing personal, mobile devices to support small groups collaborating during those curation activities. The interaction techniques can draw from previous research on considering spatial relationships between people and devices to mediate interactions. In this paper, we describe our ongoing research, open questions and challenges for future work on the technical as well as on the social aspects of multi-device setups in the wild.

Author Keywords

Ad-hoc cross-device interaction; Curation of historic documents and artefacts

ACM Classification Keywords

H.5.3. Group and Organization Interfaces. Computer-supported cooperative work; H.5.2. User Interfaces. Input devices and strategies

Introduction and Background

The process of exploring gathered documents and artefacts with the goal of curating the material in new ways can be a demanding task, requiring to collect, review, and combine a large collection of raw material from many different sources. Material is gathered from archives, oral histories are collected, buildings captured, and photographs taken, with the goal to combine this material in new ways, connecting the dots, and creating new artefacts for sharing in exhibits, print and web. Digital technology has the potential to support these tasks.

Previous research developed new tools for collaborative exploration and creation of digital content – more recently this is often done by means of large interactive whiteboards or interactive tabletops [2,6], allowing for collaboration in shared spaces, while still giving users the ability to have their own private space [5]. However, aside from their relatively high cost, such large interactive surface setups are often not well suited to support the dynamic, ad hoc, collaborative activities of small-groups when reviewing, categorising, and curating the historic data. At the same time, people often carry computationally powerful smartphones in their pockets and are using their tablets and laptops on the go. However, even though most devices are network-enabled, using them in concert with other devices around them is challenging: interconnecting and transferring content between devices is painful and often requires tedious configuration procedures and navigation through network and local folder structures to exchange files. Although for example ActivitySpace [3] provides a activity-centric information management system on an interactive tabletop, the fewest of our personal devices are actually communicating with other devices in proximity, for

example in order to share information and data between devices and to configure themselves into a larger network of devices aware of each other. In practice, this means that, from a person's perspective, the vast majority of devices are blind to the presence of other devices. This is a lost opportunity.

Ad-hoc cross-device interactions for collaborative curating activities

To better support these curation tasks, we work on the design of low-cost mobile ad-hoc multi-device configurations with tablet computers facilitating collaborative small group exploration and curation activities for historic documents and artefacts (see Figure 1). The overall goal is to facilitate sharing and exploring of digital content across multiple devices when they are in close proximity to another – for example, putting two tablet computers next to each other immediately creates a unified digital canvas displaying a historic map, or placing a tablet in the centre of a table to use it as a shared repository for selected material easily transferred from other tablets onto it.

To explore our designs in the wild and to study how they best support curation activities, we began our close collaboration with the Mill Road History Project in Cambridge¹, where volunteers record, learn, curate and present the rich history of this particular street of the city. This work is performed by members of the community (most are volunteers) and accessible by everyone. Depending on the historic data, many different document types are used: historic maps and photos,

¹ <http://mill-road.com/history.html>

audio recordings of oral histories, paper documents, location data, books, personal memories and many more.

With our designs to support these activities, we build upon earlier work that leveraged spatial relationships between people, proxemic relations, communications in everyday life and people's interactions for building new interaction techniques with technology [1,7,8]. We envision devices that foster collaboration by allowing ad hoc federations across devices when detecting the presence of other devices around them. Allowing people to use their devices with minimal effort in concert with other surrounding devices in close proximity opens up a multitude of possible interactions across the unified interaction canvas of multiple devices. We work on the design of low-cost ad hoc multi-device configurations with mobile devices facilitating collaborative small group exploration and curation activities for historic documents. In a first step this would mean tablet computers, smartphones and other widely used mobile personal devices. Extending this interaction space to a user's body through wearable devices would allow for a whole new set of interaction and would give new opportunities to exchange information between users, devices and their surroundings.

Ongoing research and design

First, we are working on ethnographic studies to better understand the current practices of curation activities, in particular of the Mill Road History project. How are documents reviewed throughout the entire process of data analysis? How are connections between the (digital and non-digital) contents built up and kept track of? We also focus on how collaboration works and how knowledge is communicated between people working with the data. This becomes in particular important when new users join a team and the findings made thus far need to be

communicated to this person.

Second, we continue our work on building the technological infrastructure enabling cross-device interactions. In our previous work we created the HuddleLamp framework [4] that enables precise low-cost tracking of people's tablets and phones on a tabletop, allowing for multi-device collaboration on a desk. This technical framework allows us to very rapidly design, prototype and evaluate novel cross-device interaction techniques. In our current work we iterate this technical framework to better support the mobility of the setup, scale to a larger ecology of devices, and work robustly in cluttered environments when deployed in-the-wild. Third, we are working on our case-study prototype system supporting co-located small group explorations and curation activities of the Mill Road History Project historic material. The findings of our ongoing study of the current practices will inform the design and refinement of the designed interaction techniques (Figure 2).

