In-Situ versus Simulation-Based Experience Evaluation of Media Augmented Urban Environments

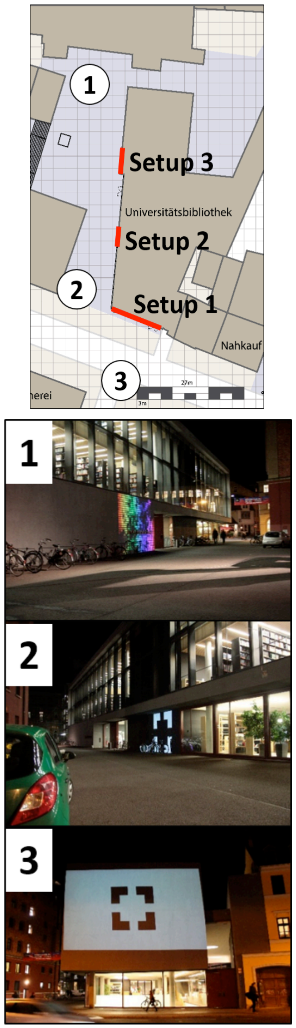

Figure 1: The 3 projection setups with exemplary vistas. Top: plan view (projections in red).

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Abstract
Developing media content for public spaces cannot be effective without a deep relationship with its location. Hence, an analysis of the location is required, especially when designing a novel medium carrying and matching the content and fitting the urban environment. We focus on our experience with an in-situ and a simulation-based evaluation approach to capture viewers' experiences generated through the amalgam of basic content and spatial configuration of an urban environment.

Author Keywords
Urban HCI; Evaluation; Media Architecture Interface.

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

Introduction
Public screens and media architectural interfaces [1] tend to embed large screens / visual displays in the built environment. But in urban environments, architectural elements and configurations influence how we experience such systems. An underlying aim of our research is to contribute to a better understanding and anticipation of how visual content will be experienced. In the study reported here, we investigated how basic content types (static images, moving text) and configu-

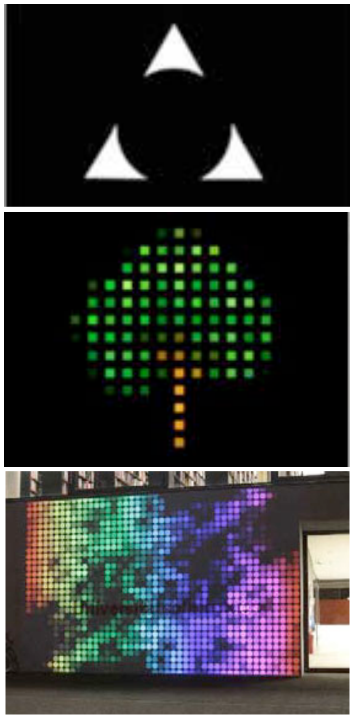

Figure 2: Example contents

Figure 3: Simulated vista for set-up 2 showing running text in a simulated projection

rations of architectural space shape viewers' experience. This led to the question if this needs to be to evaluated in-situ or whether a simulated environment might enable similar insight.

As test environment we used the Bauhaus-Universität Weimar's library as it offers a variety of space types, flow of people and several façade spaces that can be utilized for projections (GPS 50.977515, 11.327184). For the in-situ evaluation we assumed a projector is good enough for prototyping to emulate a visual display. A first step of our research process was to identify suitable surfaces for projection. We chose three locations for our projection setup with diverse spatial characteristics (Figure 1). The elevated projection in Setup 1 has a large open space in front of the façade and is positioned at a t-crossing of two streets, providing diverse views with high visual complexity of this façade from various distances. Setup 2 resembles a narrow walkway passage and the space in Setup 3 resembles a plaza. We then designed basic content types for the projection, which each was evaluated at these three spatial setups. The three major types of content were: text (static and moving at different speeds), basic shapes based on Gestalt Principles (e.g. Figure 2 top), and simple images (e.g. the tree in Figure 2, at different resolutions) or abstract colour (figure 2 bottom).

