Living Skins:
Architecture as Interface

By Peter Hall

Buildings communicate their function and status through a language of visual signs. A cross on the roof generally signifies a church, a grand arch commemorates a triumph, steel-and-glass curtain walls usually indicate there are offices inside, and a duck-shaped or hot-dog shaped building usually means that poultry or hotdogs are for sale. A more dynamic system of communications arrived in the 20th Century with the first "zipper" sign in New York's Times Square in 1928, an illuminated bulletin board that transmitted the day's headlines: buildings henceforth began to communicate in data flows as well as via bricks and mortar. Today, commercial hubs from Times Square to Seoul are showcases of giant moving graphics that fly across several stories, though more often than not they are advertisements that disregard what is happening within the building itself. What if a sign did not simply tout new movies, sodas, and celebrity babies in one-way feeds, but instead revealed something unique about the building, its occupants, or its environment? What if the building could respond, in real time, to the movement of people, the weather, or the whims of bystanders or behind-the-scenes artists? Digital designers and architects have begun working together to move beyond the façade and give buildings a living skin.

The world's biggest beating heart

A pioneering "living skin" is the Blinkenlights project, in which Europe's largest hacker group turned a building in East Berlin into a nocturnal public electronic doodle pad and game board. The system was strikingly simple; to celebrate its 20th anniversary in 2001, the Chaos Computer Club (CCC) gained access to the Haus des Lehrers ("House of the Teacher") building in Amsterdamplatz and installed a 150-watt lamp mounted on a tripod behind each of the 144 windows of the upper eight floors.
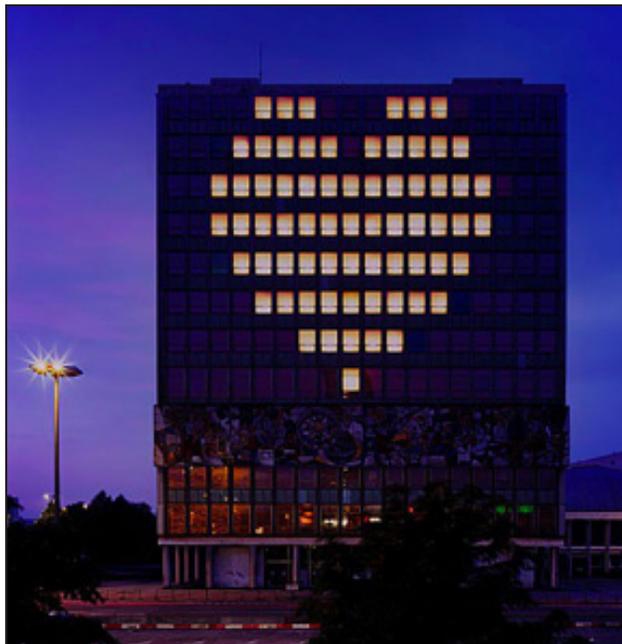
Blinkenlights by Chaos Computer Club.

Each lamp was connected to a control center on the eighth floor via a relay on/off switch and cables snaking through the building (5,000 meters of cable were used in total). From dawn to dusk for 23 weeks, the building's 144 windows—painted white for translucency—were transformed into a monochrome 8 x 18 matrix, each window becoming a pixel with an on/off value controlled by a software system built in Gnu Linux. The CCC described Blinkenlights (the name is hacker jargon for the flashing front-panel diagnostic lights on old computers), as a "public project on public ground:" Passersby could email or phone in simple animations or play Pong with another caller, using the web-based "blinkentools" developed by the programmers. The project was so popular that it was further developed (using dimmer switches to allow grayscale images) for the Bibliothèque Nationale de France in Paris the following September and "reloaded" at the Haus des Lehrers in 2003. Blinkenlights' iconic throbbing heart became something of an international symbol of optimism amid the dour days following September 11, 2001. Blinkenlights attracted 1,000 emailed animations and appeared in at least three music videos.

Architecture wakes up

Across the border in Austria, a more curvaceous living skin was being developed for the new Kunsthaus Graz, a bulbous, creature-like building designed by architects Peter Cook (cofounder of Archigram) and Colin Fournier with Spacelab.UK to house an art museum for the city of Graz. Cook and Fournier's competition entry had envisioned a membranous exterior that allowed occasional glimpses of action within: "signs, announcements, short sequences of film or images," but with funds and time rapidly diminishing, this looked likely to remain a vision. Enter another Berlin-based architecture group, named realities: united, founded by architect-brothers Tim and Jan Edler, who proposed turning the building's entire curving blue acrylic glass façade into a media screen called "BIX."

