

# Sustainable Urban Design – Principles to Practice<sup>1</sup>

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This paper attempts to make the connection between the theory of sustainability and the practice of urban design. In doing so it draws from a wide body of literature to establish ten universal principles of sustainable urban design. These it relates to some of the widely accepted precepts of sustainable development. In linking theory to practice consideration is given to how these principles impact across the range of different spatial scales: building, space, quarter and settlement-wide. The paper concludes by briefly examining how more sustainable patterns of design might be delivered and by whom. It argues that fundamentally good urban design is sustainable, but this implies much more than simply reducing energy use and carbon emissions. Instead it implies a much more profound basis upon which to make decisions which impact on the social, economic and environmental sustainability of the built environment.

Key words: urban design, sustainability, principles, practice

## Introduction

Urban design as a discipline gradually emerged throughout the second half of the 20<sup>th</sup> century as part of a critique of the contemporary urban situation and of the perceived failure of the established built environment professions – architecture, planning, civil engineering, landscape architecture and the property professions – to deliver places of ‘quality’. In a well-worn phase, it developed to fill the gaps left by the other professions, and in particular to consider how their various interventions might be better coordinated to deliver more than the sum of their constituent parts. In essence urban design is concerned with establishing the integrating fabric of urban areas that allows them to become real places for people rather than simply collections of unrelated projects.

The sustainable dimension of urban design has steadily emerged throughout and even before this period. Many ideas about the interpenetration of town and country, for example, can be traced back to the pioneers of the planning movement like Howard, Geddes and Unwin, as can notions of local social and economic sustainability. Nevertheless, the recent proliferation of writing on concepts of sustainable development has firmly shifted the urban design agenda (like spatial planning with its more strategic focus) towards broader environmental concerns. This sustainable agenda is giving the discipline a new and broadly accepted legitimacy, and one that is highly compatible with a discipline that emerged, at least in part, as a reaction to the unsustainable (anti-urban) development models of the mid and late 20<sup>th</sup> century.

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Most conceptualisations of urban design now include explicit reference to a sustainable dimension, so that sustainable urban design now fits four-square within a theoretical framework for urban design that already embraces well established visual, morphological, social, perceptual, temporal and functional concerns (Carmona et al 2003). In the UK, for example, the ten general design principles for creating more liveable places identified by the Urban Task Force (1999, p71) demonstrated a clear emphasis on environmental concerns, concerns which have gradually been adopted into policy (HM Government 2005, HM Government 2007, DCLG 2007). Similar process have been apparent across the developed world (EU 2004), and increasingly in the developing world (Romaya & Rakodi 2002).

Unfortunately, nothing is straightforward in this fast developing field, and arguments can be made both for and against many of the new policy directions that have subsequently emerged; both from the perspective of whether sustainable principles are as laudable as much of the literature would have us believe (Mantownhuman 2007), but also as regards the potential for state intervention to make any difference (Cuthbert 2006, pp168-170). In his most recent book, the influential economist Nicolas Stern (2009) dismisses all such critiques as misguided voices of the uninformed, arguing instead that there is no serious doubt that emissions are growing as a result of human activity and that more greenhouse gases will lead to further global warming. There is no space to explore these arguments here, suffice to observe that an overwhelming consensus has gradually emerged amongst writers on many aspects of a sustainable design agenda, giving added legitimacy to developing policy in this area. This paper aims to unpick this agenda and unscramble some of the confusing and overlapping language used to describe sustainable urban design. It traces the scope and nature of the field, the application of the principles across different spatial scales, and concludes by briefly postulating on the difficulties of delivering more sustainable urban design.

## **The Environmental Impact of Design**

Some argue that planning and to a lesser degree urban design have always pursued notions of sustainability and that their public interest *raison d'être* implies that concerns for environment, economy and society should be balanced. The reality is that even if such notions have existed in theory, more often than not they are largely absent in practice. Instead they are compromised by the need to deliver outcomes largely through market processes, by public political agendas that prioritise economic growth coupled to social (rather than environmental) well-being, and by private agendas that too often see the environment as of little concern. Nevertheless, as the damage being wreaked on the environment both locally and globally has become more apparent, notions of sustainability have moved up the public and political agenda and have led to a renewed questioning and refocusing of most professional remits; amongst them urban design.

