

## **SYNCHRONISING WITH NATURE**

**Article for Daylight/Architecture by Peter Buchanan**

**Over time we have progressively removed ourselves from and denied our dependencies upon the natural world, and moved out of synch with its rhythms. Science, which facilitated this, is now proving that the consequences harm us as well as the biosphere. For our health, and the happiness that reinforces it, we need to reconnect, and live in greater harmony, with nature in all its richly sustaining aspects by bringing these into the city and its buildings in as many ways as possible - while also returning or increasing its often diminished sense of urbanity.**

### **Co-evolution of natural world and us**

Until recently we lived in intimate engagement with a world of endless variety and nuance, surrounded by the multi-sensorial stimulus of nature's profligate diversity of species collaborating in complexly interdependent ecosystems. Moreover, all these responded each moment and in myriad ways to nature's shifting cycles and weather patterns. These range from the sensual stimulus of leaves rustling audibly in the breeze to create dancing patterns of dappled light, or the subtly choreographed sequence of animals and birds drinking and splashing in murmuring streams, to the health-affirming coordination of our various individual biological cycles with those of the day and season. Today we need reminding of the paradise we have largely exiled ourselves from, and even more so that we co-evolved with and, for most of human history, thrived in and were intrinsic to this natural world. Our extraordinary adaptability led us to settle not only its more benignly bountiful parts but also its climatic extremes, our adaptations flowering into the huge variety of human cultures that further compounded the awesome diversity of the world we once belonged to.

For the nomadic tribespeople we were for nearly all our time here, the natural world was home, which gave birth to and sustained us, provided food and medicine immediately to hand, and so was celebrated with due gratitude and reverence. But with agriculture and permanent settlement we wrested from this larger world a contracted and bounded home, and defended ourselves against the incursions of nature that we progressively sought to conquer and control. With passing time we saw ourselves as increasingly separate from the natural world which in the last few centuries has been considered primarily as mere material resource to be exploited. We have become deadened to, and even deny, our multiple webs of dependency on it so tolerating the ravaging of the biosphere, as supercharged by colonialism, industrialisation, technological hubris, reductionist science and extractive multinational corporatism.

## **Homogenising and unhealthy impacts of modernity**

Modernity brought great gifts, but we now confront its toxic downsides. Besides those mentioned, these include a mania for standardisation and the resulting homogenisation and narrowing of sensual experience – the antithesis of nature’s generously diverse profligacy. In architecture this resulted in standardised building components and everywhere the same dumb boxes aloofly disregarding their settings. Comfort standards too are defined as steady ideal conditions – of temperature, light levels and so on – so annihilating the sensual joys of ever-varying stimuli. Contrast a traditional building with a contemporary one. The former’s forecourt might greet us with a fountain, celebrating dependency on the precious resource of water, and a surrounding arcade offers sun or shade to move between with time of day and season while luxuriating in the sounds of the fountain and the fragrance of plants; then inside, the hearth’s dancing flames mark the home’s social and sacred focus, while beyond on a breeze-wafted terrace you can enjoy the setting sun, on which all life depends. Today water, heat and cool air are ducted in, offering no sense of their origins to curb careless consumption.

We have long known we are ravaging the planet; now we increasingly realise the extent to which the same forces harm our health too. The first wave of green design cut energy consumption, and so emissions, while increasing the use of renewable resources for energy and materials to somewhat lessen negative environmental impacts. Called sustainable design, it was merely less unsustainable, worthy but insufficiently inspiring to be eagerly and widely adopted. Besides protecting the planet, the emerging next wave of green design extends concern to protecting people, to improving physical and mental health and the intimate engagement with nature that enhances these. Scientific studies are proving what should, from an evolutionary perspective, be obvious common-sense, that the natural environment we evolved with provides multiple health benefits. (Meanwhile politicians and corporations argue, as excuses for resisting change, that such proof is not yet conclusive. In future our narrowly rationalist modern mind-set and reductionist science will be recognised as inculcated stupidity.) This essay explores some of this second wave of green measures. Like the first, it promises considerable benefits, yet is merely another step towards true sustainability which must entail more comprehensive and inspiring cultural changes than considered here. Suffice it to say that these will extend the emerging ethos, which informed earlier waves of green design, of opening up to, enjoying and drawing upon the natural world and the rich variety of ambient phenomena we evolved with.