Two Experimental Experiential Evaluation Methods

Our experimental evaluation used two approaches: Experiential Sampling (ES) and Free-to-Roam (FTR) Experiential note taking. For ES an urban designer and an expert in spatial interventions selected five visually interesting sampling locations at which four test participants filled a sheet of sematic differentials [3] each. Table 1 shows the list of bipolar adjectives. For the FTR, four test participants were asked to freely wander to explore the isovists of the projection and note visually interesting impressions. Comments, assessments and positions were documented on A4 sheets with a printed map on a 3x3m regular scaled grid. Content was shown in the same sequence for the ES and FTR evaluation. To assess whether an evaluation could also be run in a simulator, we then ran an FTR test for Set-up 2 in a simulated environment with a new set of participants and compared the outcomes with the in-situ results. Our experience from the in-situ tests informed the design of the simulator study and resulting data analysis. Both methods allowed us to gather and extract qualitative and quantitative data. A limitation of our work is that the number of participants was rather low (In-situ n=4, Simulation n=5).

In-Situ Test Results

The in-situ FTR test produced tree types of data: points on the map, comment annotations, and photo/video material. To link all data we used QGIS [6]. The software enabled us to digitize, assign supplementary information (tags, groups, media files) and perform analysis using spatial queries and tools for qualitative triangulation of the data (notes) and quantitative data (note-taking positions).

The ES method did not provide clear results as the number of test subjects was too low and many criteria were rated divergently on the semantic differentials (some people rated a view as 1, others as 5). No consistent differences in spatial experiences were found.

With the FTR, we found a large number of notes describing associations created by the content type (see

Pleasant	Annoying
Large	Small
Relaxed	Tense
Bright	Dark
Ordered	Chaotic
Harmonious	Unharmonious
Good	Bad
Interesting	Uninteresting
Stimulating	Boring
Spacious	Confined
Welcoming	Forbidding
Continuous	Broken

Table 1: Sematic differentials used for the ES method

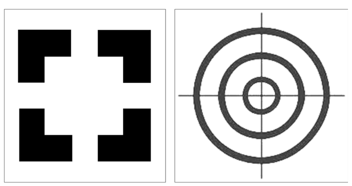

Figure 4: Example of an association that arose during the in-situ as well as in the simulation testing. Left – actual basic shape content. Right – a frequently arising association by our test participants.

figure 4). The notes revealed that associations change dependent on distance, angle, and vista composition. Comments from the in-situ test also described the relation between environment and projection. These often concerned aspects such as how projected content integrates into the visual rhythm of architectural elements. For example, comments remarked on perfect embedding into the environment due to the contents' scale, harmony of moving text with the speed of cars on the streets and visual relationships with light and shadow in the surroundings from street lights or shop signage.

For FTR, each content projection test took 10 to 15 minutes, which amounted to 2h20m to 3h30m per setup. Analysis of timing and comment quality reveal that the amount of sample points reduced over time. Our testers became less curious, as the environment remained identical and motivation to check out the same position for new content decreased. The time effort for an in-situ test depends on the test area size and configuration. A well-organized route for position checking can ease the process. In a later in-situ test of another prototype system, we used mobile devices with software that enabled to gather notes, store related position, photo and video, resulting in a more efficient process for this type of test data collection. But although this approach automatically produces data for analysis, it is not precise enough (GPS error). Unfortunately, the paper-based method cannot offer accuracy either, as a cross on paper has a variance of approximately 0,7m.

FTR Content Test using Simulation

An alternative to the in-situ approach is simulation-based. A field study is expensive – it takes time, requires specific equipment and needs adequate conditions (i.e. temperature, daylight, etc.). Simulation can thus ease the test process. We wrote our own tool based on City Compiler [5], because existing software [2, 4] did not provide the following functions: real-time content integration with adjustable parameters (speed, size, resolution) as created for the in-situ test in Processing, and the ability to collect comments as georeferenced data compatible with QGIS.

Results

Different from real world paper maps, the simulation stored the exact geo-reference position automatically whenever the testers took a note, enabling the testers to focus on finding interesting views. The resulting data shows, that the simulation test on average was 3 times faster (about 3 min. per test content) than the in-situ test. Figure 6a shows the distribution of position-points, where testers took notes in-situ and in the simulation. Shared areas (determined as interesting by testers in both conditions) are marked in turquoise. "Blind" zones (grey) extend to the left and right. Figure 6b shows the difference; many in-situ points lay in a courtyard area whereas testers in the simulation were interested in positions on and near the street area. This is probably because the simulation has no traffic and this area thus is safer than in real life, making testers curious to explore this view.

