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#### review

Stuart Harrison

#### photography

Courtesy Antarctica

FACIT

Gramazio and Kohler

Computer aided construction techniques developed over the course of the past two decades are gradually finding application in the 'real world' but, as **Stuart Harrison** discovers, their full potential still remains largely unrealised.

## Fast Architecture

**BUILDING IS** typically a slow game, often measured in years. Traditionally construction time has been evenly related to how long buildings last – as a percentage of lifespan it's not that much. Take a generic house, which would take maybe six months to build with a normal unrenovated lifespan of 30 years. That's 1.7 percent of the time it's around for. The Sydney Opera house took 14 years to build, and should last at the same percentage for 820 years – and this seems appropriate. Here we look at some faster architecture, itself a tradition going back through Buckminster Fuller to the lightweight Indigenous structures seen in pre-settlement Australia and around the world.

The tendency with quick buildings is they maintain a similar relationship to lifespan – the first project we will look at here, the Greenhouse by Joost, sits within this mould. Built in three weeks and lasting for three months over summer in Federation Square, the Greenhouse is now gone (but may yet re-emerge in another location). The project was a collaboration between florist Joost Bakker and architects Antarctica, and built on a previous project the practice completed in 2007 for Bakker, the Flowerpot House. That project used thousands of flowerpots in vertical screen walls to produce 'green' façades. The Greenhouse was a robust untreated blue steel-framed container

with straw-bale infill in walls and flooring, and it too employed a green façade of sorts – a giant wall of strawberries running along one side.

The site that the Greenhouse sat on, the staircase between the full-height shard and the Alfred Deakin Building, is one of the slightly less successful spaces of Federation Square. Perhaps underused, it handled occupation well. The urban role of linking the square back directly down to Flinders Street was maintained in the intervention, a path down the west side of the new structure becoming a vertical outdoor corridor. The main interior space had impressive scale and simplicity, tall – roughly square in section – and deep, running from the big window onto Flinders Street seemingly into the ground. This cavernous hall was finished with straw wrapped in plastic, exposing its innards. The materials used were partially recycled, but many not – the rest were 'recyclable', an important but sly distinction.

It was the intention for the steel at the Greenhouse to be rolled and cut on site, to both showcase the process and to increase speed and efficiency, as well as reduce waste. Ultimately, the building contractor spent the first week off-site undertaking works such as cutting – the contractor ultimately decided there was not enough space on-site to house the equipment. The process of removing the structure took just over a week.



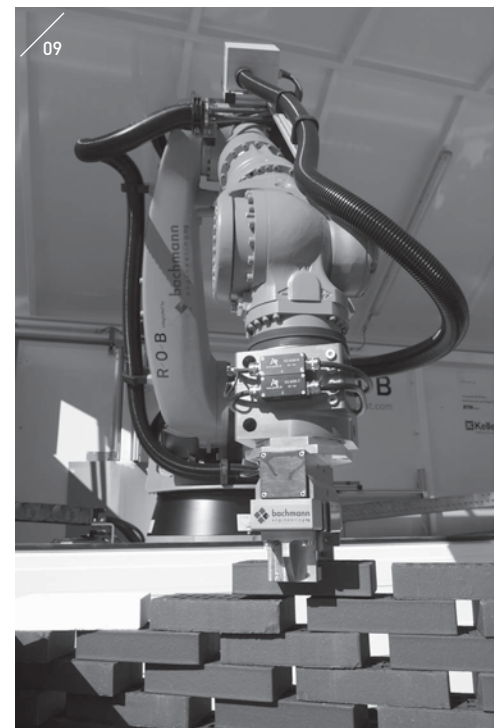
The trend in the future may be quick buildings that last a long time – and both English firm FACIT and the Swiss R-O-B-About project are rapid construction systems that deliver just this. The FACIT company boldly states, “We Print Houses”, an effective and engaging idea – as we get used to ‘printing’ physical models, why not the whole building? The slogan is rhetoric as much as anything else, as manual assembly is required, but the components themselves are all computer cut for each custom house. The hard technology is not new – CNC routing has been around for more than 20 years – but the software has improved. At the heart of the system is the use of a plywood ‘cassette’ – thick wall panels that interlock with each other to act as both walling and structure. The production is based in a workshop and then transported as these carry-able cassettes onto site for relatively quick assembly. The system is radical also in its practice model – FACIT uses a single contract process; it provides architectural, engineering and construction services.

