RED in architecture: An ecotropic approach

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The teaching of sustainability is an important aspect of the methodology of the Department of Architecture at the University of Pretoria. It forms an important part of what the department wishes its students to 'think, feel and do'.

The introduction of the Sustainable Building Assessment Tool (SBAT) implies that sustainability is nothing more than good and appropriate design. A design that has good fit with its brief is strategised around the essence of the problem and responds in a resource-efficient way that is self-evidently sustainable. This has led to the use of the term **resource-efficient design** (RED).

In the School for the Built Environment at the University of Pretoria, RED is not only presented to students in architecture, but also to students in interior and landscape architecture.

Think

Ecosystemic thinking is an approach that has emerged from the field of psychology, particularly as it is reflected in the writings of Jordaan and Jordaan. In South Africa, it has a long tradition and can probably be traced back to Smuts' holism and evolution (2006) and John Phillips' biotic community (1931).

To think ecosytemically is to think of systems as nested, each as part of a larger system; made up of subsystems, which in turn form part of a suprasystem. These subsystems can develop properties that are emergent and thus uniquely properties of the suprasystem and not found in the subsystems. One can thus speak of the ecology of building materials as biologists would use and understand the term, and see each element as part of a larger whole that impacts on other subsystems and suprasystems. It is proposed that design that has such a fit should be termed 'ecotropic' rather than 'green' or 'sustainable'.

The idea of emergence in systems originates from the thinking and writing of Ilya Prigogine and Isabelle Stengers, popularised in their book

Order out of chaos (1984). Central to their thinking is that while the universe may be an entropic system, embedded within it are events that display neg-entropy. Within these systems, order emerges from chaos. These systems display emergence where the emergent properties are more than the sum of their parts. They therefore display acquired characteristics that cannot be predicted from the characteristics of the constituting subsystems.

While it may seem obvious that all things are natural, and so subject to natural law, as an idea it does not resonate naturally with human thought. We are used to thinking in dualities. If we are of nature, we do not have to become more natural, rather, perhaps, we reflect more deeply on our own nature. Even when well embedded in theory, the designer tends to revert to a thinking of a 'natural world' – in opposition to that of the 'cultural'.

Longer-term strategies rather than immediate goals are important.

We have deliberately endeavoured to broach this dichotomy of thought by introducing the term 'biophysical' for all where human activity is not dominant, as opposed to 'cultural' where human activity dominates. Both of these are embedded as subsystems in so-called 'nature' and are consequently considered as natural. Any activities that undermine the persistence of any of these systems must therefore be considered 'natural', even when destructive. Industrial ecologies are considered as systems in the built environment, and so, when designed for, might contribute to the larger whole through

Incremental change is more sustainable than revolution.

the emergence of unpredictable properties at the urban scale.

Fridjohn Capra's *The web of life* (1996) introduces the student to many concepts that are useful when thinking about sustainability. They are concepts that come from the natural order, such as autopoiesis, homeostasis, iteration, emergence and generative processes.

In the analysis of systems, there are quantitative as well as qualitative aspects. What we value cannot necessary be quantified and that which is quantifiable is not necessarily valuable.

The last 40 years has seen an exponential growth in our ability to predict or model complex problem sets through the aid of computing. Students are exposed to these contemporary tools and are expected to understand their use in iterative processes – a process of feedback, evaluation and adaptation. Computing is not the only way of quantification and more 'primitive', but intuitive

tools are also presented and used to ensure that scholars develop a core personal understanding of issues such as solar shading and the forces of air movement. Computation, while being extremely useful, also has the potential for fascinating the mind, thereby dominating the design process and steering the final design towards a purely technocratic solution.

The obverse – that which is not measurable is not necessarily valuable – is a much more difficult aspect to teach, since it is dependent on developing an empathetic understanding of need. Such understanding necessarily requires life experience, something that cannot be taught in a classroom. Here it is important to expose students to real problems with real people who have real needs. Exposure to this is sometimes disturbing to students.

In analysis, we focus on the social, which is qualitative with quantitative aspects; economic, which is quantitative with qualitative aspects;

and environmental, which is the balance of the qualitative and the quantitative.

Students are encouraged to engage with the biophysical as a resource and inspiration in design resolutions. This engagement with the larger 'site' includes aspects ranging from the tangibles of cultural palimpsest to intangibles such as the dimension of time. Projects aim at creating an awareness of the biophysical, not only in the possibilities this might hold for the designer, but also in the impact that the biophysical will have on buildings. Steward Brand's *How buildings learn* (1994) forms an integral part of this process.

