

Designing Media Architecture: A Research Agenda for Urban Interfaces

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ABSTRACT

At the intersection of art, design, and human-computer interaction (HCI), my research focuses on the exploration of novel and emerging design in the context of *interactive media architecture*. My creative work in this domain aims at establishing systematic design processes for *urban interfaces*, investigating suitable evaluation methods, and exploring the social protocol at work in group or multi-user interaction environments. My previous investigations act as the foundation of future research in this domain. The topics I intend to tackle deal with systematically designing *urban interfaces* from scratch. In particular, I intend to investigate a **Prototyping tool-chain** for developing urban interfaces on different media and fidelity levels. Through participatory design sessions with users in their environments, commonly referred to as *research in the wild*, I hope to uncover which type of *urban interface* best suits the context of use. Into this domain, I will transfer various prototyping methods utilized to create *hybrid interactive systems*, the core focus of my Ph.D. dissertation, to investigate a complete prototyping design process cycle, from early sketches to implementation. In former projects I learned that the utilization of **UX evaluation methods**, applied in combination with standard usability metrics, have the potential to reveal the users' perceptions and emotions *more holistically*, and hence, to provide a better basis for evaluation purposes. A deeper investigation into suitable methodologies can reveal a set of methodologies for this specific research context.

Through the dissemination (code, hardware specs, and tutorials) of my work, architects, designers, researchers, and practitioners can benefit through integrating the process tools and guidelines into their work and developing their own projects and applications more easily.

Keywords

Media Architecture, Design Process, Urban Interfaces, Interactive Lighting Design, Toolkits, Media Façades.

1. INTRODUCTION

Under the umbrella terms *urban informatics* [5] and *media architecture* [8], novel research disciplines are emerging that take various factors into account. These factors will influence the design of tomorrow's urban landscape. At the same time, the decreased cost of industrial components for building new types of architecture paired with the vast distribution of mobile computing devices can allow for novel types of interactions or information retrieval in urban environments. Media architecture can be perceived as new type of *media representation* that has the potential to distribute and communicate information and content

to large audiences. Such projects also address the design operation of *media façades* [4, 8].

This term describes the designing or modifying of its building's architecture to transform its surfaces into giant public screens [7]. The *Allianz Arena* by Herzog de Meuron [3] is a prominent example of how media architecture can become an *icon* which can communicate ambient information to an audience and thereby transform the outer shell of the building into an *urban screen*.

Despite ambient information retrieval through multiple colored lighting placements, this type of architecture can also serve as an *urban interface* and allow for dialogue between people and buildings.

In past research I tackled various issues that emerge from these domains, such as the establishment of a systematic design process, prototyping toolkits to pre-test hardware and content, the experimental use of direct and indirect interaction techniques, and the exploration of suitable evaluation methods in this genre. The research questions I want to ask deal with how these *urban interfaces* are perceived by users and how meaningful content may be designed, including interactivity and aesthetic experiences that interplay and match the users' expectations while fitting aesthetically into the urban environment.

Besides the identified domain specific challenges suggested by other researchers, such as Daalsgaard et al. [2], who summarized their experiences in exposing media architectural interventions to urban environments, I suggest that there are additional issues to be considered in the process of holistically understanding and investigating this context:

Researchers, designers, practitioners, and artists who provide successful interactive interventions in urban environments should consider the design of these systems in three layers:

- **Aesthetic Experiences:** Urban interfaces must be integrated with the city in an aesthetically appealing way to gain wide user acceptance while convincing stakeholders and investors of their merit.
- **Encoding Ambient Information:** The represented information must be encoded by large audiences. Therefore, a *clear vocabulary* is necessary, particularly regarding how the distributed ambient or explicit information should be understood.
- **Enabling Interactivity:** Urban interfaces should be easy to understand and intuitive, lest they remain undiscovered and underused. A lack of documentation detailing how the implemented interaction mechanism

works may be responsible for this obscurity. Enabling interactivity delves into how to support an *urban interface* to retain usage and gain widespread acceptance. Various interface types (tangible, intangible, GUI based) and interaction mechanisms (implicit vs. explicit) must be investigated thoroughly to provide a successful interaction experience. Depending on the context, the interface representation should match and support a particular *emotional* experience when interacting with media architecture.

2. Previous Work

My previous creative work in this domain focused on various factors of implementing and pre-testing hybrid interactive systems. My initial experiments explored different interaction mechanisms that could be utilized as *urban interfaces* when interacting with media architecture. With *Color Vision* [10,11], I introduced a full body interaction mechanism that would allow a *more expressive* experience in interacting with architectural elements, such as large surface multicolored lighting (see Figure 2). By presenting *IRIS* [1,12], I aimed at providing a direct and intuitive interaction mechanism that would allow users to interact with certain parts of media façades through live video.

