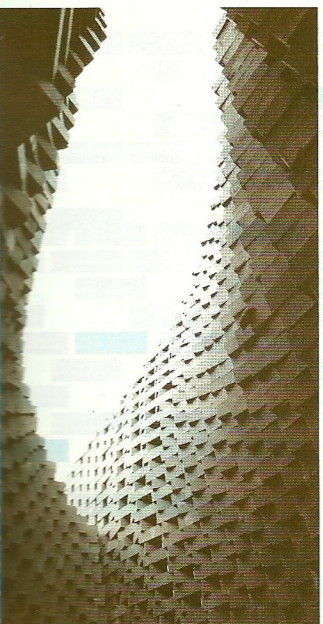


MANI ROEB

PIKE STREET LOOP: THE SCIENCE AND FICTION OF DIGITAL FABRICATION



We are two decades into the age of digitally-designed architecture, yet few seem certain of how the enormous processing power of computers will affect the look and feel of real buildings and cities. The results of complex data scripting remain largely confined to computer screens, scale models, hidden infrastructures, and elite buildings; most ordinary buildings are conceived merely as cost-efficient boxes. One approach to closing the gap between the computer screen and construction site is the development of full-scale digital fabrication—or, in the words of the Zurich-based partners Fabio Gramazio and Matthias Kohler, “digital materiality.”

The story, in the fall of 2009, that an orange robotic arm was building a wavy brick structure on a New York City street gave rise to futuristic fantasies and urgent questions. Would human construction workers, in the manner of auto workers, begin losing jobs to robots? Was the robot designing the structure as it went along, or just following a set of received instructions? Was the project to be understood as performance art, scientific demonstration, or a new kind of architecture?

As passersby and blog readers discovered, the 72-foot-long Pike Loop was a temporary installation whose purpose was to exhibit its own construction. Following three years of research at the Swiss Federal Institute of Technology (ETH), the architects were commissioned by the not-for-profit gallery Storefront for Art and Architecture to set their industrial robot to work in the median of a busy street in Chinatown. The robot, called R-O-B, executed the design for a curving, screen-like structure comprised of roughly 7,000 bricks over the course of four weeks, working in full view of anyone who cared to observe. Two human attendants monitored the robot’s work and kept its brick and glue queues well supplied. According to

Storefront, Pike Loop is the first 1:1 architectural-scale project to be built on site by an industrial robot in the US.

Pike Loop is not, on its own, a significant work of architecture, or even necessarily a work of architecture at all. But it is the latest step in a significant body of ongoing research in digital architectural fabrication at ETH, following the completion of a Swiss winery façade in 2007, an installation at the 2008 Venice Architecture Biennale, and various studio projects. R-O-B’s chief virtue is its capability to place bricks with a precision that exceeds that of a human mason, realizing hitherto impossible surface topologies. While most brick facades today are prefabricated in aggregate panel sections, the robot handles each brick as an individual pixel to be loaded into a customized surface fabric.

Just how perfect is the R-O-B’s work? When the robot leaves the protected environment of the shop, external conditions become looming contingencies. For example, the weather must be fair enough for the glue (which is less permanent and more easily machine-fed than mortar) to stick to the bricks. The trailer must be positioned and repositioned along the length of the site. The human attendants must occasionally compensate for discrepancies due to minute geometric imperfections in the air-dried bricks. And the uneven pavement of the city street required the hand-placement of wood shims at the start of the installation.

Even when site conditions are perfect, R-O-B is no master mason. It is not capable of creating the rippling solid brick elevations of Eladio Dieste’s churches. While complex curves can, of course, be molded, cast, or laser-cut in metal or plastic, Gramazio & Kohler are specifically interested in additive fabrication processes. And they are not the only ones: At the Harvard Graduate

School of Design, Ingeborg Rucker of Rucker-Lange Architects led a Spring 2009 studio geared toward programming a robot to build an undulating double-wall structure. Instead of masonry bricks, the students used wood blocks.

When R-O-B is put to work in public, it creates a kind of in-situ theater. The freight container becomes a proscenium stage, illuminated at night like a glowing kiosk in which the robot does a stiff dance. However fleeting, the construction of Pike Loop was a spectacle. Intrigued passersby snapped photos, while a local general-interest blog registered curiosity: “Watching the robot in action is especially entertaining—my friend took the video with her iPhone—as it zooms back and forth with a great swooshing noise.”⁴

Architectural construction typically becomes a spectacle at its symbolic milestones, such as groundbreaking and inauguration—and more recently, demolition. But modern architecture is not only about fixed objects; it functions as media and event, sometimes even during construction. As the Eiffel Tower rose visibly higher week by week, it triumphantly manifested the new technology that made it possible. At Pike Loop, continuous video documentation allowed the process to be condensed into a five-minute clip, streamed on the Internet and projected in Storefront’s gallery.