We furthermore believe that such opposing areas of interest or "undiscovered" places are caused by the fact that participants in the simulation test did not have a map view and thus could not see the history of their movements. The decision to omit a map overview was made because we wanted participants to concentrate on discovering interesting viewpoints according to their perception. However, it is possible that a map view in a

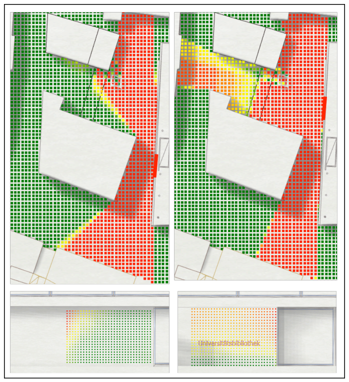

Figure 5: Analysis of potential viewing positions for setup 2 (left) and 3 (right), and visibility of projection area (lower part). Red – projection can be seen fully. Yellow – only parts are visible.

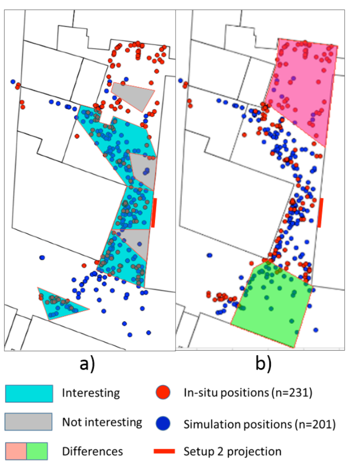

Figure 6: Comparison of in-situ data with the simulator results.

simulated environment may trigger participants' curiosity to roam more to "undiscovered" spaces.

In comparison to the in-situ results, only few comments referred to the built environment. Participants compensated the lack of visual detail in the simulation by writing about prior real-life experiences and situations at these places. They blended this experience into the test process and described past experience from memory. Similar to the in-situ test, we obtained comments regarding people's associations' in the simulation testing.

Improvements for a Simulation Approach

It is an open question what a simulation system for testing media-augmented urban spaces should look like. Should it be as generic as possible, and provide unique solutions for each case or should it be standardized to offer designers a common tool to test their ideas? We focused on the first approach and included only necessary data collection instruments. We suggest the following ideas for future design of simulation tools:

- Support several modes of working, with overview map or without, to see which points are taken, which positions need to be discovered.
- Enable users to copy-paste previous comments. This could solve the problem that participant are not motivated to repeat identical comments for another setup or position or think that this is obvious.
- Provide an option for saving a vista with its experiential annotations.

Obviously, level of detail can be enhanced to infinity and can move into the direction of ultra-realistic virtual reality to achieve better immersion.

Summary

A simulation test can provide valuable preliminary results about positioning for interesting vistas and provide initial experiential feedback from viewers. Nevertheless, a simulation cannot fully substitute an in-situ test. This is because it omits too many details – not only environment features such as light, shadows, signs, urban furniture and other objects, which impact how an installation works for a place, but also dynamic attributes: the amount of people at different times of day, pedestrian movement and other dynamic aspects of place unique for each situation. Thus, we consider simulation to be an additional tool, which can support some ideas, provide preliminary results and serve as preparatory step before an in-situ test.

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References

1. Moritz Behrens, Nina Valkanova, Ava Fatah gen. Schieck, and Duncan P. Brumby. 2014. Smart Citizen Sentiment Dashboard: A Case Study Into Media Architectural Interfaces. In *Proc. of PerDis'14*. ACM, New York, NY, USA, 19-24.
2. Balazs Farago. 2012. Real5D. Real5D, Redwood City, USA.
3. Samuel Himmelfarb. 1993. The measurement of attitudes. Psychology of Attitudes. Harcourt Brace Jovanovich College Publishers, Fort Worth, TX, 23-88.
4. Jeremy Rotsztain. BIX Simulator. 2003. Studio Mantissa. Berlin, Germany.
5. Hashimoto Sunao. CityCompiler. Japan. Accessible from http://kougaku-navi.net/CityCompiler/
6. QGIS 2.10.1-Pisa. Accessible from http://www.qgis.org.