Where there is fit between context and design response, there is fitness. The idea of 'fitness' is again a biological concept as, for example, in the notion of 'survival of the fittest'. The idea of design as something that has 'fit', requires a deep understanding of the context in which the designer is working, for only through a full understanding of the

context can the determining aspects that characterise the design solution be identified.

Feel

Sustainability is the attempt to harness our understanding of the natural order and natural laws so as to be able to spend more time as a species on earth. This involves personal sacrifice, which is a moral issue. A new mindset requires a change in the ethical standards by which we have come to judge our successes.

Essential to our thinking is empathy. Many students, by virtue of their backgrounds, are unaccustomed to engaging with the diverse aspects of the culturally and economically disparate realities of a Third World, and so direct contact is important. Empathy can only be engendered through engagement. It is only through empathy that appropriate design responses can be found that 'fit'.

By finding 'fit', professionals in the built environment not only allow for current 'fitness', but also for future growth. This fit should be 'loose' enough to allow for this growth and, with an embodied energy, high enough to make it valuable and low enough to allow for change.

Students are required to strategise around the problematiques of a specific location and generate strategies for development that react as nested systems with loose enough fit to adapt over time as new eventualities emerge, but with enough rigour to energise them for long-term impact. The designer may not always be present at the realisation of the design intent. Hence it is an imperative that the residue of this realisation is seen as acting as catalyst and stimulus for the actualisation of the intended change.

Small change is valuable.

Building on the thinking and work of Nabeel Hamdi, we believe that small interventions that impact on systems by gradual evolution and that do not upset social hierarchies are more likely to succeed and catalyse change. As is evident in Hamdi's *Small change*, it is the act of enabling that produces results, not the act of providing results that can never make allowance for growth. As Schumacher states in *Small is beautiful*: "In practice all prediction is simply extrapolation, modified by known 'plans'… As a matter of fact there are no rules; it is just a matter of feel or judgement… what can you predict?"

Students are lead to realise that no single solution exists to the multifaceted problems designers are confronted with in the real world. Engagement means allowing for emergence. No intervention is too small, but can easily be too large. The critical intervention requires the necessary minimum, even though this may seem simple. Buildings that are tightly bound by the requirements of the programme are more likely to fail or soon become redundant, other than those that have a loose fit. Programmatic design leads to rapid obsolescence. Form does not follow function, fitness follows fit.

Decision-makers must know how to modulate their involvement as designers in the process and know when to approach specialists for design solutions. The complexity of the biophysical environment, as understood from a holistic perspective, requires an input from the full range of diverse talents that is available in society and cannot be resolved through the limited responses of any one person. The implication is that the designer,

as 'master', is superseded by the designer as catalyst and facilitator. Design is not merely a product, but is a moderator of the environment.

Do

Design responses are seen as part of those ecologies of the built environment that are emergent, so that the designer is not only delivering a product, but is plugging into and optimising processes. In the feed-through cycles of resources, design should optimise the retention and delay and minimise the production of waste. Cradle to cradle, rather than cradle to grave.

All solutions are presented as hypotheses that are tested through modelling. Thereby design solutions are presented as the optimisation of the essence of the problem. Designs are expected to be optimal, appropriate and applicable. When designing, the programme of a brief must be seen as facilitating the design response. But if "buildings learn", it is also important to take long-term strategies into account as a resource in the design response. The designer has the obligation to enrich the brief, seeking out opportunities for 'double-functioning' elements and the 24/7 cycling for uses.

Interventions should be 'long life, low energy, loose fit', a concept coined as title to a Royal Institute of British Architects (RIBA) probe into the long-term use of buildings as announced by the RIBA president, Alex Gordon, in 1972.

Waste must be seen to offer opportunity. Design is currently often form-driven, with the intrigue of how the computer can generate complex

form and feed-through to fabrication. Our feeling is resonant with that of Papanek when he says: "modern technology is beginning to give mankind a chance to return to the interactive… [to become] relevant to a society of generalists, in other words, designer planners".

Design should rather be generative where the responses to each of the diverse problems that inform the design thinking are investigated independently so as to realise optimal resolution. Through iteration and convergence, the design process achieves an optimal resolution to the problem.

It must be borne in mind that the inherent qualities of each facet are but a subsystem of the emergent design that needs to be tested as a whole. An example in simple terms addressing aspects of the SBAT:

a sphere has the lowest surface area to volume, but in terms of efficiency of planning and adaptability of use it is the most inefficient, particularly as the complexity of use increases. It may be an ideal form as a hut, but probably not a hospital.

