Media-Augmented Surfaces

Embedding Media Technology into Architectural Surface to Allow a Constant Shift Between Static Architectural Surface and Dynamic Digital Display

Matthias Hank Haeusler
University of Technology, Sydney
Matthias.haeusler@uts.edu.au

Abstract: The way screens are attached to architecture at present limits architectural surfaces to carriers of signs. The research presented in this paper offers a possible solution that allows architectural surfaces to be both a space-defining element that has certain architectural material qualities and at the same time allows media technology to be embedded. These surfaces can alter their state from static material to dynamic image in an instance. The paper presents a prototype capable of fulfilling this requirement. It also positions the research within the architectural discussion by comparing it to works of others and confirming its research value by reference to work in a similar direction. Finally, the paper evaluates the research and concludes that it could offer a ‘fabric’ to be used as a sort of media clothing for architecture in the electronic age (Ito, 2001).

Keywords: Media facade technology; media-augmented spaces; architectural screen design; media architecture; digital displays.

Introduction and research background

Motivation

Thanks to recent developments in screen technology, large displays based on either plasma or LED technology, to name but two, have become more and more dominant in public space (Townsend, 2004). Examples range from individual buildings and spaces that merely function as carriers of signs (Perrella, 1998) to striking urban locations like New York Times Square or Tokyo’s Shibuya.

The number of screens placed in urban spaces is likely to increase as they become more widely available to architects and designers. According to Ava Fatah gen. Schiek: “large projection screens are becoming more and more ubiquitous in urban spaces” (http://www.firstmonday.org/issues/special11_2/fatah/index.html: March 2007). Indicators of this trend are the refinement of these products, their use in fields outside of architecture and the falling cost of LEDs screens, LCD screens, etc. Reed Business Information, a company that provides information for businesses, states in an article published in 17 August 2004 that “Prices dropped 10%-20% over the past 12 months and will decline at a similar percentage over the next year for most LEDs. The exception will be white LEDs. Tags for these devices will fall, but at a smaller rate of decline because there are fewer suppliers and less capacity than for blue, green and yellow LEDs” (http://www.purchasing.com/article/CA444978.html: February 2008). The article quotes
a regional U.S. product marketing manager from Agilent’s optoelectronics division, who notes “… that 10 years ago a 5 mm AlInGap chip, an aluminium indium gallium phosphide which produces red, orange and yellow LEDs, cost about 75 cents. Today it costs about 10 cents.” So one could argue that these developments support the tendency that “architecture and media technologies [are] melting into each other, and buildings are turning into media infrastructure” (Torres, 2004).

Existing media technology such as LCD or LED can be applied in architecture and “large-scale video screens in urban settings suggest new possibilities and challenges for city authorities and regulators, architects, advertisers and broadcasters as well as for cultural curators and producers” (http://www.firstmonday.org/issues/special11_2/auerbach/index.html: March 2007), says Anthony Auerbach in ‘Interpreting urban screens’ when discussing the role of cultural input in urban media. He further argues, “While this potential [of the screens] remains largely untested, it is clear that urban screens establish new sites for the negotiation between commercial, public and cultural interest” (http://www.firstmonday.org/issues/special11_2/auerbach/index.html: March 2007). However, where this technology has been applied, such as in Tokyo or New York and other cities around the globe, it mainly features media facade systems that cover and clad buildings. The application does not enhance the architecture. Discussing this with reference to Times Square in New York, Stephen Perrella says “...if we could strip away all the electronic signs in Times Square, we could find a cacophony of material surfaces, each working to maximize the potential readability of the sign. It is this sort of drive, motivated by economic concerns, that differentiates surfaces, and that will propel the surface into a sign, and the sign into a surface.” (Perrella, 1998).

For Perrella, it is not in the interest of architecture to function only as a carrier for messages or images, driven by economic concerns. The issue of integration of screens into buildings is also a concern for Ava Fatah gen. Schiek who suggests “that in order to achieve integration on the urban level, the displayed content and output technologies need to be embedded in the architecture of the building and become part of the emergent space and perhaps space-defining elements themselves” (http://www.firstmonday.org/issues/special11_2/fatah/index.html: March 2007).

The concern of Perrella that screens “propel the surface into a sign” and the requirement of Fatah gen. Schiek that “output technologies need to be embedded in the architecture of the building” combined with the observations of Fatah gen. Schiek, Torres that “projection screens are becoming more and more ubiquitous in urban spaces” and “architecture and media technologies [are] melting into each other, and buildings are turning into becoming media infrastructure” have led me to the conclusion that in order to address these two issues, architecture needs to develop a material able to integrate or embed media technology in such a way that the technology becomes part of architecture, instead of simply attaching or adding media technology to a surface, thus augmenting architectural surfaces with media technology.

