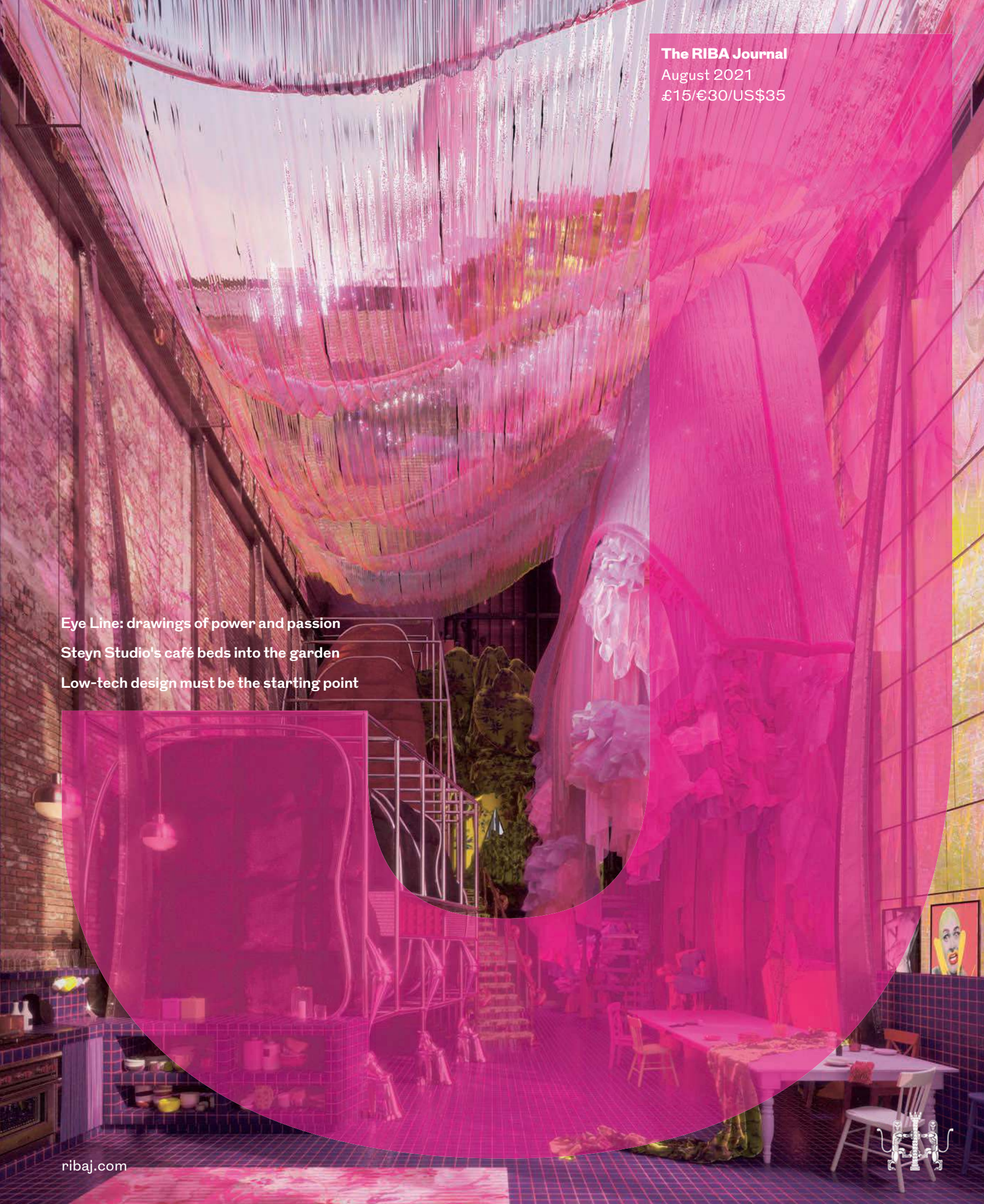
The RIBA Journal
August 2021
£15/€30/US$35



Eye Line: drawings of power and passion

Steyn Studio's café beds into the garden

Low-tech design must be the starting point

Sustainable Architecture

Design, construction & technology

Make low-tech our mantra

The carbon-rich technologies that launched modernism and high-tech now fuel climate change. A reset to sustainable, low-tech design is now imperative

This image The lengths of UK-grown Douglas fir defined the span of Feilden Fowles' studio in south London, based round a simple pitched extrusion.
Right Simple pinned and flitch joints were designed for ease of assembly and disassembly of the studio.

