

Sustainable spaces: three essays

Brian Purdey

In these three short essays, Brian Purdey explores a range of issues around the nature of 'sustainable spaces' – sustainable in terms of energy consumption and greenhouse gas emissions, and in terms of supporting human activity and collaboration.

In Sustainable spaces 1, Brian starts by raising issues of the sustainability of energy consumption in building design and occupation over time, and highlights positive moves in seeking more eco-friendly designs. However, he questions whether real achievements will be forthcoming, due to the separation of the processes of design and procurement from those of occupation and use.

In Sustainable spaces 2, Brian moves on to consider whether contemporary, technologically-enabled workplaces support a sustainable form of human interaction, in terms of providing tools for collaboration, rather than merely tools for communication of information.

Finally, in Sustainable spaces 3: sense making and the simplification of work, Brian asks us to challenge our notions of how we integrate, communicate, organize and manage in contemporary organizations, and to consider that, rather than looking for solutions that are 'out there', we should look for a more local, humanistic approach to the problems of workplace design and management.

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Sustainable spaces 1

Why sustainable spaces?

The Australian Greenhouse Office has reported that, 'over the next decade the commercial building sector will need to recognise and address greenhouse concerns. This expanding sector, with fast growing emissions can significantly contribute to meeting Australia's greenhouse gas reduction target and simultaneously improve the comfort and health of Australians in their built environment' (1). The commercial building sector is expected to almost double its 1990 greenhouse gas emissions of 32 million tons (Mt) of CO₂ per annum, to 63Mt of CO₂ per annum in 2010. The commercial office building is the most significant culprit contributing 27% of the total sector greenhouse emissions. Further, greenhouse gas emissions relating to embodied energy - that is, energy used in the production and placement of buildings - is estimated at only 8-10% of total emissions caused by energy use over a 40-year life span. Space cooling, ventilation and lighting together account for around 62% of commercial building energy consumption, and 71% of greenhouse gas emissions.

These figures highlight the leverage effect building use has on wider environmental sustainability. *Energy consumption 'in-use' is most significant, despite the inclusion of building technologies used to reduce operating energy consumption*

Sustainable spaces, or sustainable business?

Property development, building design, and construction still largely respond to the needs of a 'generic-business', even where there is a pre-let anchor tenant for a new, or refurbished building. Consequently, only a limited number of business critical issues are taken into consideration in the early stages of new building delivery. This oversimplification of the complexity of modern business dictates that the building's ability to meet organisation needs will always be sub-optimal, and may well constrain its ability to operate at full effectiveness. When the physical space limits the adoption of more innovative forms of organisation or work practices, it negatively impacts occupant satisfaction and productivity.

The building itself is a highly structured and hierarchical system. Constraints are passed down this hierarchy as risk is minimised by the various players in the delivery process. Location may influence building orientation on a given site. This in turn may affect the building fabric, options for building engineering or HVAC services, and so on. And in the construction phase, pressure to meet project time, cost and quality targets may result in sustainability initiatives being wound back. These decisions generally relate to project, not user needs. Executive decision making about space for business use most often comes at the end of this linear chain of events, and it is easy to see how businesses occupying space can unwittingly become a 'co-conspirators' in maintaining the status quo by an acceptance of supply side constraints as organisation constraints.

Of greater concern is that this linear model for decision-making about space is transferred to the mindset of the organisations that 'choose' to occupy the space. This has the potential to severely limit what occupants believe is possible from their use of space. It may well deny some the opportunity to implement the more innovative work systems required for their business to be sustainable in a globally competitive economy (2).

Enter the green building!

Against this background, there is a shift in thinking towards the need for more sustainable 'green buildings'. However, this is still very much an initiative that is supply side driven. As conventional economic wisdom holds that investment in physical capital, including buildings, is the best means for achieving economic growth, the creation of more advanced green buildings should herald the beginning of a 'new wave' of property investment. Currently, new green building initiatives appear to be focussed on embedding more sophisticated hard technology in the building itself. New facades, enhanced building automation, energy management, and lighting control systems are examples of how more sustainable spaces can be delivered.