## **Increasing the presence of nature in cities**

There are myriad rationalisations for separating ourselves (or liberating ourselves as we mistakenly saw it) from nature and denying our manifold dependencies upon it; particularly influential are the emphasis on the narrowly objective and measurable, and the utilitarian

ethos, that still underpin much science, technology and economics. Postmodern critiques, phenomenology and so on brought counterbalancing currents, but the modern mind-set still dominates thinking about architecture and the city. The latter continues to be largely seen as an engine of productivity, with parks and recreation merely for distracting release and amusement, rather than as the crucible of culture, consciousness and the continuing evolution of humankind.

More prosaically, the vastness of cities, ringed off from countryside by sprawl, now isolates urban dwellers from nature. Even the countryside is not nature but agribusiness monoculture poisoned by pesticides so that wildlife and biodiversity have retreated to suburban gardens. (In the UK, official guidelines encourage gardens hospitable to wildlife using low maintenance indigenous plants.) Children today lack the easy access to woods and wilds enjoyed by earlier generations, a problem compounded by paranoid parents prohibiting children (with some justification) from wandering freely for fear of traffic and dangerous strangers. Numerous studies show children spend diminishing time outdoors, depriving them of intimate engagement with nature and physical adventure (both essential to their development), leading to 'nature deficit disorder'<sup>i</sup> and health problems related to lack of exercise (diabetes and obesity, poor coordination and cognitive development), and vitamin D (synthesised in sunlight), leading to rickets and other diseases of poverty returning to affluent societies.

Modern urban life has brought epidemics of 'diseases of civilisation'<sup>ii</sup> that can be ameliorated by the introduction of nature, particularly trees and planting. People are more inclined to walk or cycle (reducing obesity, diabetes, hypertension and other cardiac problems) if streets were pleasantly shaded and sheltered by trees. These also absorb pollutants like CO<sub>2</sub>, NO<sub>2</sub> and ozone, and help precipitate particulates, cleaning and refreshing the air to offset diseases like asthma (although contributing to pollen allergies). To enhance health - and reduce energy consumption and global warming - urban designers advocate 'compact' cities of dense mixed use neighbourhoods suited to walking and cycling along shady streets, with quieter traffic-free greenways for walking to school, jogging and so on<sup>iii</sup>. These are also corridors for wildlife, some of which must migrate as food plants and suitable climatic conditions move with climate change. Other scientific studies prove the soothing presence of trees and plants - and the birds, butterflies and other wildlife they attract - dissipates stress (proved by reductions in cortisol, heart rate and blood pressure<sup>iv</sup>), which compromises immune systems and contributes to almost all diseases. For instance, patients in hospital wards with verdant outlook heal quicker than those without natural outlook. Indoor plants bring similar benefits, especially for those looking after them<sup>v</sup>. There is even evidence of reduced violence in verdant areas - perhaps reflecting their greater affluence, although planting has reputedly brought peaceable behaviour to non-affluent areas. (Elsewhere, people remove planting as potential hiding places for criminal types.) Other studies show planted streets, and particularly easily accessible green spaces removed

from traffic, encourage social interaction and multi-family play, bringing social and health benefits (including alleviating stress), reflecting our communal tribal origins. This tallies with the widespread adoption of the successful *woonerf* concept of slowing traffic and mixing it with pedestrians in paved and planted multi-use access to residential complexes.<sup>vi</sup>

Hard, heat absorbing surfaces of streets, parking lots and modern flat roofs contribute to the 'urban heat island effect' whereby temperatures rise several degrees above those of the surrounding countryside. Many cities are becoming almost unbearably hot in summer (especially for people without air-conditioning, which further raises temperatures outdoors), causing fatalities amongst the elderly. Planting, including on roofs, offsets this with cooling shade (and screening windows and roof lights from direct sun), by absorbing heat through photosynthesis and with transpiration-induced up-currents of air sucking in fresher air. The same hard surfaces, and sun-baked soil, cause rapid run off of rainwater and flooding. Planting prevents this by keeping shaded soil permeable to absorb water to slow runoff while roots guide rainwater into the earth and its aquifers. Recent UK research shows a single row of trees can prevent rainwater rushing down slopes<sup>vii</sup>. Grassy swales are increasingly prevalent landscape features, slowing runoff and downstream flooding. And there is a movement, still more discussed than acted upon, to clean, open up and landscape the banks of rivers buried under cities to become visual and leisure amenity, and to temper summer heat.