Key to the use of straight-to-computer cutting is the removal of drawings and manual conversion. Instead of ‘measure twice, cut once’, it’s measure not at all – just push pre-cut pieces together. The accuracy enables greater rigidity between the interlocking components and adds strength to the system, as well as reducing waste through template efficiency. The spruce plywood can then be used as a finish, or cladding internally or externally. It is then commonly filled with recycled newspaper insulation in the cavity to improve thermal performance. The FACIT group built a house for Grand Designs television presenter Kevin McLeod, and this

**/01**  
Antarctica’s temporary Greenhouse bar in Fed Square, Melbourne, was constructed in a mere three weeks.

**/02 /03 /04 /05 /06 /07 /08**  
The house built for *Grand Designs* by FACIT – the “printed” components were assembled on-site in two days.

**/09**  
R-O-B About, a portable computer-controlled brick layer, is incredibly fast and superhumanly accurate.



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took two days to assemble following three weeks of cutting using one CNC machine.

The R-O-B About system is perhaps the most revolutionary method discussed here, but also the most embryonic. Showcased for the first time in exhibition at last year's Venice Biennale, this is a computer controlled robotic brick laying machine. It looked like a car-building robot arm had walked out of the car factory and made its way to Venice – in this case, via a crisp white shipping container.

In the Swiss Pavilion the robot produced a series of undulating three-dimensional brick walls that incrementally tested the possibilities of staggering brick. Perhaps most engaging was the ability for a single skin brick wall to become self-supporting when it takes this form. The installation at Venice was two-fold – the machine out front (the tool on display), and within the Pavilion and its courtyard the wrapped 100-metre-long brick wall, with breaks for pedestrian access. The frequency of undulation is related to the path of the overall curvature – the wall gets a 'higher pitch' when running straight to give additional rigidity. The project is pure research and in its nascent stage, a collaboration between architects Gramazio and Kohler, ETH Zurich and Keller AG Ziegeleien. The project automates the timeless act of bricklaying, and doesn't just bring super-

speed to the process, but superhuman accuracy – it would not only be slow to build these walls by hand, it would be effectively impossible. This is due to the incremental positioning differences involved in this digital system. The difference between two elements (bricks in this case) is small; however, the overall system of organisation goes through considerable change.