Edmund Fowles

The architectural approaches of recent years, often gathered together under the unsatisfactory umbrella of 'contemporary' architecture, appear to be falling well short of the radical reform needed to tackle today's climate and biodiversity emergency.

Without a compelling theory of architecture to respond to the challenges and opportunities of our own age, spatial and material ideals instilled by the modern movement still define mainstream attitudes to building.

A century ago, in 'Vers une Architecture', Le Corbusier dismissed over-stylistic trends, rejoicing in the possibilities of mass production and materials such as reinforced concrete, which facilitated his use of pilotis and ribbon windows to enable the free plan.

A generation later, digital design tools and advanced manufacturing processes facilitated the seemingly limitless structural possibilities of the high-tech movement. Paired with the optimism and boom of the 80s and 90s, it led to an extraordinary development in methods of construction, fit for the scale of global growth that followed. The best examples of high-tech were dazzling in their clarity, efficiency and elegance of structural expression, such as the 1971 Centre Pompidou by Rogers and Piano in Paris.

However, Richard Rogers' stridently cantilevering final building this year felt particularly poignant. Given the Château La Coste Gallery's flagrant disregard for embodied carbon, it seems a fitting memorial to mark the end of an era, and a new agenda.

Today this attitude of excess is perhaps no better showcased than in the work of Bjarke Ingels' BIG, who turbocharged Mies van der Rohe's maxim 'less is more', for a 21st

DAVID GRANDORGE (3)

Right The timber beams of Feilden Fowles' studio cantilever outdoors to support a covered walkway.

Over-technologisation and mechanisation has made buildings that offer little to nourish the soul

century audience, in his 2009 book titled 'Yes is More!'. Form now seems slave to the big idea; as it is technologically possible to do just about anything, resulting in buildings that are undulating, contorted, writhing masses of glass and steel and concrete. The logical end of modernism, 'Junkspace' as Koolhaas prophesied, is here.

Move away from stylistic eclecticism

This insouciance, where 'the idea', fuelled by boundless technological capability, eclipses rationalism, must be challenged in an age of depleting resources and an urgent need to reduce carbon emissions. Fortunately, a new generation of practitioners and thinkers is leading a growing shift away from the preoccupations of modernism and stylistic eclecticism, towards leaner, more vital forms of architecture. We call this approach low-tech.

While Le Corbusier drew from the cutting-edge technology of the time, little formal inspiration can be found in a microchip today. Compared to the wizardry in your smartphone, buildings are relatively simple accumulations of material, yet they have somehow become slave to technological advancement.

Over-technologisation and mechanisation has resulted in buildings that are such finely wrought, finitely controlled, antiseptic glass and stainless steel edifices, they offer little to nourish the soul. One outcome, sick building syndrome, is a worsening clinical condition recognised by the NHS. Clearly something is wrong when, instead of nurturing us, buildings make us ill. It is no surprise following the Covid-19 pandemic, many would prefer not to return to inner city offices. This reflects a broader social trend – a resurgence in people seeking reconnection with nature through craft, making and the outdoors, as a counterpoint to living life online.

Low-tech seeks to re-balance the relationship between buildings and technology. It is about leanness, fewer components, a preference for natural, low-embodied carbon materials, reduced reliance on technology and mechanical servicing, robustness and flexibility – in essence, simplicity.

These practical tenets combine with broader social, wellbeing and ethical ambitions, ranging from ensuring buildings have sufficient access to green space, to the responsible sourcing and fabrication of materials, supporting and stimulating local craftsmanship. In this way it shares many of the social ambitions of the Arts & Crafts movement, echoing Ruskin's 'truth' – using handcrafted and an honest display of materials, and 'memory' – creating buildings that respect the culture from which they have been developed.

But far from being anti-technology, low-tech is interested in using all forms of it as efficiently and sparingly as possible. It always seeks the simplest solution to the problem – vital in an age of resource scarcity.

In fact, to create leaner buildings, there is a greater reliance on new digital technology to model and quantify outcomes. Low-tech approaches must combine intuitive design, often looking back to historic precedents and forgotten methods, with the meticulous and empirical processes of iterative design, digital modelling and measurement. It relies on the advancements in digital design tools, such as IES (Integrated Environmental Solutions) and embodied carbon calculators, which are now vital to the design process to tune, refine and whittle designs down to their essentials.

The challenge of course in this reductive approach is the risk of buildings becoming stripped bare of expression or exuberance.

We believe there are great opportunities for architects to define a new, low-tech language of architecture, and have been experimenting both in our own work and learning with interest from other practitioners.