Therefore, although an explicit sustainable goal is a relatively recent concern in urban design practice, it is arguably also the most important amongst design objectives. Unfortunately, urban designers have been primarily concerned with changing the physical world so that it better fits a set of human needs. Hence, like all built environment professionals (at least those operating in the private sector), the urban

designer's primary responsibility has tended to be first to his/her client and only second to the wider community and natural environment (Lang 1994, p15).

Consequently, when the design process operating within most Western economies is considered, the major effort goes first into achieving the functional requirements of the client - within the economic constraints set by the budget. Second, to a concern for the visual, contextual and social impact of the development - to the extent that it is either financially prudent or a requirement brought about by public intervention in the design process. Last (usually) it will focus on broader environmental concerns which tend to feature poorly in both private and public agendas, and responsibility for which is frequently highly fragmented (Carmona & de Magalhaes 2007, pp60-62). The result can too easily be a token engagement with sustainability, rather than a serious attempt to reflect a more holistic sustainable urban design agenda (Figure 1).

**Figure 1: Sustainable tokenism, wind turbines in a sea of car parking**



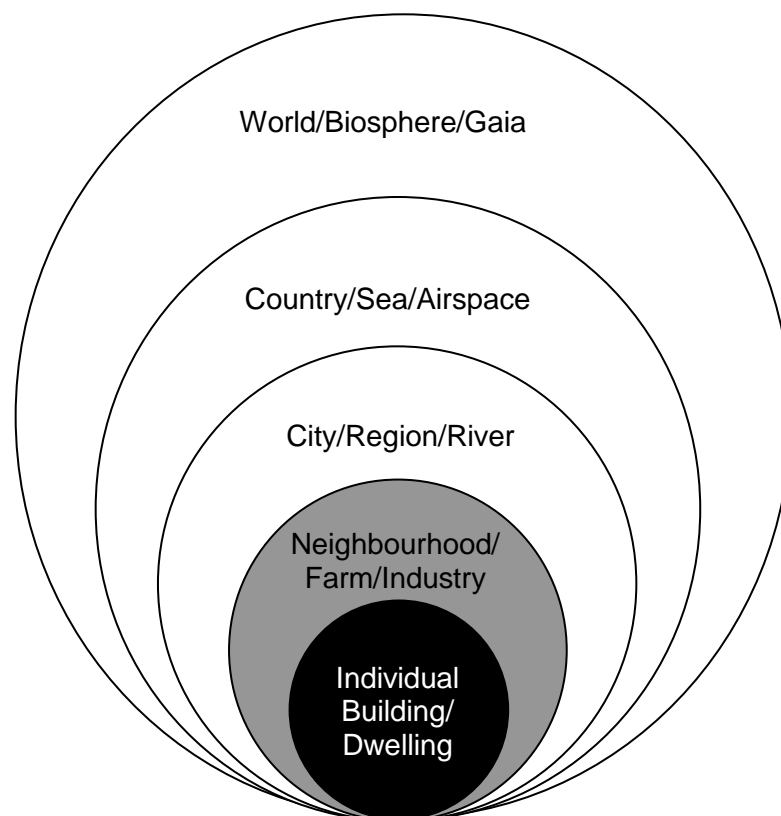
The problem stems from the failure of Western development processes to fully reflect environmental impact (and therefore environmental cost) within the development process (Rees & Wackernagle 1994). This is because any one development has a much larger environmental impact than is immediately apparent. At first sight the imprint may appear small, just the impact on the site on which the development sits. But, when the environmental capital inherent in the construction of that development is considered - the energy and resources expended in the manufacture and transport of materials, the energy required to prepare the site and construct the development, the energy required to expand the above and below ground infrastructure to service the site, and so forth - a hidden, but much larger environmental impact is apparent.