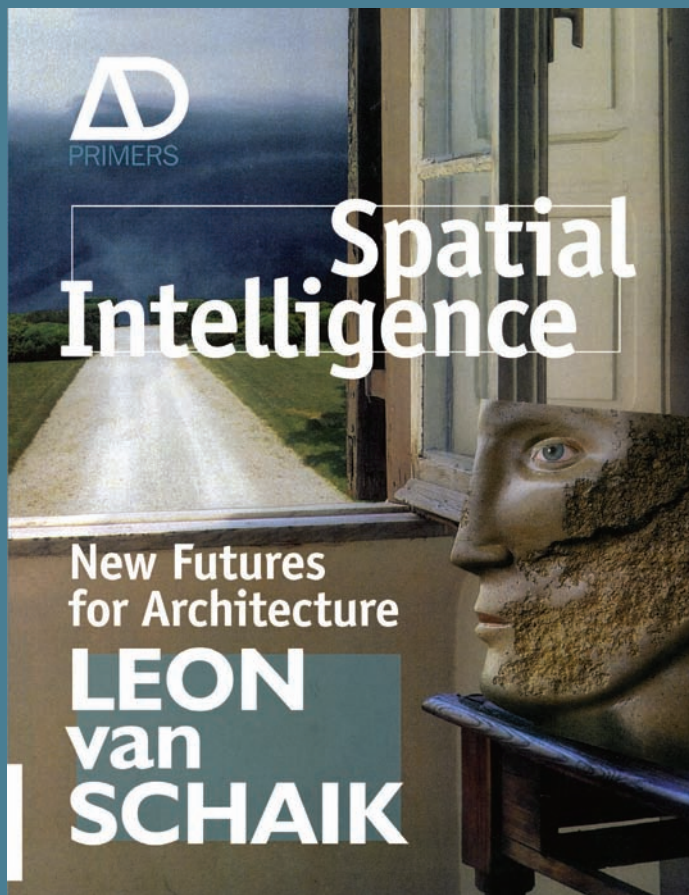
The bricklaying process involves using glue rather than mortar; the brick is picked up by the arm, passed over a fixed gluing tip, and then laid in place. Unlike the FACIT system that recognises the strength of the computer led prefab process, but uses people to carry and assemble the pieces, the R-O-B About process is more about moving the machine to the site and letting it go – bringing the manufacturing out of the factory to the job. While FACIT claims its system has the potential to locate the cutting hardware on-site to reduce transportation and increase speed, this has yet to be tested.

Speed equals distance over time. In fast building it could be volume over time, cubic metres per hour. The Greenhouse was built at about 3.2 cubic metres per hour. The interesting issue facing a group like FACIT remains design time – they still have to design and then importantly go through arduous planning processes just as we do in Australia. Faster building

techniques, through partial prefabrication, may not have a massive effect on overall project time. Often less than half the time spent on a typical residential project is absorbed in construction. In this way, 'design' time is the longest period, and this is held up most of all by planning/development applications. A national planning code in Australia with set rules that architects can creatively work within would present an opportunity to fix the goalposts, and reduce the amount of wasted time for all involved. This code could encourage quick construction, energy minimisation, actual orientation and the retention of existing buildings where possible.

Digital techniques offer a bridge between CAD and construction, and removing drawings and traditional modes of issuing information may expedite the areas of design time that we have control over. Building may become more like assembly than what we would understand today to be construction. Making architecture faster is possible, but 90 percent of the quality comes in the first 10 percent of time – getting the initial design right. Everything after that can be on fast forward. **ar**

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## Spatial Intelligence: New Futures for Architecture

Spatial intelligence is one of man's most underrated human capabilities. The result of millions of years of evolution, it enables us to navigate our way through our daily lives. It is less consciously applied than linguistic, mathematical, kinetic, natural, musical or personal intelligence. Despite architecture's dependence on spatial knowledge and experience, the discipline remains bereft of a theoretical underpinning. Understanding and knowledge of space is only pursued through precedent and challenged with experience, but the role of every individual's history in space, the unfolding and developing of their spatial intelligence is largely unaccounted for. This book argues for a greater continuum between our spatial intelligence and the built environment, and thus a greater connection between architecture and everyday life.

Providing an overview of spatial intelligence as a human capability, this book also acknowledges how widespread recognition of it in architectural education and the profession should enable the demystification of the practice of design, forming the basis of a more democratic interface between society and practice.

Ultimately, it suggests how spatial intelligence might provide exciting new opportunities for practice in the linking of real and virtual environments in the information age.

**Leon van Schaik** is Professor of Architecture (Innovation Chair) at RMIT, Melbourne, Australia. From his base in Melbourne, he has promoted local and international architectural culture through practice-based research. In 2006 he was awarded an Order of Australia, Officer (AO) in the General Division, for service to architecture as an academic, practitioner and educator, and to the community through involvement with a wide range of boards and organisations related to architecture, culture and the arts. He is the author of *Mastering Architecture: Becoming a Creative Innovator in Practice* (John Wiley & Sons, 2005), and *Design City Melbourne* (John Wiley & Sons, 2006).

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