The practice of simply adding on media facades and screens onto space rather than embedding them into the architectural surface in my opinion raises two fundamental issues that are supported by quotes above: (1) if space is only clad with screens, architecture becomes a mere carrier of sign and the image dominates the urban landscape, as discussed previously and (2) screens that are attached onto facades fulfil their purpose only when activated by media content which has to be constantly renewed. I have discussed and found evidence of the first of these two points, while the second point is based on observing screens. I therefore want to argue as follows: if a screen is purchased and installed in a public space in such a manner that a switched off screen looks like an appendix, its existence can only be justified by playing media content nonstop. Obviously, the quality of media content will suffer if it has to be
Methodology

Instead of understanding and executing the task merely as a design exercise the studio was conducted as a scientific experiment in which the process of design was documented. This approach ensured that the final prototype was not a product purely based on taste and aesthetics but on scientifically documented steps to assure a design by research based upon principles introduced by Peter Downton (Downton, 2003 and 2004).

The research methodology comprised the following steps:

- Both space-defining material and LED technology were analyzed and tested before selecting one particular material and LED type. This ensured that students gained a deep understanding of the qualities of the products to be used.
- Material and LED technology were then combined to form a new material. The focus in this second step was on investigating the optimal distance from LED to material, the relation of LED brightness to the visual appearance, the distance LED to LED in comparison to distance LED to material, amongst other considerations dictated by the particular prototype.
- Based on these premises the students could finalize their design and start drawing plans for their prototype, giving due consideration to material requirements.
The final step was then to build the prototype by assembling the materials and wiring the electronic components of the media facade.

**Prototypes**

Based on this methodology, the students developed and designed a number of media-augmented surfaces. In the following I would like to introduce one of them.

One student team decided to use concrete as their material of choice. By embedding acrylic tubes into the concrete that will transmit the light of the LEDs a concrete element was realized that allows the transformation of a concrete facade into a screen. The concrete element is designed as non-load bearing facade panel with all cables and electronics in the gap between the wall and the facade panels. In the event of a faulty LED single panels can be removed and replaced.

At first glance, the approach may appear to be rather trivial. But the final prototype was the result of a number of trial-and-error steps, in particular when (1) combining the location of LEDs with a metal mash embedded in the concrete for structural reasons and when considering (2) the possible replacement of faulty or damaged LEDs at a later stage. Both problems were addressed with a holistic approach involving acrylic tubes embedded in the concrete containing the LEDs. In this way, the LEDs are not physically connected with the concrete and the acrylic tubes are positioned and fixed by a perforated metal plate that doubles up as a structural element. Like any other media facades the prototype is able to display all three characteristic communicative forms of media facades: text, graphic and image in the form of pre-recorded, live or interactive media content (Haeusler, 2009). Due only to budget constraints, the students chose to use red LEDs instead of RGB LEDs, a fact that does not effect the result and can be altered by simply replacing the one type with the other. Existing hardware at the university has also determined the size and the distance from LED to LED. Using a 64 LED control Phidget, the arrangement of 8 * 8 LEDs and the distance of 2 cm from LED to LED was chosen. These decisions were the result of working in a student environment and there is no reason why the prototype cannot be altered into a high resolution RGB screen.

Having presented a prototype and explaining its function, in the following I want to position this research in a context of existing media facades to demonstrate its significance.

**Work by others to demonstrate significance**

There are publications of contemporary examples where architects have achieved a high level of integration of media technology into architecture. However, when analysing media facades in publications such as ‘Media facades – History, Technology, Content’ (Haeusler, 2009) it becomes apparent that all they do is cover media technology with an architectural material to integrate it into the architecture. None of them integrate or embed media technology into architecture uniting architectural material and media technology. I want to illustrate this by considering the Kunsthaus Graz designed by Spacelab.uk (Peter Cook and Collin Fournier) in 2003 with realities:united, Berlin as media facade consultant. As one can see in Figure 4 the media technology, in the case of the Kunsthaus Graz fluorescent tubes, is mounted onto the facade of the building with a glass layer to clad the technology behind. Media technology and architectural surface are two separate building components.

