Enriching Smart Artefacts with a Social Dimension

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Abstract
The author is involved in a large-scale collaboration project aiming to develop a platform for cultural heritage professionals that would allow them to embed digital content into physical artefacts. Some of the mobile physical artefacts are designed to be used by visitors in museums or cultural heritage sites for augmenting their visit. We are interested in studying how a collaborative perspective could be included in the design of these smart artefacts.

Author Keywords
CSCW; interactives; museums; social interaction; smart objects

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

Introduction
The proliferation of mobile devices results in more and more people carrying around one or more personal computing devices: laptops, tablets, smart phones, wearable devices that can connect to the Internet or to each other via wifi, Bluetooth or NFC. As mobility is on the increase, research has mostly focused on how these devices are used for distributed work, while co-located use received far less attention. At the same time,

people find innovative new uses every day and smart phone manufacturers are adding functionalities that allow co-located users to share connections, transfer files, create multiple windows displays, share screens and so on.

Background

Lucero et al have looked at how co-located users use their devices to go from personal-individual towards shared-multiuser experiences and interactions [3] .

A platform titled "the Social and Spatial Interactions (SSI) platform" that supports shared co-located interactions using the mobile phone as a physical interface to manipulate data is introduced in [3]. The initial set of interaction techniques built into the platform includes: *exploring* (the phone is used as a window into a virtual space), *expanding viewing area* (juxtaposing several phones), *multiple annotations* (annotating a shared screen), *spinning* (to be used to delete something, perform a random search, or throw the dice), *stacking* (combining images, text or audio files).

Reitmeier et al. speak about *proxemic interaction* that is characterized by distance, orientation, movement , identity , and location [5]. They suggest that proxemic interaction would be built upon "a performative account of identity and an interactional understanding of context". The mobile phones, which carry so much personal information, can become the vehicle of sharing when co-located, as their owner controls what is being shared. Reitemeier and his colleagues identify two design spaces: *Share Face2Face*, assumes that the natural co-located sharing is one of co-consumption and co-orientation, and *Cloudlets to be hyperlocalized*, ad-hoc instantiations of the cloud[5].

The seminal work of Hindmarsh et al. [2] focuses on serendipitous, ad-hoc collaboration in museums and art galleries. While the technologies under discussion are neither personal nor mobile, they resulted in a series of "design sensitivities" that promote natural interaction and sociability meant to guide exhibition design.

Creating "opportunities for interaction" brings to the fore the need to design not only for individuals or groups, but also for the presence of bystanders. An interesting use of personal devices in a cultural heritage environment is illustrated in [1], but in a mediated way: personal impressions recorded in situ are shared with other visitors through a central board in the school building, allowing to preserve the contributors' anonymity.

We are interested in designing opportunities for interaction using personal devices that range from tablets, mobile phones and wearable devices to smart artefacts that are offered to visitors in cultural heritage environments in order to inform and guide their visit.

Materiality and Digital Cultural Heritage

The Material EncounterS with digital Cultural Heritage (meSch) project has set to design, develop and deploy an integrated platform for the creation of tangible interactive experiences that connect the physical experience of museums and exhibitions with relevant digital cross-media information in novel ways [4]. Taking into account the large amounts of cultural heritage-related digital content currently available in on-line repositories and archives (ranging from digitised text and images of artefacts to 3d scans), it is striking how little it is put to good use. meSch proposes to allow visitors to access digital cultural heritage resources during their visit by providing cultural heritage professionals with a platform for the creation

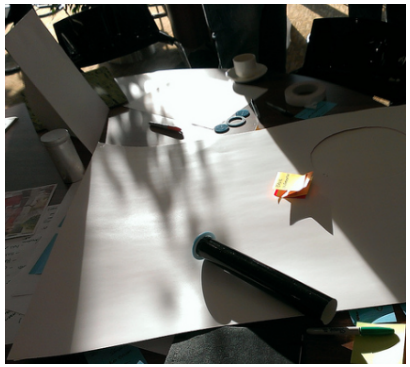

Figure 1. Torch mock-up

Figure 2. Original lamp used in the Forte Pozzachio galleries during 1st WW

of tangible smart exhibits. The meSch platform will support professionals to compose and realise physical artefacts enriched by digital content without the need for specialised technical knowledge: the platform will include an authoring environment for the composition of physical/digital narratives to be mapped to interactive artefacts, and an embedded multi-sensor digital system platform for the construction of ad-hoc physical adaptive smart objects [4].

Within the project, a whole range of exploratory prototypes have been developed and built. Rather than focusing on these prototypes, we would rather present some of the reflections that occurred during earlier co-design activities where we discussed affordances for collaboration and co-visiting of emerging design concepts.

Design Concepts Resulted from Co-Design

During the project kick-off, we held a co-design workshop that allowed a familiarisation of design, research and technical partners with the problems encountered by the partner museums. In a group including a representative of Museo della Guerra (Rovereto, Italy), the brief included the need to present artefacts in a neutral way, allowing visitors to uncover layers of information as suitable. A torch was devised to illuminate objects, while at the same time projecting information on or next to the artefacts. Changeable lenses would allow visitors to alternatively take the perspectives of different countries involved in the war (see Fig.1). One dilemma we encountered was that of groups or individual visitors arriving at the same time and pointing their torches at the same object. How would the combined projections work? What interactions would be appropriate in such circumstances? How can we encourage collaboration and communication between parties that might not have a common language?

In another co-design workshop 10 months later in Museo della Guerra in Rovereto, the brief required cultural heritage professionals to choose a real museum artefact and imagine the actions that would be attached to a smart replica. What would the object do, and what would the interactions add to the actual visit?

In a first round, one of the groups chose a metal lamp (Fig.2) found in the galleries of Forte Pozzachio, a fort in the Alps that was conquered and inhabited alternatively by Austrian and Italian armies. The lamp had space inside for a candle, and movable metal panels on the four sides to hide the flame and control the beam of light. The curator explained that while used by soldiers to find their way in the dark either inside the galleries or outside on the mountain, it also incurred the danger to be seen by enemy soldiers. It was meant as a personal device and we could easily imagine current days visitors of the fort carrying a smart replica while walking through the fort and the surroundings. We then brainstormed on the potential manipulations of the object (affordances) and the actions that these might trigger. While it was very easy to imagine the gestures afforded and the potential actions of the visitors (such as holding up the lamp to reveal information about a specific location one finds herself in, lifting the lamp to make the light more intense or dropping it in a docking station to charge when it is flickering and picking up another lamp), coming up with collaborative actions the lamps could afford was not a banal task. Would more lamps hold up

reveal supplementary or different information? In what language? Based on whose interests, age, profile?

Studying Co-located Interaction

While meSch focuses on empowering cultural heritage professionals to create interactive exhibits by creating a platform for embedding digital content and narratives into smart objects, the use of personal smart phones and tablets in these environments is also on the rise. From wayfinding applications and museum guides through to augmented reality and interacting via social media, personal devices have become part of most museum visits.

What kind of co-located interactions are appropriate in such environments in order to encourage sociability and rich experiences for different types of situations? How can we design for families with kids, couples, groups of friends coming to the museum together, and organised tourist groups? How can we cater for school visits that usually have a guide/facilitator? And how do we include bystanders in this mix, who want to be left out of the interaction but nevertheless enjoy watching? These are some of the challenges we would like to bring in to discussion at the workshop.

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