Open questions and topics for discussion at the workshop

Configuration: How can we minimize the overhead of manually configuring or reconfiguring these multi-device federations? When and how should devices be connected and disconnect (as a function of their relative distance and orientation)? Starting points are previous works, leveraging a desk's space such as HuddleLamp [4] or interactive surfaces such as ActivitySpace [3]. How can wearable devices support the task of configuration?

Supporting heterogeneous data: How can multi-device technology support the curation and sense-making of multivariate data? How can digital and non-digital content be seamlessly supported together? How can we design for environments with cluttered work areas and noisy data? Do we need different interaction techniques depending on

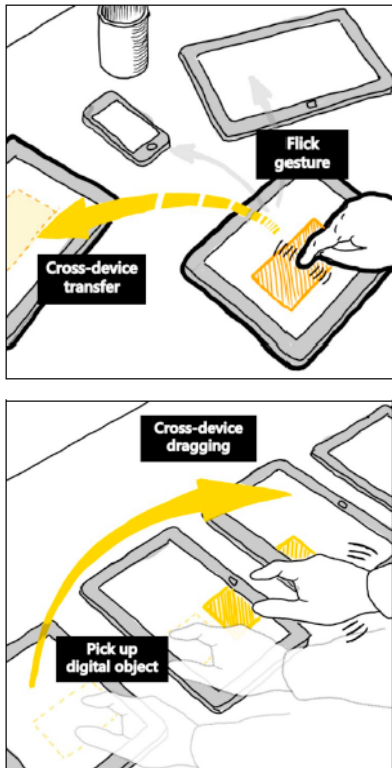


Figure 2: Cross-device interaction techniques from [4] – a starting point for our new set of techniques that focus in particular on small-group collaborative curation activities.

the kind of data (photo, text, GPS coordinates, audio, etc.) and content of the data (interviews, location information, historic documents, etc.)? Can there be a one-for-all solution? Are there any particular interaction tasks better to be carried out on mobile or wearable device?

Strategies for the masses: How do volunteers with a non-technical background adapt and/or re-appropriate the new cross-device interaction techniques? How would this change for wearable devices? Mobile smartphones and laptops are well known, but the idea of other wearable computing devices is still very new and reservations against these technological advancements might come up. Does the form factor influence people's likelihood to use new techniques in this society of devices?

About the authors

Frederik Brudy is a PhD student at the UCL Interaction Centre, working on ad-hoc cross-device interactions facilitating collaborative small group activities exploring historic documents.

Nicolai Marquardt is a Lecturer (Assistant Professor) in Physical Computing at the University College London.

Hans-Christian Jetter is a Professor for UX and Interaction Design at the University of Applied Sciences Upper Austria, Hagenberg.

Steven Houben is a postdoctoral research associate in Physical Computing and Interaction Design at the Intel ICRI Cities and University College London.

Abigail Sellen is a Principal Researcher at Microsoft Research Cambridge in the UK and co-manager of the Human Experience & Design group.

Yvonne Rogers is a Professor of Interaction Design and the director of the UCL Interaction Centre.

References

[1] Ballendat, T., Marquardt, N., and Greenberg, S. Proxemic interaction: designing for a proximity and orientation-aware environment. *ACM ITS* 2010.

[2] Everitt, K., Shen, C., Ryall, K., and Forlines, C. MultiSpace: Enabling electronic document micro-mobility in table-centric, multi-device environments. *IEEE TableTop 2006*.

[3] Houben, S., Tell, P., and Bardram, J.E. ActivitySpace: Managing Device Ecologies in an Activity-Centric Configuration Space. *ITS* 2014.

[4] Rädle, R., Jetter, H.-C., Marquardt, N., Reiterer, H., and Rogers, Y. HuddleLamp: Spatially-Aware Mobile Displays for Ad-hoc Around-the-Table Collaboration. *ITS* 2014.

[5] Ryall, K., Forlines, C., Shen, C., and Morris, M.R. Exploring the effects of group size and table size on interactions with tabletop shared-display groupware. *ACM CSCW* 2014.

[6] Tang, A., Tory, M., Po, B., Neumann, P., and Carpendale, S. Collaborative coupling over tabletop displays. *ACM CHI* 2006.

[7] Vogel, D. and Balakrishnan, R. Interactive public ambient displays: transitioning from implicit to explicit, public to personal, interaction with multiple users. *ACM UIST* 2004.

[8] Wang, M., Boring, S., and Greenberg, S. Proxemic Peddler: A Public Advertising Display that Captures and Preserves the Attention of a Passerby. *PerDis* 2012.