View of the Kunsthaus with the BIX installation from Schlossberg, *©2003 Harry Schiffer.*

Night view of the Kunsthaus with the BIX installation, *©2003 Landesmuseum Joanneum, Graz.*

Although the installation was to be permanent, requiring a more durable set up than Blinkenlights, the basis of BIX was equally low-tech: a matrix of 930 ring-shaped fluorescent lights behind a 20 x 40 meter area of the translucent skin, each acting as a pixel controlled by computer. The ring lights could be dimmed, or varied at a rate of 18 values per second, but the display was "extremely low" resolution, according to the Edlers: 0.2 percent of the pixels on a typical TV screen. Jan Edler argues that high resolution screens become outdated so quickly that the building would have been sporting obsolete technology almost as soon as it opened; besides, "it was a highly complex shape and we were looking for technology that was cheap enough to cover most of the outer surface." Equally important was establishing an economic model for sustaining the screen as an appropriate display surface for an art museum, rather than a source of revenue. "We managed to have something integrated and cheap enough that it doesn't have to be refinanced through advertising," he says.

The museum opened in 2003 with a specially commissioned series of sound installations synchronized with a lighting program developed for the exterior. (BIX software was built for the museum's Macintosh operating system by John Dekron and Jeremy Rotsztain using the MAX/ MSP & Jitter platform.) Since the display system was developed before the skin was constructed, the living skin is highly integrated, giving the impression that the images emanate from within the beast itself. The tricky part, according to realities:united, is sustaining an interesting level of commissioned work on the surface and not succumbing to the temptation to hand it over to the museum's sponsors. When the museum's director rented the façade to a local newspaper to celebrate its 100th birthday, the system's creators and some local residents were incensed enough to complain. Chastened by public disapproval of its dalliance, BIX has remained commercial-free since. As Edler sees it, one of the common problems of giant screens recast as building surfaces is that their content is utterly disconnected from the architecture and the function of the building. With BIX, he says, "future improvements are not to the resolution and technology but to the development of concepts to program the surfaces; ones that have something to do with the architecture and don't seem alien to it." The disconnect is familiar to most designers: a stunning medium lacking in content.

Light and Media installation SPOTS at Potsdamer Platz 10. *©2005 Bernd Hiepe*

With a follow-up project, entitled with similar monosyllabic pith "SPOTS," the Edlers developed an 1,800 lamp light matrix for the glass façade of an existing building in Berlin's Potsdamer Platz. This time a program of curated exhibitions was initiated at the same time to ensure a level of ongoing performance. (To finance the artworks, Mondays were reserved as exhibition-free days when advertisers could rent the façade: though to date, no one has bought space). One of the art pieces, entitled *33 Questions per Minute*, by Mexican-Canadian artist Rafael Lozano-Hemmer, invites passersby to type in personal questions on a terminal near the façade, to see their words writ large across the building. If no question is asked, the computer generates its own question from a database of sentence fragments. The piece ran from December 2005 to January 2006 and, in Edler's view, the questions submitted by passersby were far less interesing than the "machine-like poetry generated by the software."

Information flows in lights

Edler's challenge for a mutable skin that behaves in a manner appropriate to the building—reflecting the activities within rather than simply displaying ads to pay for itself—is more directly addressed in an upcoming project in Minneapolis, Minnesota. The city's new 357,000 square foot central library, designed by Pelli Clarke Pelli Architects (formerly Cesar Pelli) and opening in late 2006, will include an electronic light sculpture provisionally named "Word Up" by multimedia artist Ben Rubin. The project uses a matrix of LED (Light Emitting Diode) tubes on the outer surfaces of each of two elevator cabs.

"Checked Out," public art commission for the Minneapolis New Central Public Library, Ben Rubin, 2006. *(Photo courtesy of the artist)*. *View the animation*.

As the cabs ride up and down an inner atrium, the LED displays will reveal, letter by letter, the titles of books being checked out by library patrons. The system is being developed with David Small Design (writing software in C++ and Open GL) so that the elevator position sensors can communicate with the LED displays and tell them when to display the titles. In the context of Pelli's transparent glass atrium with elevated walkways, the climbing and descending book titles seem to evoke the idea that library patrons have become part of a giant reading machine: the LED signs will, says Rubin, "scan as if they were text hanging in the air." The project also dispenses with old notions of libraries as fusty repositories of dusty books and emphasizes the more current model of a library as a node in a network of information flows.

