Collaboratively Developing an Interactive and Touchable City Model to Foster Exchange in a Museum

Jiannis Giatagantzidis

University of Siegen

57078 Siegen, Germany

jiannis.giatagantzidis@uni-siegen.de

Konstantin Aal

University of Siegen

57078 Siegen, Germany

konstantin.aal@uni-siegen.de

André Sekulla

University of Siegen

57078 Siegen, Germany

andre.sekulla@uni-siegen.de

Volkmar Pipek

University of Siegen

57078 Siegen, Germany

volkmar.pipek@uni-siegen.de

Abstract

Tangible objects and sensors are ubiquitous in our environment, the majority is also connected to the internet and provides the users information. One of the few areas where tangible objects are rare to see is the museum. Our research tries to combine various directions to improve the experience in such places: creating a tangible object to tackle the vanishing visitors of the museum especially youngsters and children who grow up in the digitized world. We focus on the collaborative process of developing and building the tangible model. Results indicate that the right environment enhances the overall process and involvement of different participants.

Author Keywords

Tangible interface; museum technology, internet of things, fab lab, prototyping, open fabrication, community

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;
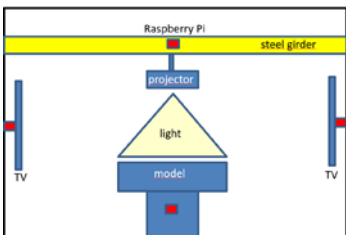
ZEIT.RAUM in the making

interactive city model - installed and in use

Wiki

First concept

Installation Concept

Introduction / Research Setting

The *Siegerland Museum*, a regional museum of the city of Siegen struggles like other museums in provincial cities with the problem of stagnating visitor numbers. Topics and (technological) possibilities are sought, so that attention and interest can be aroused, ideally also to address new target groups.

For the ZEIT.RAUM project, various partners have come together, driven by different interests, to design and implement a technical artefact to convey a city history close to the people. The artefact is already in regular museum operation, with appropriation studies and further developments being carried out depending on actual observed use. The development and negotiation process for the final artefact is thus not yet complete.

Social, economic and technical factors play a role in these processes. It was important to reconcile the various stakeholders, some of whom have conflicting interests. The development is user-centred and is highly motivated by social factors. However, structural peculiarities, technical availability, but also limitations have significant influence on the current form of the artefact.

The Museum's sponsoring association supports the activities of the museum with the same goals and aligns its activities with a view to a pleasing and (commercial) successful cultural enterprise. In addition, the city of Siegen also pursues the intention to use the city's history as a marketing tool for the city. This results in a special, politically motivated and thus steered selection of topics. This led to tensions with another actor, the university Chair for Didactics of History. The team attached great importance to portraying the city's history from the citizens'

perspective, which only can be achieved with a high level on citizen participance. Similarly, the didactic concepts of *Lieux de memoire*[1] [5, 1] should be mapped by the technology to be developed. For this reason, a tangible interface was developed as a haptic interactive city model, as well as a collaborative platform (city wiki) were implemented in the project. It is intended that the places of remembrance, to which citizens have attached great importance in the community-based discussion, should also be integrated into the haptic model. The chair of CSCW with its own driven Fab Lab Siegen[2] took over responsibility for the realization of the two components, wiki and city model, as well as the appropriation studies. In the following, the current state of development of the artefact and one the peculiarities of its production is presented is discussed.

Related Work

Recent research highlights the potential of tangibles in the realm of participatory Design and innovation, so-called tangible workshops and formulate a research question around the possibilities of 'things' to facilitate collaboration [3]. Our research tries to fill this gap by following two ways of research: on the one side, observing how different participants collaborate to create on artefact and on the other side, how the visitors interact collaboratively with the artefact later in the museum.

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[1] Lieux de momoire: places of remembrance can be places, but also people, events, ideas and traditions.