Subsequently, when the development is in occupation, the ongoing energy and resources expended to sustain the development - the maintenance requirements, the energy requirements of the development (heat, light, electricity, etc.), the waste disposal requirements, and the travel requirements of the occupants - the impact extends even further. Thus, even in a 'very' efficient building, ongoing energy use over the lifetime of a building will represent four times that of the embodied energy used in the construction process (Barton et al, 1995, p27). Finally, when the development reaches the end of its life, the energy required to alter or demolish the development and to deal with the resulting site and materials completes the lifetime environmental costs of that development, so extending the environmental impact further and far beyond that originally perceived impact. This concept is fully reflected in the literature on environmental footprints which argues that in Western

developed economies, we are typically unaware of the true environmental impact of our lifestyles (Wackernage M & Yount J D 2000). This is certainly the case in most Western development processes where the original developer is often only concerned with the direct development and construction costs - costs which directly impact on the project's economic viability - but rarely with the subsequent environmental impacts (or even management costs) over time. In the UK, for example, the footprint per person per year is 5.4 global hectares, whilst recent research suggests that this needs to reduce by two thirds to 1.8gha to meet 'one planet living' objectives; moreover that sustainable design can be used to allow residents to achieve this (BioRegional & CABI 2008, p11 & 8).

To achieve a more sustainable urban design, the aim should be to reduce the lifetime environmental impact of any development by reducing the energy and resources used and waste produced at each stage of the development life cycle - construction, occupation and if necessary demolition. This can be achieved through reducing dependence on the wider environment for resources and reducing pollution of the wider environment by waste products - in other words by making any development both in its original construction, and throughout its lifetime, as self-sufficient as possible (Barton et al, 1995, p12).

**Figure 2: Nesting Spheres of Influence (Barton et al, 1995, p12)**



In this context, self-sufficiency is relevant at a range of scales from the individual building to the city region, and although most urban design interventions are relatively minor, the succession of minor changes can add up to major modifications to the overall natural systems of the neighbourhood, town, city-region and eventually to the earth's biosphere. The city in this sense is a complex interconnected system in which any intervention impacts on the sustainability of the whole (Philips 2003, p29).

Therefore, if each scale is visualised as a sphere of influence, then according to this analysis, at each level the designer should attempt to maximise the degree of autonomy by reducing the impact of the inner spheres on the outer spheres. Alongside architects and planners, urban designers will have an important direct role to play in the first three of the spheres identified in Figure 2. Therefore, at whatever scale they are working, built environment professionals - architects, urban designers, planners, property managers, surveyors, engineers, and developers - all have an important role to play in creating and maintaining sustainable urban form.

### **Towards Sustainable Design Principles**

Whilst space does not permit a debate about what sustainable development is, or is not, a number of commonly agreed tenets can be identified in the literature that underpin notions of sustainable development (see, for example, Carew-Reid et al 1994). These include:

- Futurity - because we owe future generations an environment at least as rich and opportunities at least as good as those available today;
- Environmental diversity - because maintenance and enhancement of various forms of natural capital underpin notions of sustainability;
- Carrying capacity - because by remaining within the carrying capacity of environments, activities can be accommodated in perpetuity;
- The precautionary principle - because environmental impacts are by their nature uncertain and because prevention is better than cure;
- Equity / quality of life - because sustainability extends to the needs of people in that environments which fail to meet human needs and in which resources are poorly shared are unlikely ever to be sustainable;
- Local empowerment - because sustainability is a process as much as an objective, requiring the acquiescence and preferably the active involvement of communities;
- The polluter pays - because those responsible should pay for the consequences of their actions.

But how do such general principles relate to urban design? Lang (1994) has argued that sustainable approaches to urban design should first avoid the misconception that dealing with the environment is merely 'an engineering problem' to be overcome by technology; and second, that designing to meet people's social needs is appropriate at the expense of the natural environment. Unfortunately, in the presence of cheap energy, theorists have long argued that the urban environment is being shaped by a technology whose goals are economic rather than environmental or even social. The result has been the alienation of city from the country through a misuse of urban and rural resources and an alienation of urban dwellers from the natural processes which in earlier times dictated so much of the flux of life. In the 1960s McHarg (1969) argued that towns and cities were still part of a wider, functioning ecosystem - no matter how distorted - and that decision makers should understand the altered but nevertheless functioning natural processes still operating within the city.

Thus settlements can be viewed as natural ecosystems. In this regard, a settlement is like a living organism which has the capacity to reproduce or renew itself (in part through urban design); which ingests quantities of food, fuel, water, oxygen and other

raw materials and which ejects waste fuels, solids and atmospheric emissions. Therefore, just “as ecology has now become the indispensable basis for environmental planning of larger landscape ... an understanding and application of the altered but none the less functioning natural processes within cities becomes central to urban design” (Hough, 1984, p25).