The key question is; will this technological determinism - the belief that all will be solved by technology - actually deliver the greenhouse gas outcomes required in the commercial property sector? Since the Australian Greenhouse Office (AGO) considers the greatest technical impact is to be found in 'lighting', yet it is estimated that technical fixes in this specialist area alone "will require an additional capital investment of some \$4.2Bn (1990) to achieve a 30% emissions reduction by 2010" (1), then, clearly, the answer to the question is...not necessarily. A technical strategy alone would appear to be unsustainable. Some of the reasons for this are:

- Over time, the property industry may be able to deliver a more technically advanced, but relatively standardised new building ‘product’. But, the process for the supply of space may continue to prescribe what tenants can expect from this space, and constrain them from accepting responsibility for delivering better environmental outcomes from its use.
- Even the domestic video player, packed with redundant functionality in the hands of the most technically savvy user, has an instruction manual. With little attention given to tenant user manuals, there will be an ‘intelligence disconnect’. Transfer of knowledge about how to get the best business results from building use to the initial tenant may be low or, across multiple tenancies over the life of the building, non-existent.
 - It is well known that new technologies create entirely new categories for human error, and more automated environments contribute to a breakdown of clear cut definitions as to who does what at any given time, and who is responsible for what. In the case of more automated buildings, a culture of ‘fit and forget’ has prevailed (3), with a consequent reduction in the number of facilities personnel considered necessary to ‘maintain’ the system. Research consistently shows more complex systems require more, not less, management resources to deliver their promised value, despite what technology suppliers would have us believe (4).
 - Technological determinism - the belief that all will be solved by technology - risks disempowering the end users of space in the process. Sustainable value is embedded in the building, not in the core values of the organisation occupying the building. Without taking on these sustainable values business cannot derive maximum benefit from its use of space.

So, should the property sector alone take responsibility for reducing the greenhouse gas emissions resulting from the commercial use of space?

What is a building for?

As the push to create greener buildings gathers momentum, it is worthwhile reflecting on the question: "What is a building for?" (5). Productive human endeavour could be the catch-all answer, addressing the need for buildings to support occupant comfort, health, satisfaction, and better work performance but, in the future, not at the expense of the wider, natural environment. Productive human endeavour will therefore remain an outcome to be delivered in the provision of more sustainable spaces.

Investing in Human Capital

To compete effectively, business today must not only grow faster, it must deliver *productivity increases* as well. Economists believe that even with technological advances,

investment in physical capital provides only a one-off boost to economic activity, and is subject to diminishing returns. *It cannot produce increases in the rate of economic growth.* Green building investment would theoretically contribute to this boost, but with a lesser impact on the natural environment. However, 'new growth theory' holds that investment in human capital does not result in diminishing returns, because it can be embodied in the organisation and produces *sustained increases in the rate of economic growth* (6).

By emphasising investment in human capital, business can get closer to the factors that actually drive sustainable improvements. The reasons for this are as follows. Firstly, ideas (like how to deliver better environmental outcomes from building occupancy) are not restricted to the intellectual property of building technologists and other specialists who compete to have them incorporated in new, or retro-fitted buildings. When ideas about sustainable spaces are 'non-exclusive', they can be adopted by a wide range of occupants and in support of a diversity of applications and outcomes. This approach can provide sustainable productivity increases as well as sustainable spaces.

Secondly, ideas adopted in any tenant organisation become cumulative. New knowledge is added on top of existing knowledge that may initially come from a diversity of user experiences, including those outside of the commercial building environment. The more occupants acquire knowledge of how to use green buildings, the easier it is for them to acquire knowledge and skills for the sustainable use of space generally.

Thirdly, these skills become complementary, in that individual benefits flow to others in the broader business community through networks and connections. This has been demonstrated with technology tools used in buildings, such as computers and mobile phones, but is yet to be demonstrated for technologies embedded in buildings themselves.

An analogy for the green building in its current form is that of the situation in which a tenant 'buys' a more intelligent fridge, but the users continue to leave the door open! The new product may be rated as more energy efficient, but the purchase decision has not been accompanied by any behaviour change. In use energy performance could be worse than expected. *A more empowered workforce facilitates more rapid adoption of new ideas. The green building challenge if managed well could actually be a catalyst for improved performance on a much wider front.*

Is there a role for the informed user?

If we are serious about reducing the negative environmental impacts of commercial buildings, then it is paramount that users become more informed and aware of how to actually use the buildings they occupy. The Australian Greenhouse Office has also reported that, despite the energy rating of consumer white goods, the total energy consumption by these goods in Australia has actually increased. Why? Because consumers, believing their responsibility to reduce energy consumption rests only with buying the most energy efficient appliance, have continued to buy more of these appliances. Similarly, in the residential housing sector, total energy consumption continues to increase, despite energy smart housing design, because dwelling size is also increasing. We have to put all those appliances somewhere!