[2] Fabrication Lab, a space which provides a diverse set of tools for people to work on their individual projects

terrain and buildings / buttons

3d-printed map section

map tiles with sensors

all relevant electronics

ZEIT.RAUM is highly influenced by the idea, that tangible interaction can enhance the visitors' experience and the use of modern information technology will deliver benefit for museums [4]. Since one of the project aims is citizen participation, we follow Marc Weiser's approach to encalm technology to raise social interaction [7], while using (computer-) technology in background [6]. An investigation by Chipman et al. [2] created technology to support children in creating artefacts in a collaborative way: the researchers combined a shared digital space with tangible interaction. The results show that this technology helps to explore independently an environment while authoring digital information together with classmates. Again, our research builds upon these insights and incorporates the aspect of collaboratively using artefacts to enhance the experience.

Tangible, Online Model

The interactive city model is currently on display at the **Siegerland Museum**. In the exhibition space a landscape model with 17 building models and 8 buttons for selecting POI information, as well as 3 language selection buttons are installed. To the left and right of the model, two TV screens display information about the respective POIs. Above the model, a projector visualizes POI-related information onto the haptic model. The visual material corresponds to the satellite view of the city center. In front projection, a distinction is made between blue active and white inactive POIs. If the user guides a finger on one of the building models or one of the option buttons, the respective screen information or front projection changes. In fact, the system is not a pure tangible interface, it is a hybrid, because further information is still presented on an additional display.

The two TV-screens and the projector are present next to the model, but capacitive sensors, Arduino boards and several Raspberry-Pi for signal processing and communication work in background. In addition, four tablets on goosenecks are arranged in the corners of the model. They display the city wiki.

Findings

Collaborative Prototyping
The interface was developed in the Fab Lab of the university. It turned up, that at the time when conceptual work has finished and went into the phase of handcrafting, the format **open lab** was introduced into operation. Therefore, the artefact was not produced in a closed lab, all progress could be observed, tested and commented by the diverse fab lab community.

Some of the guests gave hints to improve the 3d-printing process, also the use of the final capacitive sensors is a result of the discussion in the community. Remarkable is the engagement of one fab lab user, who spent passionately six days of worktime on voluntary basis to solve problems that occurred during the projection mapping.

Collaborative Usage
In order to realize the didactic concept of *Lieux de memoire* technically the historians insisted on placing tablets, that display the city wiki around the interactive model. In the prototyping process, but latest after presenting the installation to the public, it has been indicated, that most of users are unimpressed by the tablets. Instead of this, one group of pupils (mis-)used the tablets as steering wheel to play races and caused
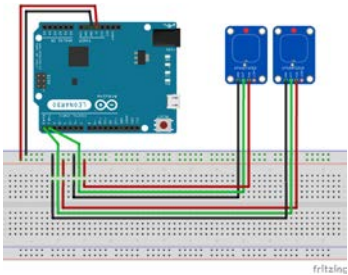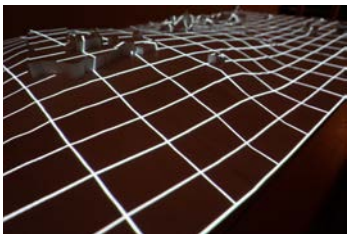
Leonardo and sensor wiring

frequent input by participants of the open lab

prototype model

projection mapping

a defect.

Another problem is the hybrid character of the actual system. The users switch content by interacting with the model, so their focus is on touching and viewing the model. Sometimes attention escapes and users miss to look at the TV-screen for further POI-information and seem to be confused.

Further usage statistics show that the tablets and city wiki is rarely used. At this point it is not sure, if the installed tangible interface attracts all attention, so that the tablets are hardly noticed, or if the local museum visitors do not spend too much attention to tablets. However, finally it has to be stated, that the wiki as collaborative platform is not used in front of the model.

Conclusion

We could show how the Fab Lab (in this case, especially the time during the open lab) improved the development of a tangible, online artefact. By involving not only the relevant stakeholders and future user, but also volunteers or random visitors in the design process, we developed an interactive and tangible model of the city for the museum, which has a very high acceptance rate among the visitors (in the museum). Future research will focus how this collaborative process can be enhanced and which factors play an important role to create an environment for this process (e.g. a safe and friendly space to meet, an area to tinker around and see what other participants are building). We will use this workshop as a starting point to discuss the following question:

- How can we establish a community to work together on tangible objects?

- Which ways of designing collaboratively can support the process of creating tangible objects?
- How does the background of participants influence the way in which they attend to and make sense of the objects?

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