In a subsequent project, I investigated the utilization of toolkits to support the creation of hybrid interactive systems from scratch. To pre-test content and hardware before the final implementation, I presented a prototyping toolkit [9] and introduced a systematic design process while adapting UX evaluation methods to suit the context [12] (see Figure 2,1+2).

3. Current Research

3.1 Prototyping Toolkits

Light emitting elements embedded in architectural structures come in different dimensions and can incorporate varying spatial distribution. For example, in a project conducted by Seitinger et al. [6], small (10x10cm) light emitting *pixels* were built of single elements that emit punctual lighting and convey ambient information. On the other hand, the *Ars Electronica Center* in Linz (AEC) has an outer shell in which single windows of the glass façade can be illuminated via light emitting diodes (LED) embedded in a larger, individually controlled LED wall-washer. In this case, a single pixel measured roughly 3 x 2 meters. These *pixels* were positioned next to each other, while in the Seitinger et al. [6] project, individual *pixels* were unevenly distributed over a whole façade. It was found that the *pixel* dimensions and their distribution must affect the design process when prototyping and pretesting media architecture interactions. In a case study conducted at the AEC, we developed a prototyping toolkit to pre-test both content and hardware before the final implementation [9] (see Figure 2, 1) which had to match roughly the dimensions and their distribution. In a case study conducted at the *Hochschule der Bildenden Künste* (HBK) in Saarbrücken, we utilized a purpose-built toolkit with an embedded data projector for pre-testing the high resolution façade (see Figure 2, 2).

These properties play a role when designing for specific contexts of use: the chosen spatial distribution also partially defines the information density (resolution) that these systems can incorporate.

In summary, the pixel scale and their spatial arrangement – or distribution – creates potential future usage scenarios and choices for **prototyping as a means of pre-testing**.



Figure 2. Examples of previous work on toolkits and interfaces: (1) a prototyping toolkit for low-res media façade types and (2) hi-res back projection façades, (3) interaction techniques realized through live video, and (4) embodied interactions.

In previous research, I conducted two cases studies with different media façade types (light emitting low-res and back projection hi-res, see Figure 2, 1+2). The purpose-built prototyping toolkits for pretesting content and hardware components delivered valuable insights into the feasibility of the envisioned interface concepts before the final on-site implementation, and thus exemplified a *more systematic* design process in this domain. In future research, I hope to explore other façade types and develop prototyping toolkits with different materials to match façade specific characteristics.

3.2 Evaluation Methodology

Another critical challenge when designing interactive media architecture is the cultural context of the users' perception of these interventions. As social protocol differs strongly throughout different cultures, the representation of an urban interface has to match the common context. This can be done by finding a suitable evaluation methodology to reveal deeper insights into users' motivations and experiences through the very interactions these systems employ. As the users' experiences play a strong role in urban interaction design (IXD), various metrics and methodologies must be investigated. In a publication presented at the *Designing Interactive Systems Conference* (DIS), we investigated the experimental and preliminary use of *User Experience* (UX) evaluation methods in this context [12] and gained first promising insights. However, we used a set of methods that seemed likely to provide the *most promising solution* for the given context, and we did not explore alternative methods for the purposes of comparison. A future investigation should therefore take into account a deeper investigation of (a) different UX evaluation methods in parallel and (b) their adaptation to changing cultural contexts.

3.3 Temporary Ownership

In a previous project [12], we discovered that when multiple users interacted simultaneously with an urban interface, frustration often occurred, particularly if the users did not know each other beforehand. Similarly, the interaction led to a more positive group experience if users were familiar with each other and could communicate while interacting. This finding suggests that suitable turn-taking algorithms may prevent users from experiencing frustration. The current investigation should therefore document

different mechanisms that allow users (a) to interact simultaneously with a media façade and (b) to simultaneously negotiate *temporary ownership* over a media façade.

4. Future Research Objectives

My previous creative work in the domain of interactive media architecture focused on (a) the investigation of interaction techniques, (b) the investigation of design process models and (c) the introduction of supportive toolkits (see Figure 2, 1-4). These implementations provided the basis for my future research agenda, dealing with the systematic ideation, development, deployment, and evaluation of the following systems in public contexts:

4.1.1 Prototyping Tool-chains

The successful establishment of new technologies, such as interactive media architecture, may be hindered by the sparsely documented case studies and practical applications of this domain. As pointed out by Schneiderman, in any emerging technology domain there is a demand for supportive toolkits. These toolkits allow for replication while lowering the entry barrier for designers and artists with limited technical expertise to develop their own applications and solutions. One of my goals must be therefore to establish a tool-chain that supports the complete design process cycle of urban interfaces. I will investigate suitable design process tools that co-exist in different media, such as virtual simulation, rapid prototyping techniques, electronic platforms, and instrumented spaces. These tools especially help architects to express their ideas, convince stakeholders in advance, and conduct pre-tests with users in order to judge which applications would possibly suit urban interfaces for individual use contexts.