The property industry is faced with more than one generation of commercial space users who know only the automatically controlled, fully air-conditioned building, and who probably believes accountability for building energy management and greenhouse gas emissions rests not with them, but elsewhere; perhaps the Facility Manager. *There is a danger that, despite our best intentions, the current approach to creating more sustainable spaces might not deliver the greenhouse outcomes we seek... unless we do more than just embedding buildings with technology, conducting energy simulations, and giving them star ratings.*

There is an underlying assumption driving current initiatives that must be challenged. It is that, because people occupy buildings, they actually know how to use them, or squeeze the best value out of them. As new, green buildings come on stream - particularly those that are more naturally ventilated, or mixed mode in operation - they will require greater, not lesser involvement of the user in their operation. These buildings may be simpler, more robust, but they will necessitate a more informed and empowered user if they are to be successful. Research conducted by The University of Sydney (7) shows that mixed mode office environments can deliver energy savings of up to 70% of their air-conditioned equivalent, where good user controls are in place. Further, it was concluded that around 50% of normal office occupancy in Sydney is suitable for passive and natural drivers of ventilation. Similar results might be expected in other Australian capital cities although more work is needed to confirm this (8).

The Australian Greenhouse Office has concluded that energy management initiatives alone will never achieve the same outcomes as the combined effects of "voluntary measures and improved level of awareness in the marketplace" (1). Clearly, there is very little

incentive for users to change their behaviour if the green building movement emphasises hard technologies in the design of a building, over human technologies, in its 30 to 50 years of occupancy.

The way forward

There are signs that a broader demand-driven agenda is emerging. My participation on the Australian Building Greenhouse Rating (ABGR) scheme National Steering Committee leads me to believe that, in the next phase of 'market transformation', there will be more emphasis on engaging tenants, and in ensuring energy efficient spaces are monitored to ensure they are comfortable and productive as well. The Facility Management Association of Australia is more actively advocating demand side issues, and has prepared a position paper. It is also securing funding to build a web-based *Environmentally Sustainable Design Toolkit* for use by Facility Managers, and will assist the Barton Group (a think tank involving built environment industry experts) to prepare a retrofit strategy for commercial buildings to support the Australian Federal Government's Environment Industry Action Agenda (EIAA). The Green Building Council of Australia will also incorporate 'in-use' issues as it develops its Green Star rating system.

Beyond these broader industry initiatives, what other strategies could be adopted? Firstly, tenants should demand more evidence-based solutions as opposed to those relying on mere anecdote. Processes like probe (9) enable occupant health, comfort, satisfaction and productivity to be independently assessed, alongside the building's external environment performance. There is little to be gained by saving energy at the expense of occupant productivity. Secondly, adopting a more integrated or "systems" approach in strategic planning for space would result in closer alignment of financial, organisation, technology and building objectives in the pursuit of sustainable environment outcomes. Thirdly the demand and supply sides of the property industry need to work much closer together and overcome the "intelligence disconnect". Better briefing processes that consider occupancy and use issues earlier, tenant user manuals and closing the feedback loop between actual performance and design intent would be helpful.

References

1. www.ago.gov.au, Australian Commercial Sector Greenhouse Gas Emissions 1990-2010
2. Wheatley, M.J. Leadership and the New Science - Discovering Order in a Chaotic World, Berrett-Koehler, 1999
3. Leaman, A. and Bordass, B. Strategies for Better Occupant Satisfaction, 5th Indoor Air Quality Conference, UK, 10 July 1997
4. Leaman, A. Calling the Tune, Building Services Journal (UK), November, 2000
5. Leaman, A. What is a Building For? Paper presented to Building Pathology (UK), 18-20 September, 1991
6. Dowrick, S. Investing in the Knowledge Economy: Implications for Australian economic growth, Australian National University, 16 April 2002
7. Rowe, D. A study of a mixed mode environment in 25 cellular offices at the Sydney University, International Journal of Ventilation (in press)
8. Rowe, D. Why Natural or Hybrid Ventilation? Presentation at a Forum on Natural and Hybrid Ventilation of Non residential Buildings, University of Sydney, 3 August 2002.
9. For more information on the probe method, contact the writer.

Sustainable spaces 2

Is the modern executive lifestyle socially unsustainable?