Lang (1994, p348) has also written of a ‘pragmatic principle’ for urban design: “The pragmatic approach for urban designers to take in dealing with the biogenic environment is to ask what is the human self interest in the long run. The urban design objective is then to avoid creating patterns of built form that might ultimately harm people by leading to a deterioration in the quality of life”. Given this position and the fact that future needs are unpredictable, Lang argues that the wise position for urban designers to take is an environmentally benign one and not to assume that humans will always find technological ways out of any bind. He suggests “Necessity may be the mother of invention, but the invention that may well be necessary is for urban designers to have a conservation ethic”.

If only for selfish reasons therefore, it can be argued that the human race has an interest in reducing its collective impact on the planet. A number of theorists have identified design principles to help achieve this. Hough (1984), for example, has identified five ecologically sound design principles which seek the integration of human with natural processes at their most fundamental level:

- The concepts of process and change - in that natural processes are unstoppable and change is inevitable and not always for the worse;
- Economy of means - that derives the most from the least effort and energy;
- Diversity - as the basis for environmental and social health;
- An environmental literacy - that begins at home and forms the basis for a wider understanding of ecological issues;
- A goal that stresses the enhancement of the environment as a consequence of change - and not just damage limitation.

Others have simplified the philosophical argument for sustainable urban design. For example, Bentley amended and extended the principles from ‘Responsive Environments’ (Bentley et al, 1985), to take on board one of the omissions of the earlier work - sustainability. He termed this ‘ecological urban design’ and argued that at the cultural heart of modern industrial societies lie the values of freedom and consumer choice. These, he suggested, find expression through consumerist lifestyles, but that the urban expression of such lifestyles is essentially ecologically destructive. In an extension to the ‘pragmatic principle’ he reasoned that urban designers cannot ignore these values but must seek to balance human desires with their ecological effects.

Bentley (1990) defined eight qualities which together cover the key issues for designing places which are both ‘sustainable’ and ‘responsive’. At the same time the European Commission’s *Green Paper on the Urban Environment* (CEC, 1990) emphasised the concept of ‘green urban design’ and with it a set of broader concerns emphasising the link between green urban design and green planning processes to secure sustainable design across the different spheres of influence. More recently the European Union updated thinking through the auspices of their Working Group on

Urban Design for Sustainability. Greatly expanding the agenda, they argued that “Sustainable urban design is a process whereby all the actors involved work together through partnerships and effective participatory processes to integrate functional, environmental, and quality considerations to design, plan and manage a built environment that” (EU 2004, p39):

- Is beautiful, distinctive, secure, healthy and which fosters a strong sense of pride, social equity, cohesion, and identity
- Supports a vibrant, balanced, inclusive and equitable economy
- Treats land as a precious resource; reusing land, promoting compactness at a human scale and concentrated decentralisation regionally
- Supports city regions as functioning integrated networks and systems, with an integrated view of the urban and regional landscape
- Strategically locates new development to address resource conservation, biodiversity, public health needs and public transport efficiency
- Promotes mixed use development to maximise the benefits of proximity, vitality, security and adaptability of the built form
- Has sufficient density to support public transport and services, whilst maintaining privacy and avoiding pollution
- Has a green structure to optimise the ecological quality of urban areas, including their microclimate, and to give access to nature
- Has high quality public infrastructure, including public transport services, pedestrian and cycle networks, and an accessible network of streets and spaces
- Makes use of state of the art resource saving and recycling technology
- Respects the existing cultural heritage and social capital of places, whilst avoiding conservation for its own sake.

One line of research has focused upon the environmental stock as regards the global ecology (air quality, climate, bio-diversity), regional resources (air, water, land, minerals, energy resources) and the local human environment (buildings, infrastructure, open space, aesthetics, cultural heritage), with Blowers (1993) arguing that sustainability should focus on the satisfaction of basic human needs (shelter, health, food, employment) and the retention of self sufficient ecosystems. Other work has attempted to define now commonly-accepted principles of sustainable development (Breheny M, 1992) and relate these specifically to urban design (Haughton & Hunter, 1994), although perhaps the most comprehensive analysis of sustainable design principles to date has come from Barton et al (1995; 2003; summarised in Barton, 1996) who identify seven clear principles for the creation of more sustainable urban design.