All these measure resonate with and complement those of current and increasingly influential international movements. These include various forms of urban agriculture ranging from using empty land and roofs for food production (vegetables and grain, fowl and fish), and the deep satisfactions (including a sense of meaning) gained from participating in such enterprises, to 'urban farms' offering city children a chance to encounter and tend farm animals and to till, sow and harvest. Originating in Italy is the Slow City (Citta Slow) movement dedicated to making urban life more convivial and less stressful by, amongst other things, planting streets and adjacent spaces to be more hospitable to lingering and socialising, and celebrating local customs and cuisine to enhance the character and enjoyment of cities. Spreading rapidly within and out from the UK is the Transition Town movement committed to making urban areas more resilient to better resist future challenges by being more self-sufficient and socially vibrant. Its many strategies range from planting streets with fruit and nut trees, increasing the interdependency of towns and surrounding country (including with farmers' markets for local produce) and letting the younger and less well-off share the gardens of the elderly and/or more affluent. More limited in its focus, but still significant in countering nature deficit disorder, is the 'forest school' movement, originating in Germany and spreading elsewhere, in which pre- and early school children study and are active outdoors in woodland settings.

Yet no measures described above should be mistaken as endorsements of the currently influential academic fad for 'landscape urbanism', now taught as a specific discipline in some architectural schools and manifesting in designs of academic-practitioners currently garnering publicity. Offered in antithesis to the generic urban typologies of 'New Urbanism', the attention given to local topography and ecology is obvious good sense. Many designs, though, seem to prioritise surface water management above all else, resulting in networks of elongated, wiggly parks or greenways that offer alternative pedestrian circulation to the street system. This would be laudable if the street system were not handled in a similar way, so rendering all locations within these interwoven networks as much the same, essentially homogenising what should be a richly varied public realm and annihilating true urbanity, choice and social intensity. Thus even large urban areas with tall buildings wind up no more urban than a gigantic golf estate<sup>viii</sup>. Instead we should seek to simultaneously increase both the presence of nature and the sense of urbanity, which need in not be mutually exclusive, to facilitate a wide range of activities and experiences along with the benefits to the health of people and planet.

### **Connecting interiors to ambient conditions outside**

The impulse to increase the presence of nature in the outdoor spaces of the city is complemented by that of reconnecting building interiors with the natural world outside - which brings benefits beyond maximising natural light and ventilation for energy efficiency. For us today, the most pathological form of modern architecture (once admired as the epitome of narrowly defined efficiency and suave corporate cool) is the freestanding, air-conditioned, tinted glass enclosed box that ignores context, culture and climate. Besides not shaping a legible public realm by framing urban space, the abstractly gridded facades further annihilate any sense of place - aptly reflecting the abstract disengagement of the global corporations they house from their deleterious planetary impacts. Occupants sealed within might as well be under the sea or on a planet with a poisonous atmosphere rather than on the paradisiacal planet these energy guzzlers are destroying. Yet the truly toxic conditions are inside, with chemicals off-gassed from finishes and furniture, recycled germ-laden stale air and an unhealthily narrow spectrum and low levels of light - the latter partly a consequence of seeking efficiency and economies in energy consumed in the necessary artificial lighting and air-conditioning. Illuminance in offices, factories and schools (where away from natural light) is often only 200 lux and seldom more than 4-500 lux in contrast to the 10,000 lux of an overcast day in northern Europe or 100,000 lux on a bright sunny day. Medical studies show we are starved of the health benefits of natural light and that vitamin D deficiency contributes to many diseases besides rickets -including cancer (colon, breast and prostate), hypertension and heart disease, osteoporosis and autoimmune disorders<sup>ix</sup>. Moreover, low light levels strongly correspond with depression, a modern epidemic resulting in massive loss of workdays.

Constant light levels are a problem too in that they tire the eyes that are relaxed by continual changes in focus and light intensity - hence working on computers is wearying and deleterious to eyesight. A Japanese company experimented with lighting systems, not yet in production, that adjust light levels in offices in slowly moving waves. This both relaxes the eyes and provides the subtle pleasure of varying sensory stimulus denied by constant, supposedly ideal, conditions of light, temperature and ventilation. Even before energy costs and global warming provoked rethinking notions of constant, ideal conditions, a nineteen sixties Swedish study exposed the fallacies of such assumptions. This proved the obvious, that in winter, when warmly dressed, people feel more comfortable inside at lower temperatures than in summer, when lightly clad. It took two decades for service engineers to take notice, but recognising this seemingly minor issue and letting temperatures fluctuate through the year brings huge energy and cost savings. Variations in temperatures considered acceptable proves even greater in naturally ventilated spaces where occupants control their own conditions. A post-occupancy survey of Foster's Commerzbank tower in Frankfurt found people sitting happily before open windows at much warmer and cooler temperatures than expected, so much of the building is naturally ventilated for more of the year than anticipated during design.