But there are examples of media technology
embedded in architectural surfaces along the lines of the research. One example is LightPoints™ by Schott Glass and LIF Germany that comprises transparent glass conductor plates equipped with LEDs. Layered between two laminated cover glasses invisible conducting paths supply the power to the LEDs to allow illumination, running lights or animations. (http://www.schott.com/architecture/english/lightsolutions/lightpoints.html: May 2009). The product also offers two states as it is capable of transforming from an architectural surface (glass) into a media surface.

Thus, for me the development of LightPoints™ validates the concepts driving the research presented here.

**Evaluation of research**

The prototype demonstrates the possibility of altering any surface from a space-defining element into a digital screen in a matter of seconds by simply switching the screen on. It is no longer necessary to decide whether to have a screen or a surface; now both are possible. In comparison to other works the paper has demonstrated that it is possible to go the next step from adding on media technology, as seen in the buildings of New York Times Square, to integrating media technology into architecture, as illustrated by the Kunsthaus Graz, to augmenting surfaces through media technology.

The fact that the prototype was developed, designed and built in a student environment at university clearly shows that the augmenting of surfaces is certainly a task that architects can manage. Issues and problems that might arise in a mass production phase could be addressed and solved by facilities used to dealing with mass production and with the resources and expertise to do so. The possibility of developing media-augmented surfaces takes the field of architecture, in this case facade design, into new realms. How can one evaluate and position the advantages of such a hybrid?

When considering the possibilities for the facade to react live and to alter its state when required, there are the obvious differences between images and architecture. After being erected architecture creates, “...a static image that will not change over a period of time and is not yet in the position to fulfil the postmodern need for a ‘persistent new’ and react to different steams and trends” (Klauser, 1994). Wilhelm Klauser describes this need for a ‘persistent new’ by comparing the function of buildings in Tokyo to that of clothes. Fashionable for a season or a fashion stream they need to be extraordinary to justify their existence. When locating media-augmented surfaces in the urban environment this need for a ‘persistent new’ can be satisfied by refreshing the appearance of a surface with an ever changing media content while at the same time keeping the static appearance of the original material.

In this way, LED technology can be injected into a surface rather than (1) just added on, as it is the case in Times Square, amongst others or (2) integrated as the Kunsthaus Graz example has shown. When focusing on the least preferable result, where large display screens have been added to an existing wall or erected as a freestanding object in prominent locations, they fulfil their function as a wall only when
in use and showing media content. A switched-off screen on a facade has lost its *raison d'être* in that place and can even be perceived as a disruptive element. Through the integration of the LED technology into the surface, a screen is no longer an attached element but an integral part of the space defining walls, floors or ceilings.

It must be possible to switch the screen off at times when the screen is not in use, and that is essentially at any time when no one is paying attention to the screen or no viewers are located near to it. The ‘off time’ of the screens helps to keep energy costs down simply by reducing the running time of the screen. The difference here is that the visual appearance then is not one of a switched-off screen but of a standard architectural element as was the case in one of the prototypes built of concrete.

LEDs have a long useful life compared to light bulbs, for instance, but their total life in an application can be increased still further if switched off for part of the day. Assuming that the lifetime of an LED is 35,000 – 50,000 hours or 4 – 5 years (http://www.netl.doe.gov/ssl/PDFs/lifetimeWhiteLEDs_aug16_r1.pdf: accessed January 2009) a display switched off during the night from say 1.00 – 5.00 am would increase the lifetime by nearly a year and thus reduce the costs necessary for replacement.

An important point is avoiding the constant need for ever-changing media content. Playing media content 24 hours a day, seven days a week, 365 days a year places virtually impossible demands on the creativity of the designer. The possibility to switch between surface and screen relieves the demand for new media content. Screens could be switched on only at certain times, for instance when people are actually in front of the screen and activate it.

**Conclusion**

I therefore argue that a media-augmented surfaces offer a way of embedding media technology in an architectural way. Recent developments in media technology such as OLED already used in a television produced by Sony or the e-paper used in Amazon’s Kindle are further indicators that screen technology will continue to influence our environment and the way we live. The prototype presented here offers an architectural design solution of how media technology can be part of space and demonstrate that architects are capable of expanding their field of competence by adapting media technology and mixing it with architectural design intentions. Toyo Ito stated in an interview, “Architecture should be a sort of media-clothing, which is necessary in order for man to have a relationship with and integrate himself into the environment.” (http://www.designboom.com/eng/interview/ito.html: accessed May 2009). In my opinion the prototype presented here represents a first step towards producing a ‘fabric’ that could be applied for Ito’s idea of architecture being a “sort of media-clothing”.

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**References**
