photo Bata Shoe Museum

Dreaming of metaphors for ecodesign: Lightness

***Adriaan Beukers**, one time Dutch rocket materials scientist, is these days overseeing a revolution in new synthetic fibres. These superlight composite materials promise elegant strategies for environmental design solutions. Here Beukers talks about how this design and engineering movement is growing.*

In Holland, a culture of 'lightness' is beginning to take root. Or, at least the first shoots of a new way of thinking around the key metaphor of lightness are beginning to emerge as a fully formed conceptual approach to how we design and organise the man-made world around us.

'Lightness' is about the integration of a new generation of lightweight, fibre-reinforced polymer materials, part of the family of synthetic and natural fibres. These materials are being used in many areas of the designed and built world, from vehicles to aircraft, from buildings to specific things – such as beer kegs and windmill rotorblades. The area of research builds on earlier investigations into the use of radically lightweight structures, developed for aerospace engineering at Delft University of Technology. For those involved there seems to be considerable confidence that, in the words of one paper, composites are 'on the brink of a new industrial revolution.'[1] Apart from Delft, 'Lightness' as a guiding metaphor has been embraced by other Dutch design organisations, including the Foundation for Smart Architecture, the Dutch Design Institute, and a design movement nattily titled Droog Design (Dry Design). In fact in 1999, the Design Institute published the ground-breaking book, *Lightness; the inevitable renaissance of minimum structures*. It has done much on mainland Europe to spread the word about this way of looking at the world. With that dispersal of influence, the notion of lightness as the key to apprehending the relationship between design and sustainability, has joined together others with separate though overlapping conceptual tools – notably Factor Four, and those of the ecological rucksack – allowing designers, builders, anyone actually, to understand the nitty-gritty of what practical sustainability boils down to.

It goes further than this though. As Adriaan Beukers – co-author of the 'Lightness' book, and one of the main players in the development of the field – repeatedly points out, the tradition of 'lightness' is a very long one. It stretches back to prehistoric times, and the consequences of human powered transportation. Until the domestication of the horse and other animals, travelling humans would have had to have lived within the constraints of their own carrying capacity. They would have had to travel 'light', and necessity being the mother of invention, would have developed ways for covering the furthest distances, whilst expending the least energy. Only with the changes instigated by the use of the horse, and what followed – from caravanserai, to train, to internal combustion powered vehicle, did carrying capacity outgrow these constraints. This has meant a gradual abandonment of the pre-modern lightness principle. With industrialisation and the mass adoption of metals, weight became, relatively, irrelevant, an evolutionary pathway which has led progressively down a cul de sac. It has inculcated bad habits; a reliance on ecologically heavy materials and methods, both in themselves, and for their transportation. Today, the results have included exponentially rising costs for transporting goods and people, in terms of energy input, and in terms of transport infrastructure. The clear implication is that "transport needs less energy if we develop lighter vehicles and reduce the weight of transported goods and packaging."[2] Which is where low density materials come in.

Environmental research factories such as Factor Four at Wuppertal, have shown that buildings, and the construction industry, account for 40% of European energy use. Architects, taking on the Lightness metaphor, and following the lead of Buckminster Fuller and his geodesic visions, have increasingly pursued structures which rely on the dynamic relation between tension and compression, whilst optimising the inherent properties of the materials being