Although prestige office buildings are increasingly naturally lit and ventilated for much of the day and year, some building types, such as art galleries, require more stable and controlled conditions, at least where the fragile artworks are. Even here huge energy savings can be made by keeping conditions stable only in the bottom three metres of the galleries while the air rises slowly to high ceilings and roof lights, under which temperatures fluctuate widely – a strategy used by Renzo Piano and Arup at the Beyeler Foundation outside Basle. Curators prefer the predictable performance of artificial light, but the fluctuations of 'living' natural light not only relaxes the eye, eliminating the tiredness many experience in artificially lit galleries, but subtly animates the artworks, further enhancing our enjoyment.

More responsive to conditions outside are the large transparent- or translucent-roofed spaces found in many contemporary buildings, such as atria in offices and glass-roofed courts in museums. Besides contributing to the social conviviality and identity of the building, they can considerably improve energy efficiency, particularly when occupied by each user for only short periods when less than ideal temperatures are tolerable. With careful design of the roof lights and reflective side walls, spaces overlooking these are often brighter-lit than those along sun-shaded exterior walls\*. And with temperatures intermediate between those outside and interiors, such as offices and galleries, they act as thermal buffers. Designing the lighting and sun-shading, ventilation and temperature controls of such spaces has almost become a specialisation in itself. Besides creating an internal microclimate, designers seek to enhance experience of the space by making aspects of this microclimate sensually perceptible in the movement of sun, slight temperature variations through the day and even awareness of the convection currents that are intrinsic

to the ventilation system – so giving a semi-outdoors feeling in enriching contrast to the building's other spaces.

### **Chronobiology, circadian rhythms and reconnecting with nature's rhythms**

Another scientific field bound to impact architecture, particularly how it is lit, and provoke rethinking of our lifestyles, is chronobiology. This studies the cyclic temporal rhythms of organisms as they respond to larger cycles such as those of the sun and moon. The most important of these are the circadian rhythms that govern the 24-hour cycles of all organisms and, with humans, include lowering body temperature and blood pressure during the night and raising these and cortisol levels (to increase alertness) in the early hours prior to waking. The body has many biological clocks distributed through it, but the master clock controlling all others is in the suprachiasmatic nuclei (SCN) in the brain. This influences the downstream rhythms of glands in the brain such as the pineal that adjusts melatonin, which effects our sleep cycle, and the pituitary, which influences the release of cortisol by the adrenals, as well as other body clocks controlling a wide range of organic functions.

Without external stimulus the periodicity of the circadian rhythms would be somewhat more than 24 hours. But the incidence of bright light detected by photoreceptors deeper in the eye than the rods and cones of normal vision (and active in many of the blind), which connect to the SCN independent of the optic nerve, fine-tunes these cycles, adjusting them somewhat to the seasons and re-synchronising them with local conditions after changing time zones through flying. Particularly significant is the low warm light of dawn and dusk, confirming the old idea that bedrooms and breakfast rooms should face east to facilitate alertness in the mornings. For similar reasons, classrooms and workplaces might in the future be flooded with bright warm light as the day begins. When the sun is high on cloudless days, natural light acquires a blue tinge that suppresses the presence of melatonin and keeps us alert. Then in the evening the warm light of sunset and incandescent light prepares us for sleep, and warm firelight even makes us drowsy.

These natural cycles are disturbed in the modern 24-hour city in which, rather than being freed from nature's cycles by electric light, we tend to insufficiently acknowledge the role of circadian rhythms and their responses to light. Many people are deprived of sleep and time spent in outdoors in bright natural light, which should be at least 30 minutes a day. Hence their circadian rhythms may not be fully synchronised with the solar day, contributing to chronic stress, depression and seasonal affective disorder (SAD). Artificial light levels are typically not bright enough to reset circadian rhythms. Studies show that even those who habitually work night shifts never fully reset their circadian rhythms, with diminished alertness and productivity and greater proneness to mistakes and accidents. Worst of all are conditions in intensive care units where constant low levels of light inhibit healing of

patients and the alertness of medical staff, despite ample evidence that bright light speeds recovery.