4.1.2 Investigating Experiences

A next project I will pursue makes use of an embodied lighting control mechanism (i.e. gestural interface) and movable hi-power LED projectors. This technology infrastructure will serve as a prototyping test-bed for investigating the first iteration of the below questions and will clear the path to higher fidelity prototypes (i.e. a media façade) while revealing insights into user engagement and evaluation.

How can one systematically generate and evaluate urban interface experiences in public settings?

How do users perceive widely visible interactions in front of a large audience?

How can one enable audiences to interact with media architecture simultaneously?

Can low-tech solutions also produce rewarding experiences?

4.1.3 Research in the wild

On main challenge of successfully deploying urban interfaces in public places is their immediate utilization by the citizens. Lab studies in this domain remain limited as they emulate an artificial setting a situation that does not take into account what role that artificiality will play in designing and implementing architectural investigations in the wild. We therefore want to establish a culture of co-developing these systems via an integrated user-centered design process, which considers how these systems will adapted by potential users in their contexts. Therefore, I want to utilize prototyping methods for the creation of hybrid interactive systems, which coincide with my research focus in the past years [ref.], and apply them to urban contexts. To do this, I will experiment with a flexible and movable media façade consisting

of 2096 individual *pixels*. By applying these pixels on deformable materials (i.e., a mesh), I will emulate different façade types that stretch over edges or are non-planar in other ways. By prototyping different interactions with this infrastructure, I will propose different low-fidelity mockups of interface representations and confront potential users in semi-public settings. Such an approach is ideally embedded into a street festival which invites artists, designers, researchers and citizens to explore design concepts in a practical manner:

At the pulse of the city: prototyping urban interfaces in the wild. Citizens can interact with samples of media architecture through provided interface representations. While interacting, they can, for example, get a sense out of what information a specific site may be concealing. In the context of an “urban prototyping festival” we will present different interface representations: tangible, gestural, or unique to mobile devices, etc., to potential users. We want to compare which type of urban interface representation users prefer in a given context.

5. Conclusion

At the intersection of architecture, industrial design, and human-computer interaction, my research focuses on the exploration of novel and emerging design contexts, such as urban interfaces.

The output of my research will lead to new set of guidelines that practitioners, designers, and researchers can follow and thus create usable and enjoyable experiences, all of which make for interactions with urban interfaces more expressive and invite active participation.

6. REFERENCES

- [1] Boring, S., Gehring, S., Wiethoff, A., Bloeckner, M., Schoening, J., Butz, A.: MultiUser Interaction on Media Facades through Live Video on Mobile Devices. In Proc. CHI’11.
- [2] Dalsgaard P., Halskov, K. Designing Urban Media Façades: Cases and Challenges. In Proc. CHI’10.
- [3] Fischer, J. German football stadiums. Daab Pub, 2006.
- [4] Haeusler M. H. Media Façades: History, Technology, Content. Avedition, Ludwigsburg, 2009.
- [5] Foth, M. Handbook of research on urban informatics: The practice and promise of the real-time city. Information Science Reference, IGI Global, 2009.
- [6] Seiting, S., Perry, D.S., Mitchell, W.J., Group, S.C. Urban Pixels: Painting the City with Light. In Proc. CHI’09.
- [7] Sommerer, C., Jain, L., Mignonneau, L. Media Façades as Architectural Interfaces. In The Art and Science of Interface and Interaction Design, Springer, 2008.
- [8] Tscherteu, G. Media Façade Online Catalogue, 2010 <http://www.mediaarchitecture.org/mab2010documentation/>, accessed January 2012.
- [9] Wiethoff, A., Blöckner, M. Lightbox – Exploring Interaction Modalities with Colored Light. In Proc. TEI’11.
- [10] Wiethoff, A., Butz, A.: ColourVision Controlling Light Patterns through Postures. In Proc. Symposium on Smart Graphics’10.
- [11] Wiethoff, A., Gehring, S. Interacting with Light. In Proc. of Aml’11.
- [12] Wiethoff, A., Gehring, S. Designing interaction with media facades: A case study. In Proc. DIS’12.