Other contributions develop many of the themes of the earlier work and to some degree reflect the consensus emerging around a number of principles. Edwards (2000, p30) focuses specifically on sustainable housing, espousing a predominantly physical agenda around energy and resource capture and reuse, whilst also reflecting broader social agendas of, for example, tenure mix, safety and social interaction. At the local scale, Rudlin & Falk (1999; URBED, 1997) and Jabareen (2006) have attempted to understand how to design the sustainable urban neighbourhood as an alternative to ecologically destructive suburban sprawl. At the larger spatial scale Richard Rogers (1997) in his 1995 Reith Lectures outlined his vision for the sustainable city; analysis which culminated in a series of sustainable city principles,

whilst in one of the few empirically based studies of sustainable urban form across macro and micro scales, Frey (1999, p32-33) has broken desirable sustainable characteristics into their constituent parts:

- Physical properties of the city: containment, densities to support services, mixed use, adaptability;
- Provisions of the city: readily available public transport, reduced and dispersed traffic volumes, a hierarchy of services and facilities, access to green space;
- Environmental and ecological conditions: low pollution, noise, congestion, accidents and crime, available private outdoor space, symbiotic town and country;
- Socio-economic conditions: social mix to reduce stratification, a degree of local autonomy, a degree of self sufficiency;
- Visual-formal quality: imageability of the city and its constituent parts, a sense of centrality and a sense of place.

Individually, all these contributions represent valuable conceptualisations of sustainable urban design / form. Nevertheless, by placing them together it is possible to identify a combined set of sustainable urban design principles that best reflect the concepts identified in the literature (Table 1)<sup>2</sup>.

Returning therefore to the key tenets of sustainable development discussed at the start of this section and to the question ‘how do these relate to urban design?’, the answer is found in a complex web of inter-relationships represented in Figure 3, where each tenet relates in turn to a range of sustainable design principles. So, for example, the need to plan ahead and consider the impact of urban design today on the experience of future generations (futures) concerns the careful stewardship of the environment through the ability of projects to enhance established environments and create manageable places that people will want to look after. It relates to the need to design for energy efficiency because energy and resources are finite. It concerns human needs because sustainable environments are those that cater for human requirements alongside other sustainable objectives. It requires that environments are resilient because future needs remain unpredictable. It concerns attempts to reduce pollution because irreversible changes to the environment will most likely undermine future inheritance. It encompasses notions of local distinctiveness because what is special about place can easily be undermined by insensitive development. And it requires biotic (ecological) support, in that bio-diversity is often the first casualty of the over-intensive human occupation of the environment.