New opportunities for exuberance

We built our own studio on a meanwhile site in Waterloo, in 2016 (RIBAJ, May 2017). It was our first attempt at a truly low-tech building, in part due to our limited budget and the imperative that we would one day have to dismantle and move it. But this was the start of a great partnership working with structural engineer Peter Laidler of Structure Workshop. Parameters were set early in the design process, such as using solid homegrown timber for the frame. This in turn defined our maximum span of 8m due to the availability of Douglas fir sections. The building, a simple pitched extrusion, was designed very much in section, optimised to harness direct light and warmth (in winter) from the south, with an asymmetric pitched roof generating a clerestory window offering diffuse north light deep into the plan. The beams cantilever outdoors, forming a covered walkway, doubling to shade the south-facing glazing in peak summer months. Slight angling of the northlights creates a small zone between the glass and north wall, to expel air at high level and stimulate passive cross-ventilation.

These simple calibrations were measured and iterative, optimising the form, aspect and aperture of the frame. All frame connections were designed for ease of both assembly and disassembly, using simple pinned joints with flitch plates. We wanted each element of the building to work as hard as possible and often

to fulfill more than one purpose. For example, the ply sheathing to the roof and perimeter walls doubles as the visual lining, there is no plasterboard nor wet trades involved. Gutters and downpipes were eliminated, with run-off from the cantilevered canopy captured by a rill below and delivered to the garden. The result is a building which achieves an embodied carbon of just 310kg/CO_2e/m².

The studio building proved instrumental in putting into practice our early thinking on low-tech principles. The challenge is how to scale these ideas, but recently we have been trying to apply and develop these principles through larger, more high-profile projects.

The complexity of modern cavity wall construction, with endless layers and secondary elements that will degrade and fail over time, led us to explore the use of solid masonry wall construction on a trio of buildings at Green Templeton College, Oxford. This approach also reduces the associated high Kg/CO_2e of typical steel or concrete frame infilled with blockwork. To model the thermal characteristics, we worked closely with Structure Workshop, which developed its own embodied carbon tool, and Ritchie + Daffin environmental and services engineers. The proposed construction simply uses two densities of Porotherm blocks. Extruded clay captures air in a matrix of voids to increase its thermal properties while omitting the need for cavity insulation. They are load-bearing up to four storeys, with floor slabs bearing onto the inner block. They can be simply finished inside and out with lime renders, achieving a breathable system that also moderates internal humidity and has exposed thermal mass, reducing temperature fluctuations. This method of construction eliminates swathes of materials: cavity insulation, wall ties and trays; building papers; secondary structure; plasterboard and so on.

FEILDEN FOWLES

Above Can low tech design be scaled up? At Feilden Fowles' National Railway Museum York Central Hall a 3500m² timber frame is planned.
Below A low tech and radically simplified wall built up with Porotherm for Green Templeton College, Oxford, by Feilden Fowles.

It also raises interesting questions about the formal possibilities of more primitive and low-tech construction approaches combined with factors such as the reduction in glazed area to lessen heat loss. The result is a more stereotomic architecture, where openings are carved from a singular mass forming deep reveals and more dramatic play of light and shadow.

Working with natural materials

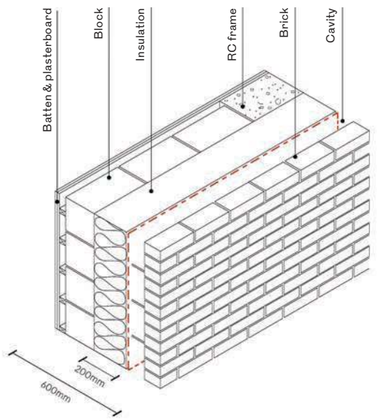
We pursued this monolithic language of architecture, with deep load-bearing walls, activated to serve multiple purposes, at Yorkshire Sculpture Park on its gallery and visitor centre, The Weston. Aware of the scrupulously controlled environments often required to moderate temperature, humidity and ventilation to preserve artworks, we talked to Julian Cottrill of Skelly & Couch, about how to achieve this. Julian told us how natural materials buffer moisture and humidity in many historic, vernacular buildings. This is due to the hygroscopic qualities of materials such as lime and clay, which can absorb moisture from the air. Despite this, the science and data have only recently been developed, notably by Tim Padfield at the University of Denmark.

The concept was developed through a mixture of thermal modelling using IES, spreadsheet humidity calculations and measurements taken on the hygroscopic properties of specific clays. The resulting design uses 10,000 unfired clay bricks, arranged in a labyrinth within a deep section of wall adjacent to the main gallery space. Air is drawn through here to absorb humidity before reaching the gallery via a discreet low-level plenum.