If sustainability is to have relevance in the new knowledge economy, it must address the needs of people in the social environment of work as well. As business today strives to do more with less, many people working in both public and private sector organisations find the quality of their life deteriorating. They spend longer and longer hours either at work, engaged in quasi-work, or commuting. Finding that work-life balance can prove elusive. Those who remain in executive roles are also becoming increasingly 'time poor', with likely long-term consequences for the quality of their decision making.

Information technology has both a cause and effect in all this. Descriptors such as real-time, on line, 24x7 and global economy provide terms quite broadly used to describe the radical changes taking place in the systems for the production and consumption of goods and services. These changes are forcing the restructuring of domestic economies and the value creating organisations that comprise them. The changes resulting from the ascendancy of the techno-economic paradigm present two clearly related outcomes. Firstly, there is the seemingly inevitable reduction in the power and influence of 'local' managers. Secondly, there is an increased feeling of insecurity for local managers and workers alike (1).

The eminent business writer and academic, Charles Handy, has postulated that the executive lifestyle may be coming socially unsustainable; 'We are in danger of populating companies with the modern equivalent of monks, people who forgo all else for the sake of their calling' he says (2). Our modern working environment has been called 'libido leeching', which might be just as well if one decides to choose the monastic life! Against this background, how can modern business best protect its investment in human capital from the demands of its own work?

The re-emergence of community

One option currently gaining credence is for organisations to see themselves more as communities, capable of meeting both individual and shared needs. However, as many businesses have been downsized, the concept of community has shifted towards a 'community of practice', capable of fulfilling more formal needs. When business finds itself without the critical mass of employees engaged in specialist tasks or functions, it is increasingly turning to technology to share information and knowledge across organisation boundaries and amongst peers. These communities have a rational-economic purpose; to harness and apply knowledge to help meet corporate objectives, without the need for each

individual organisation to necessarily develop and maintain its own complete base of knowledge. Underneath this strategy for corporate survival is a fine example of the use of cooperation in order to remain competitive. This approach is quite different to a strategy that consciously aims to develop a culture that embraces social community as a key corporate value, and one essential for long-term business sustainability (3). Principles of 'community' are now being stated in design criteria for new commercial working environments, but how well do the built outcomes reflect authentic, sustainable qualities of social community?

Interaction or collaboration?

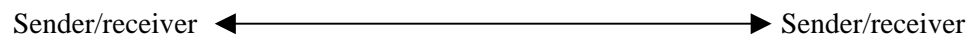
A part of the answer lies in an understanding the role and importance of collaboration in the formation of social community. In the context of an organised social system for work, collaboration reflects more purposive relationships that involve a desire to solve a problem, create *shared purpose*, discover or generally to produce meaningful outputs. The true medium of collaboration is other people, and collaborative effort becomes a medium for individual self-expression, and hence *personal development*. Quite separately, research conducted by Mc Kinsey and Co and the Boston Consulting Group (4) found that *the top two work environment factors affecting motivation* are, opportunities for *personal development*, and having a sense of *shared purpose*. Given the positive links between motivation and performance, there would appear to be sound economic reasons for designing working environments for collaboration, not simply interaction.

Tools for collaboration

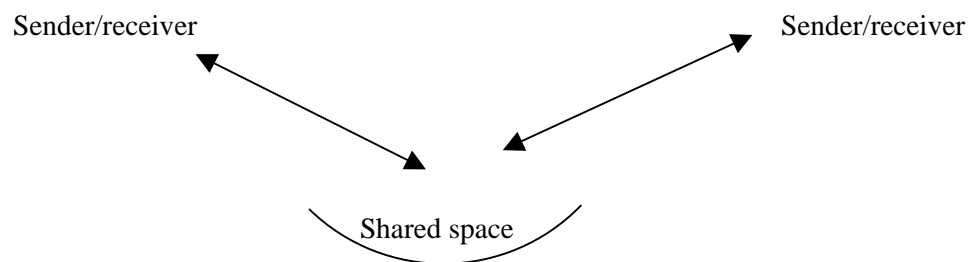
What sort of essential 'tools' are needed to support collaboration? Firstly, good tools for collaboration must seamlessly become an extension of the user. With little extra time or skill, they enable creativity to flourish. Secondly, they should enable the user to better come to grips with their work. Thirdly, they must be easily used by anybody else, as often or as seldom as required. Are these the kind of user benefits delivered by a Palm Pilot for example? A quick check in the modern working environment shows most prevalent office equipment is actually designed to support individuals, not collaboration; e.g. workstations, laptops, and telephones. These 'tools' simply aid interaction and the accumulation, processing, duplication, packaging, transmission and distribution of *information*. Real community is characterised by collaboration, whereas much of the current workplace design emphasis is on improving interaction in the physical space, supported by technology. Collaboration and interaction are qualitatively different. Apart from the essential ingredient of people, collaboration requires a 'space'; where conversations can be shared, where there are opportunities to create shared memory.