Contributing to sleep problems is the blue tinged light computers and televisions emit and that suppresses the production of melatonin which helps us fall asleep. Although medical advice is to switch these off some hours before bedtime many are now semi-addicted to their use. Blue tinged light from high efficiency light fittings and many LED lights also inhibits sleep, but these are now made to emit a range of different colour temperatures. Some specialists now propose that we design artificial lighting to change in intensity and colour balance through the day to best suit human physiology and the activities then taking place. This may be a future development, but at present we simply do not know enough to do this. How much better, surely, to simply admit more liberally the natural light which already does this, and more, so well. Then, instead of sleeping in one long stretch (a new phenomenon historically) we might return to sleeping in two stretches interrupted by a waking period for reading and other activities. Indeed, sleep may once again be distributed more intermittently with daytime naps – a habit now encouraged by some leading US corporations to benefit creativity and productivity. Cubicles for napping might become regular features of workplace design<sup>xi</sup>.

Not respecting our circadian rhythms and living out of synch with the natural world is again being proven to have deleterious physical and mental health effects beyond diminished work performance. Besides, as with the definition of standard ideal conditions, the desire to minimise the difference between day and night is another homogenising effect – as is our general lack of appreciation of the importance of the colour of light. We have lost the cosy closeness to each other brought by warm fire or candle light, when winding down for sleep and dreams made a perfect time for storytelling, fantasy and shared intimacies – all of them psychologically enriching. And in contrast to this inward turning dynamic, light pollution outside obliterating the stars has robbed us of the expansive dynamic that draws our psyches out in wonderment into the vastness of the cosmos. By denying or attempting to transcend our innate connections to nature and not synchronising our lives to its cycles we might have gained much in a material sense; but we have also lost much of what is magical about this miraculous world as well as of what would make us the more healthy and happy humans we know deep down that we are meant to be.

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Apart from other references, two books proved invaluable sources for this article, providing much more information than that footnoted below. The books are *Biophilic Design: the theory, science and practice of bringing buildings to life* by Stephen R Kellert, Judith Heerwagen and Martin Mador, John Wiley & Sons, 2008 and *Go Wild*, by John R Ratey MD and Richard Manning, Little Brown, New York, 2014

<sup>i</sup> *Last Child in the Woods: saving our children from nature-deficit disorder*, by Richard Louv, Algonquin Books, 2006

<sup>ii</sup> For an illuminating discussion of diseases of civilization – a concept that dates back to lectures in the 1840s by Stanislas Tanchou, a French physician who had served Napoleon's army – see the chapter 'What Ails Us' in *Go Wild*, by John R Ratey MD and Richard Manning, Little Brown, New York, 2014



<sup>iii</sup> Humans evolved to be particularly suited to running, but also capable of a much wider range of movement than any other creature – a major factor in developing our complex brains. So jogging tracks should wriggle, rise and fall, include obstacles to negotiate and change in camber and roughness of surface, as would a mountain track. See the chapter, 'Nimble' in *Go Wild*.

<sup>iv</sup> See chapter on Biophilia in *Go Wild*. The same chapter tells of Japanese studies showing that a walk in the woods can raise the immune system's killer cell count by 40 percent and that areas with a high proportion of forests have diminished cancer rates.

<sup>v</sup> See Chapter 6 of *Biophilic Design*, 'Biophilic Theory and Research for Healthcare Design' by Roger S Ulrich

<sup>vi</sup> For more extensive discussion of these themes see *Biophilic Design: the theory, science and practice of bringing buildings to life* by Stephen R Kellert, Judith Heerwagen and Martin Mador, John Wiley & Sons, 2008, particularly Chapter 7, 'Nature Contact and Human Health: building the evidence base' Howard Frumkon

<sup>vii</sup> 'Drowning in Money' by George Monbiot, *The Guardian*, 14 January, 2014

<sup>viii</sup> For more on landscape urbanism see *The Landscape Urbanism Reader* edited by Charles Waldheim, Princeton Architectural Press, 2006. An excellent compilation of New Urbanist counter-attack is *Landscape Urbanism and its Discontents: dissimulating the sustainable city*, edited by Andres Duany and Emily Talen, New Society Publishers, 2013

<sup>ix</sup> See chapter on biophilia in *Go Wild*.

<sup>x</sup> As at One Finsbury Square by Arup Associates in the Broadgate development, London

<sup>xi</sup> For more on circadian rhythms, sleeping and so on see 'Light, Health and Wellbeing: implications from chronobiology for architectural design' by Anna Wirz-Justice and Colin Fournier in *Design & Health Scientific Review*, January 2010 and the chapter 'Bodies at Rest' in *Go Wild*.