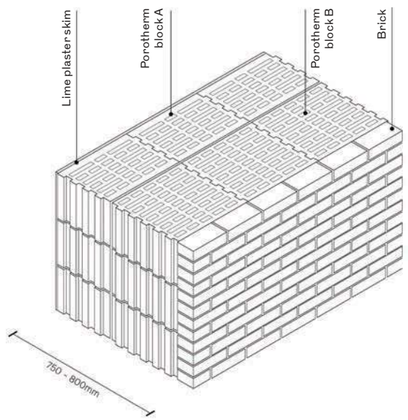
This passive humidity buffer reduces energy use compared to mechanical systems by up to 60%. It was however only possible due to the client's boldness in departing from the norms of a highly serviced and controlled gallery environment, often dictated by artwork owners and insurers. Humidity records have shown that the system is able to achieve very slight humidity variations of just +/- 4%. It goes to show how much construction wis-

> Much construction wisdom has been lost over years that is only now being resurrected

Traditional RC frame block and brick cavity



Porotherm solid wall construction



dom has been lost over years and only now being resurrected. It can be seen in companies like Ty Mawr, a manufacturer and distributor of sustainable building materials based in Brecon, which has long promoted the benefits of age-old materials and forgotten methods of building. There are great opportunities for architects to employ these techniques and materials on new commissions, although with more contemporary applications.

Such an approach has been brilliantly demonstrated by Practice Architecture, which featured in the recent RIBA Architecture Anew talks. The Flat House project at Margent Farm in Cambridgeshire, uses hemp grown on site to form prefabricated, timber-framed cassettes containing hempcrete, which constitute the main wall construction system of the three-bedroom house. Not only does the hemp serve to sequester carbon; minimising the distance between raw material production, harvesting, processing, manufacture and delivery, it significantly reduces the project's embodied carbon. The standardisation of panels also seeks to democratise construction by assisting with maintenance and operation, future upgrading and replacement of parts. This pioneering project is being used to drive further research by Material Cultures – an R&D initiative that came out of it – into sustainable and natural construction materials, in turn supporting circular economy principles.

It is encouraging to see a range of public projects being delivered that echo these emerging low-tech principles.

To initiate real change at scale we need intelligently defined policy and radical regulation

RORY GARDINER

PALOMA GORMLEY

Below Mae Architects used recycled materials including waste-based StoneCycling bricks on Sands End Community Project.

Right At Flat House by Practice Architecture hemp grown on site is used in timber cassettes – the main wall construction.

Materials plus restrained approach

Sands End Community Centre by Mae combines the use of recycled materials with an intelligent and restrained approach. The centre's placement, orientation and massing reduces overheating, maximises natural daylight, and promotes passive ventilation.

Project architect Michael Dillon describes how the material choices had to work as hard as possible, obviating the use of unnecessary linings to use less material more efficiently. Over 35% of the building's materials contain recycled matter, together with a CLT timber structure that has been responsibly sourced and will sequester carbon rather than produce it. One of the key contributors to this impressive figure is the use of StoneCycling bricks, a revolutionary product using waste – in this instance, recycled glass – to form up to 70% of the brick compound. The reformed bricks are fired with 'forest compensated gas', which means trees are being planted to compensate the footprint. The resulting brick therefore has far lower embodied carbon than newly formed UK brick – and upcycles construction waste.

Scale remains one of the greatest challenges to the low-tech agenda. While there are many exciting and encouraging projects they remain of a relatively modest size. It is hard to conceive how these principles may be effectively and economically scaled up to larger buildings, but we are now embarking on a project with The National Railway Museum in York on its new Central Hall project, putting forward a 3,500m² solid timber frame. Fortunately, the Science Museum Group, which runs the museum, is an ambitious and enlightened client.

To initiate real change at scale, architects need inspired and visionary clients, developers and patrons to buy in, but vitally we need the backstop of intelligently defined policy and more radical regulation to kick the construction industry as whole into action. The RIBA's 2030 Climate Challenge has set admirable and ambitious targets for architects to move towards, but they remain optional and we need regulation to catch up.

More restriction and a need to reduce will of course be seen as regressive by some, but it should be framed positively as the spirit of our age, reflective of the broader societal changes we will need to embrace over the coming decades – consuming and travelling less, moderating our diets and even comfort levels.

Architects must seize this opportunity to define a new language of architecture for our time. Actually, less is less, but today that is precisely the aim. ●

Edmund Fowles is director and co-founder of Feilden Fowles