Iteration

RED is an acquired discipline that can be learnt, but not schooled. It is an attitude, underpinned by skills and not a skill in itself. It does not obviate the need for a designer or suggest that design can be left to computers. However, it does highlight the use of computers and computation as aids to informed decision-making, as well as the need for other inputs by those skilled in their particular areas of expertise. Design should not be an end in itself, but the privilege and obligation society offers those so talented. ●

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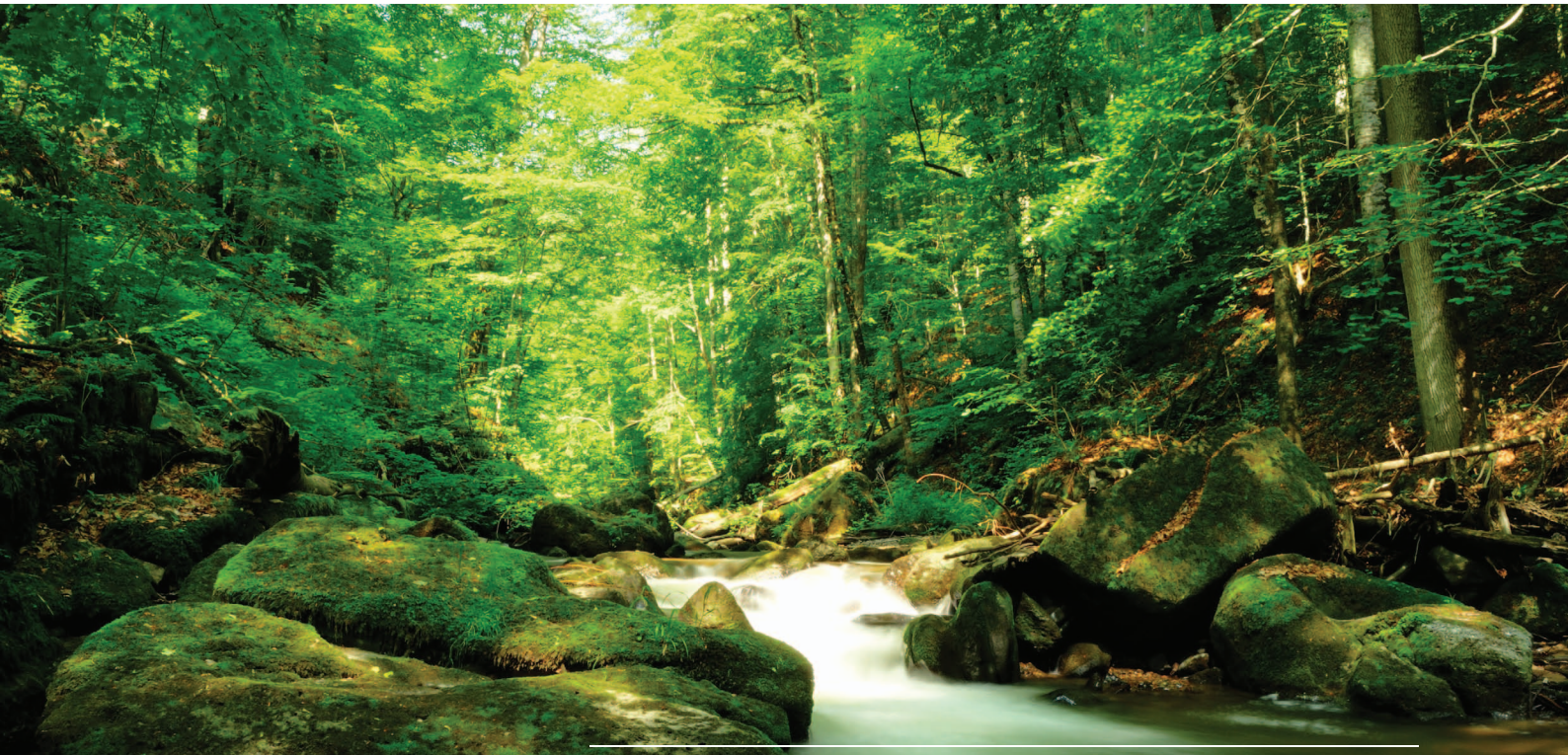
The embracing of the forces of nature in design lends to the aesthetic experience.