Rubin is also at work on a project destined for the upper service floors of Adobe's new corporate headquarters in San Jose, which he has titled *San Jose Semaphore*.

Concept image, "San Jose Semaphore," public art commission for the city of San Jose, by Ben Rubin, 2006. *(Photo courtesy of the artist).*

Here the installation is a meditation on the coded nature of communication. Behind the top windows, and visible from several streets and freeways away, will be four giant illuminated orange disks, each nine feet in diameter, and entirely composed of LEDs. A stripe through each disk will rotate every six seconds: each disk has four possible positions, which translates to eight bits of information across all four disks. Using this simple semaphore to encode letters of the alphabet, the four disks will transmit a secret message at the astoundingly slow rate of 10 bytes per minute (60 billion times slower than the 3GHZ processor in most personal computers). Rubin is considering offering a prize to the first person patient enough to decode and identify the source text of the secret semaphore message, though his larger goal is more philosophical. "My initial impulse arose out of trying to take digital communications technology, which is Adobe's business, and make it visible. This and other pieces I've made are really about the impulse to communicate and the basic human need for call and response."
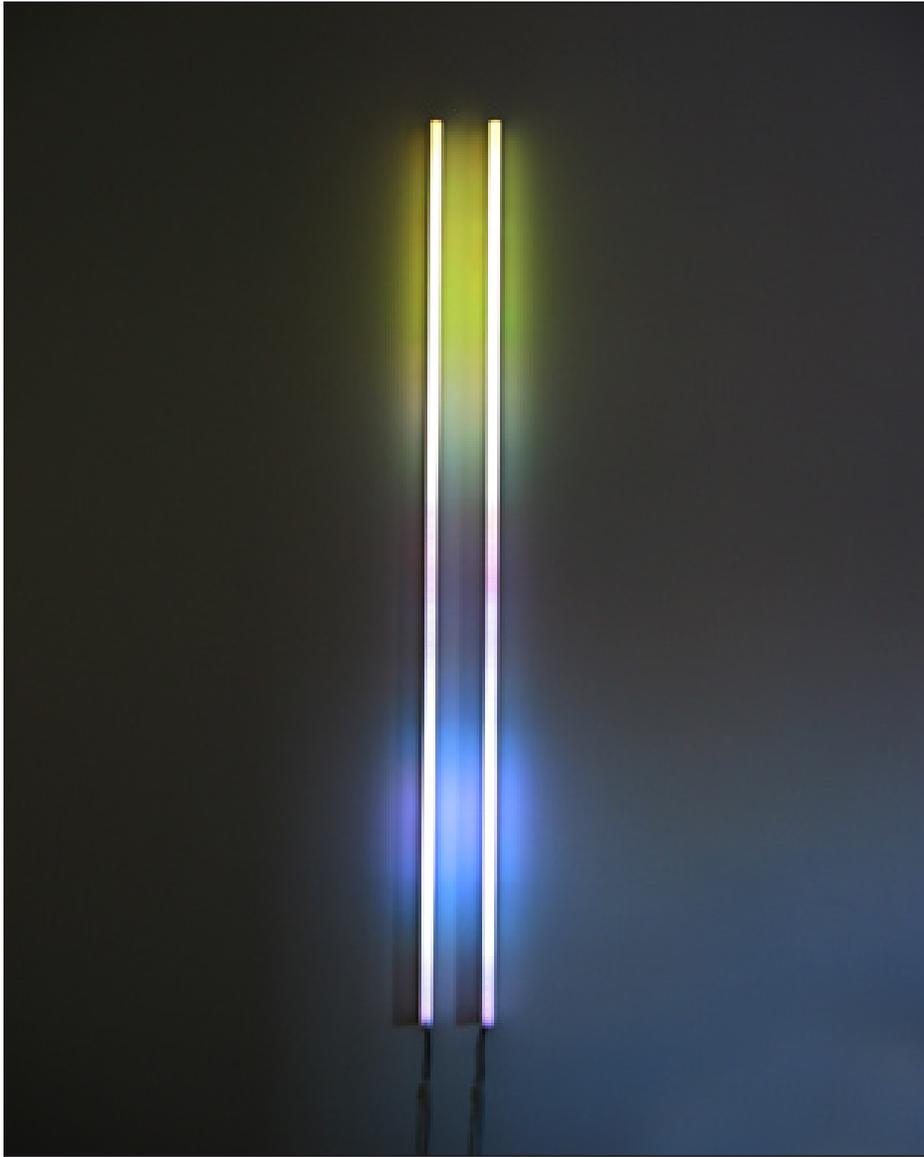
"Motion Study," by Ben Rubin, 2004 *(Photo courtesy of the artist)*.

