"SPACE CRAFT: DEVELOPMENTS IN ARCHITECTURAL COMPUTING" DAVID LITTLEFIELD

SECTION OPENERS

1 EVOLUTION & EMERGENCE

At its most explorative, architectural computing hinges on a new relationship between the user and the machine. Here, the computer is treated not as a dumb slave at the beck and call of of its operator-master; rather, it is treated as a thing of some intelligence. The architect or engineer is not a placer of lines and arcs but a writer of programs, a setter of rules and an asker of questions to which there are no obvious answers. Perhaps these programs are constructed in such a way that they rewrite themselves according to what they have learned. It is a practice that seeks inspiration from biological systems, genetics, brain models and chemical processes. When applied to the architectural realm the results can be intriguing, surprising and challenging – but almost always revealing and useful. Solutions do not necessarily reveal themselves suddenly; rather, they emerge over time as a the result of a sequence of selective steps. Solutions evolve.

2 ARCHITECTURE AND STRUCTURE

Through the application of pure geometry and analysis from the very start of a building project, digital modelling can bring the disciplines of architecture and structure into a closer relationship. Like a medieval Gothic cathedral, the one is seemlessly an expression of the other. This, consequently, triggers a closer relationship between what has become two distinct professions and architects start thinking a little like engineers, and vice versa. It fosters an architecture of purity, robustness and rigour that is more than skin deep. A building's curves, the position and incline of its columns, the junctions between its surfaces – all are simultaneously aesthetic, practical and structurally considered moves. This is not an arrchitecture of floors, walls and ceilings, but one of planes and geometric relationships.

3 ANIMATION, DESIGN INTERROGATION, DRAWING

Techniques of visualising and depicting buildings are moving closer to the mainstream design process. Indeed, it is a modern curiosity that design teams are having to show what their completed building will look like (its shadows, its reflectivity, its texture and impact on the environment) at every twist and turn of the design process. Verifiable views, the recreation of context, the instant demonstration of how a designer's abstract idea will manifest itself . . . these are becoming design tools rather than post hoc illustrative ones. Moreover, any visualisation is often an amalgamation of a large number of techniques (not all of them digital) including laser mapping, stereo-photography, rendering, montaging, scanning and even conventional drawing. The result will only ever be a representation (a la Magritte's "Ceci n'est pas une pipe") so pretentions to realism are not always helpful. Sometimes the drawing shows more clearly the idea of a project than the final building itself. It is not a matter of "does this image look realistic" but "what is this image for?"

4 TECHNOLOGY AND FABRICATION

If the digital model has been well-made, and analysis demonstrates that it is an object of integrity, then it can be fabricated. Whether through rapid protoyping, full-scale manufacture or the cutting of components and templates, almost anything that can be modelled can be made. Indeed, complex forms need not be composed of complex components. Flat surfaces can be twisted, folded and otherwise manipulated into a collection of elements that combine to form 3-dimensional forms that belie their elemental nature. Furthermore, digital processes can provide a new degree of certainty within manufacturing – if the pieces fit together in the model, there is no good reason why they should not fit together on site. Better than that, computing opens up the possibilities of mass customisation. Large economies of scale may no longer be necessary to make a component financially viable; architects can create bespoke forms from bespoke components without requiring fantasy budgets.

5 MODELLING THE UNSEEN

The beauty of the digital model is that it can encompass that which a 2-dimensional drawing cannot: temperature, air flow, the behaviour of smoke, light and acoustics (and even people). It is this facility – one of ensuring that a new building makes its occupants feel safe and comfortable – that makes modern architectural computing particularly compelling. It acknowledges that buildings are not artefacts to behold, but spaces to be experienced. It is an emerging science – wind tunnels are still managing to retain an edge over computer programs, while (for the time being at least) software cannot take full account of human psychology in a panic sutuation. But they can certainly replicate the process of a fire drill and predict how a structure will perform when set alight. These are things which once lay in the territory of experience and the rule of thumb, but which are now becoming expressed as mathematics.

6 COLLABORATION

Collaboration provides a "dimension" to 3d computer modelling which, if unexplored, leaves architectural computing an incomplete resource. Collaboration – whether manifested in file-sharing, interoperability, the building information model or anything else – lies at the rather prosaic, workaday end of digital

modelling. But it underpins all the analysis, simulation, testing and fabrication described elsewhere in this book. Without any sense of the art of collaboration, the complex and wonderful 3d model sitting within a hard drive would be ripe with possibility but little else. Proper collaboration requires planning and discipline, but the benefits are considerable: less risk, less error, more certainty and more capability.

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