The following diagram(s) show the fundamental differences between interaction and collaboration. In both cases, there is a communication of information between sender and receiver. Interaction uses traditional office tools, while collaboration takes place in a ‘shared space’.

Interaction



Collaboration



The role of the ‘shared space’ is to add extra dimensions to the conversation, by embracing the representation of symbols (e.g. sketches, mud maps), manipulation, and memory. This is not simply a shared physical space that allows people to ‘drop by’ and casually connect, like around a cappuccino machine, or in a designated social space. It is more a shared ‘*media space*’ with at least the following characteristics;(5)

- It has low barriers to entry and exit
- It is accessible in a number of different physical locations
- It has equity of access

From this perspective, space for collaboration is also very different to a formal meeting space. Meeting spaces tend to support a group of individuals who share the same *physical space* and a common problem at a specific point in time. The social ecology of meetings is also very different to the social ecology supporting effective collaboration. What then are some of the more important themes we need to pay attention to when creating collaborative working environments? The following short list provides a starting point;

1. Collaborative environments support *social processes*, not the production of outputs
2. Tools should enable conversations to *seamlessly extend* across physical spaces, from location to location and through time

3. Media spaces can be shared using *hard technologies* (eg windowed whiteboards, integrated screen based systems, what you see is what I see (WYSIWIS) etc)
4. There should be a *diverse mix* of formal and informal physical spaces
5. The best collaborative environments stimulate *relaxed intensity*

References:

1. Arthurs, H. Labouring into an uncertain future; in Australian Financial Review (AFR), 14 June 2002, extract from presentation to 10th Annual Labour Conference, University of Sydney, 2002
2. Handy, C. Reprinted from HBR in Australian Financial Review (AFR) , 20-23 December, 2002
3. Wheatley, M. and Kellner-Rogers, M. A Simpler Way, Berrett Koehler, 1998
4. Cave, M. Go Ahead, Motivate Me! Australian Financial Review (AFR) BOSSmagazine, June 2002
5. Shrage, M. No More Teams - Mastering the Art of Creative Collaboration, Doubleday, 1995

Sustainable spaces 3: sense making and the simplification of work

'In the hands of an inspired artist, a worthless lump of clay turns into a priceless work of art'

Lama Anagarika Govinda, Foundations of Tibetan Mysticism, 1969

Despite the predominance of the economically rational business paradigm, it seems that as individuals, we still rely an awful lot on sense making for much of our corporate survival. Without our permission, our imagination ranges around in the mind, connecting our perceptions of 'reality' received through our various senses of sight, sound, taste, touch, smell and intuition. Our mind uses this faculty of 'imagination' to build composite mental pictures, and then moves them to powerfully shape the way we think and act. The pathways by which this actually happens we are just beginning to understand. (1)

Our action often takes the form of physically constructing things; products, roads, bridges etc. The built spaces we work in are just one aspect of this physical template. These templates, or 'entrenched integration networks' (1) as they are called, then communicate meaning back to us. We could view buildings generally, and workplaces specifically, as culturally created billboards embodying certain meanings or messages. Examples in our wider culture of where it is intended that very specific meanings be communicated to users include churches and law courts. Through the conversation that takes place between our perceptual and physical realities, we can make sense of the world of work. When there is little or no dissonance we tend to be more psychologically comfortable. and able to perform more effectively as a result.

With increasing emphasis on using workplace design to facilitate organisation culture change, how well do we understand these entrenched integration networks? Can our ability to make sense in the world of work be influenced by workplace design or do wider cultural forces have a much more powerful effect?

Recently completed US research in the health care sector demonstrated that good built environment design did enable occupants to 'naturally map' their perceptual world on to such a physical template (2). In this example, sense making was simplified, as a continuous process of interpretation, action, and comparison. The resultant model was then used to better understand the perceptual reality of people affected by Alzheimer's, providing a basis for the design of a 'total health care system'. This system incorporated the integrated design and management of buildings and their surrounding "open space" environments used by

'occupants' as well. . Extended post occupancy evaluation confirmed statistically significant relationships between the delivery of specific health care outcomes and built environment attributes. These were fed back in order to improve the overall health care system. Natural mapping for occupants could then be optimised, meaning no special instruction was necessary for occupants to function effectively in their health care environment. Their learning experience was also enhanced enabling them to provide feedback into the ongoing design of the health care system.