Rubin's project is reminiscent of another architectural icon, the Empire State Building, which in 1984 began observing holidays and special events with the installation of an automated colored lighting system by designer Douglas Leigh. Though much appreciated by New Yorkers and visitors, the meaning is not always obvious. Most viewers need to consult an accompanying website or magazine announcement to decode the three-tiered language of colored lighting. A red/gold/red combination, for example, is traditionally the color of the Lunar New Year, but has also served as the signifier of the 100th anniversary of the subway system; a blue/blue/white combination has been used to symbolize everything from Colon Cancer Awareness to Greek Independence to Jackie Robinson Day. Perhaps a more rigorous ontology is in order.

Buildings that breathe

All of the projects discussed thus far are based on display systems, a reflection that we are still in the midst of a "society of the spectacle." But what if the building's façade could physically change? Does the idea raise the creepy prospect of the ever-multiplying rooms in Mark Danielewski's novel *House of Leaves?* Or something more sensuous and practical than displays that are only skin deep?

Columbia University architecture graduates Soo-in Yang and David Benjamin, whose firm is called The Living, have developed a prototype wall that "breathes." Exploring the idea of architecture that responds to internal or external conditions with movement, Yang and Benjamin came across shape memory alloy technology (SMA)—metals that temporarily change their shape at certain temperatures. Deliberately avoiding the use of fanciful 3D renderings in favor of real working prototypes, Yang and Benjamin (in collaboration with engineers at Columbia) built a prototype window that, on exposure to certain levels of CO_2, automatically opens to allow fresh air to flow in. The window can be surprisingly thin, and free of bulky mechanisms. SMA wires are embedded in a pliable transparent plastic and connected to carbon dioxide sensors. When CO_2 reaches a certain level, the wires contract, pulling open slits in the polymer. "Something like CO_2 is not immediately visible and you cannot smell it, but it is important to the environment of a room," says Benjamin. "Too much CO_2 makes a room stuffy." Benjamin and Yang now teach a class at Columbia and Pratt Institute titled "Living Architecture: Responsive Kinetic Systems Lab" and are continuing to explore their breathing skin, which they believe has the potential to alleviate conditions like sick building syndrome (where indoor air pollutants cause repeated ailments among occupants). By combining the polymer with thin film photovoltaic strips, they could also make the skin self-powering. Benjamin has boundless optimism for this line of inquiry: "We do really think that people will fall in love with this idea of bringing architecture to life, and that it may capture the imagination of the general public in the way that it captured ours."

A collaborative future

The future of architecture looks enticingly malleable and increasingly collaborative. Clearly, architects cannot produce buildings that transform themselves in response to a data feed without intense collaboration with artists, designers, programmers, and engineers. And for these collaborators, the building offers a decidedly public canvas on which to see their creations come alive. Back in the 1980s, futurists like *Wired* magazine's Kevin Kelly imagined a neo-biological era of manufactured hybrids, living silicon polymers and mutating buildings. As buildings gain the capacity to communicate, the potential arises for mutations that are useful, dramatic or, perhaps, downright mischievous.

ABOUT THE AUTHOR

Peter Hall is Senior Editor and Fellow at the Design Institute, where he edits the Knowledge Circuit and is co-editor of the DI's second book, *Else/Where: Mapping* (University of Minnesota Design Institute, 2006) Peter is a contributing writer for *Metropolis* magazine and has taught a seminar class on design theory and writing at Yale University since 2000. He lives in Brooklyn, New York.

RESOURCES

Blinkenlights project
www.blinkenlights.de

Chaos Computer Club
www.ccc.de/?language=en

Realities: United
www.realities-united.de/index.html

Pelli Clake Pelli Architects
www.cesar-pelli.com/flash.cfm

David Small
www.davidsmall.com

Ben Rubin, Ear Studio
www.earstudio.com

Minneapolis Central Library
www.mpls.lib.mn.us/newcentrallib.asp

FOR MORE INFORMATION

Visit: *www.adobe.com/motiondesign/main.html*

Better by Adobe™