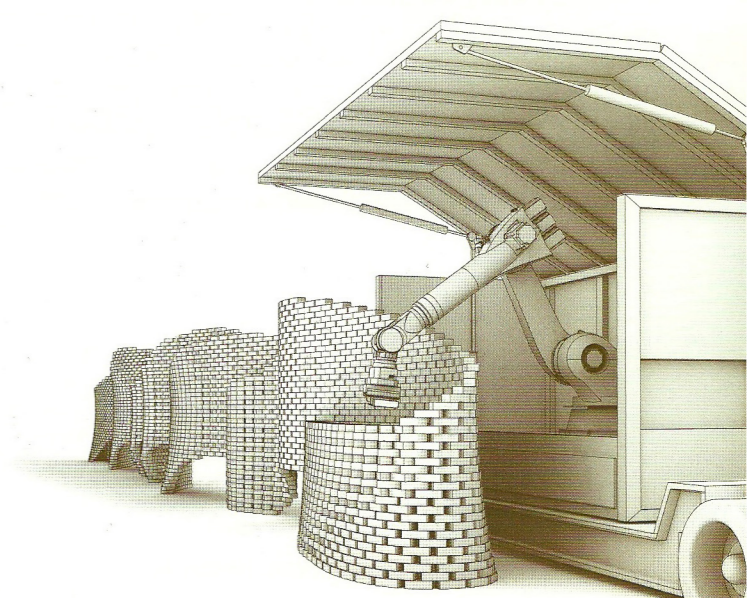
R-O-B is about more than simple bricklaying; it draws on latent fantasies of self-building buildings. These fantasies, both liberating and threatening, are increasingly believable as computers grow more sentient and fabrication techniques more automated. Extrapolating from the work of the Futurists and other avant-gardes, Manfredo Tafuri argued that technology ultimately seeks to merge with humanity, allowing for a total “mechanization of the universe” through artificially-intelligent, hybrid machine-organisms.⁵ But if intelligent robot-servants could be put to work constructing utopia, the old dream goes, couldn’t they also take power?

One vision of such a dystopian future is Superstudio’s “Continuous production conveyor belt city” of 1971. In the project the city is a gigantic machine that trawls across the landscape, “devouring shreds of useless nature and unformed minerals at its front end and emitting sections of completely formed city, ready for use, from its back end.”⁶ Over a decade later, Richard Rogers’ Lloyds of London building put a positive spin on the fantasy of auto-construction through machine-inspired detailing that implied ongoing fabrication. More recent-

ly at Schouwburgplein, a public plaza in Rotterdam designed by West8, four giant red cranes loom above the flat, open expanse. These modified industrial robots are coin-operable, striking a variety of postures to appear menacing, playful, or anything in between.

Blurring the boundary between robotic means and ends, and between living and computerized organisms, Francois Roche and his Paris-based studio R&Sie(n) have proposed Swarm Town—a complex rolling topography shaped by a team of industrial robots. Better known is their 2006 Olzweg proposal for a competition held by the FRAC contemporary art institute. Here, an industrial automaton not unlike R-O-B slides along a track, creating a highly textured wall by placing thousands of green-glass rods at different depths and heights.⁷

Like other “hi-tech” creative projects, Pike Loop wraps its artistic intention in a cocoon of supposedly neutral and rational technology. But Gramazio & Kohler reject the engineer’s cult of efficiency, and embrace the artist’s radical search for new forms, new methods, and new visions of society. No longer content to arrange symmetries comprehensible to the naked eye and sedentary body, architects may in this way become designers of codes and processes. **C**



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Images courtesy Gramazio & Kohler, ETH Zurich.

1. Aaron Betsky, “A Virtual Reality: The Legacy of Digital Architecture” (*Artforum International* v. 46 no. 1, Sept 2007), 440.
2. “Pike Loop: A Robot-Built Installation in NYC.” *Current Exhibitions*. Storefront for Art and Architecture, 30 September 2009.
3. Marcus Fairs, “On the Bri(n)ck at Graduate School of Design, Harvard University” (*Dezeen Design Magazine*, 11 May, 2009).
4. “Pike loop: a robot-built installation in nyc, really!” (*CherryPatter nyc*, 23 October, 2009).
5. Manfredo Tafuri, *Architecture and Utopia: Design and Capitalist Development*. Trans. Barbara Luigia LaPenta (New York: The MIT Press, 1979), 76.
6. Piero Frassinelli, “Twelve Cautionary Tales for Christmas.” (*Architectural Design*, December, 1971), 740.
7. Giovanni Corbellini, *Bioreboot: The Architecture of R&Sie(n)* (New York: Princeton Architectural, 2010).