In another US study, the concepts of 'perceptual market research' were used to link objective and subjective measures in open plan office environments (3). The aim of this research was to understand what occupants responded to, either positively or negatively, in their work environment. The initial findings showed that when occupants were asked to rank on the basis of only one sense - *visual* differences, in otherwise identical open plan offices - they were unable to do so. Further, the 'feelings driving their rankings were not consciously known to them' (3). So much for sense making in this modern working environment! However, the research also concluded that current workplace design techniques may routinely overlook 'subtle yet potentially important design features'. Research by Leaman in the UK (4) also indicates that users perceptions of workplace needs may be largely shaped outside the office, and are less likely to be linked to stimuli from more immediate physical design variables.

It would appear from these three examples that the 'science' of occupancy and more evidence-based design have some way yet to go.

If there is still room for improvement, how well do our modern workplaces help occupants with sense-making given the apparent increasing complexity of work? It seems that despite society's increasing sophistication, the mental predisposition that guides our workplace behaviour actually performs better in smaller cultural groupings, communities, or work groups. We may be more 'tribal' in our behaviour than it is fashionable to admit. It looks like our minds have a tendency to recreate smaller 'physical communities' to which we continue to attach meaning.

Larger floor plates, often favoured by developers for their 'flexibility', can accommodate much larger groupings, but building depth is also a correlate for spatial complexity, because buildings become disproportionately more complicated as they get bigger (5). This is not just a matter of building services, like mechanical ventilation, air conditioning, and access to natural light, but also of behavioural complexity of occupants.

There will be a larger number of occupants, more diverse work activities, and much greater likelihood for conflict in bigger floor plates. Sometimes these work-spaces are filled with people we hardly even know!

Spatial and behavioural complexity, when combined with a completely different human existence demanded by 'knowledge work', can give rise to both minor and major 'disasters'. We seem to be designing work environments that not only challenge our ability to make sense of them, but add to the complexity of work as well. But is assigning responsibility to the physical workplace for providing so much meaning to work missing the point? What are the real sources of work complexity? A survey of 2500 individuals in 460 companies (6) identified the top four sources of work complexity as being;

- Lack of integration of change
- Unclear goals and objectives
- How we communicate
- How we organise information and manage knowledge

These findings challenge the belief that modern work complexity comes from 'out there', and is imported by business from a rapidly changing and increasingly global external environment. The factors identified are very much within the control of individuals within the organisation. Work is, however, becoming more complex because our ability to move information often exceeds our ability to make sense of it or make it useful. We may not yet be fully wired for knowledge work. While the physical work-space was not specifically a focus for the survey, the 'lack of integration of change' has, potentially, the most relevance for managing work complexity. Often, the provision of a built environment is disconnected from the real nature of the work to be performed, and how this is actually changing. The triangular interaction of the mental space of the individual/organisation, the physical space of the built environment, and the network space created by technology is often not well understood in the design process. This can result in the adoption of a more linear approach - space plan follows business plan - as opposed to an integrated or systems approach.

The other factors listed above highlight the importance of management over design in the delivery of workplace performance outcomes. They generally support Nicholson's hypothesis (7) that traditional values may be more important in the modern working environment than we might care to acknowledge; smaller communities and networks, clearer organisation structures and leadership amongst others.

References:

1. Fauconnier, G. and Turner, M. The way we think - conceptual blending and the mind's hidden complexities, Basic Books 2002
2. Zeisel, J. Assisted Living in Residential Care Homes, Hearthstone Alzheimers Care, presentation at University of Sydney, 7 February, 2003.
3. Orfield, S. J. The Open Plan Office, Facility Management Journal, September - October 2001
4. Leaman, A. User Needs and Expectations in Cole R. and Lorch R. (eds), Information, Buildings and the Environment, Blackwell Publishing, 2002
5. Leaman, A. and Bordass W. Productivity in Buildings: the killer variables, Chapter 12 of D Clements-Croome (ed) Creating the Productive Workplace 1999
6. The search for a simpler way, The Jensen Group USA, 1999
7. Nicholson, N. Managing the Human Animal, 2000.