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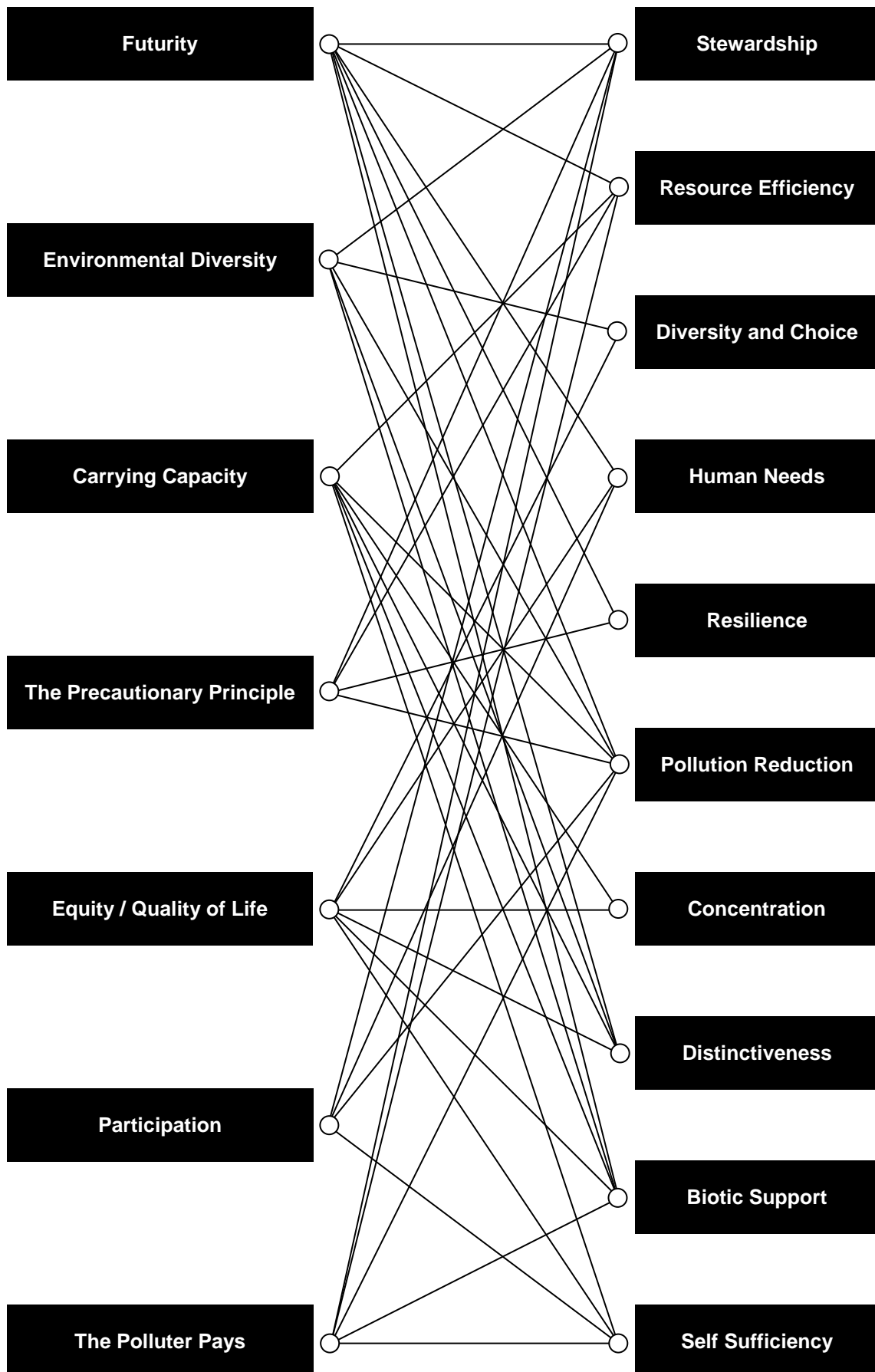
<sup>2</sup> Categorisations of this type are not perfect as the fuzzy and over-lapping nature of many of the concepts make them difficult to categorise, or to place under one heading only. The intention here is not to attempt a definitive categorisation, but instead to identify the conceptual scope and complexity of the subject and to recognise some of the internal contradiction and inter-linkages.



**Table 1: Sustainable Design Principles Combined**

	<b>Hough (1984)</b>	<b>Bentley (1990)</b>	<b>CEC (1990)</b>	<b>Breheeny (1992)</b>	<b>Blowers (1993)</b>	<b>Haughton &amp; Hunter (1994)</b>	<b>Barton (1996)</b>	<b>URBED (1997)</b>	<b>Rogers (1997)</b>	<b>Frey (1999)</b>	<b>Edwards (2000)</b>	<b>Clarke (2003)</b>	<b>EU (2004)</b>	<b>Jabareen (2006)</b>
<b>1. Stewardship</b>	enhancement through change		integrated planning	town centre rejuvenation				a feeling of stewardship	a creative city		integrated land use and transport planning	urban management focused on sustainability		
<b>2. Resource Efficiency</b>	economy of means	energy efficiency	reducing travel/energy reduction, recycling	public transport, CHP systems	land/ minerals/ energy resources, infrastructure & buildings	economy of means	energy efficient movement, energy strategy	minimal environmental harm	an ecological city	public transport, reduce traffic volumes	public transport, renewable energy, rainfall capture, low energy / water use	orientation for solar energy, public transport	land reuse, resource conservation, public transport efficiency resource and recycling technology	sustainable transport passive solar design
<b>3. Diversity and Choice</b>	diversity	variety, permeability	mixed development	mixed use		variety, permeability		integration & permeability, a rich mix of uses	a city of easy contact, a diverse city	mixed use, hierarchy of services and facilities,	mixed use, diversified tenure	mixed use high streets, housing mix, permeable block structure, social streets	vibrant, mixed use, connected streets	mixed uses diversity in housing types and prices
<b>4. Human Needs</b>		legibility			aesthetics, human needs	security, appropriate scale	human needs	quality space, a framework of safe/legible space	a just city, a beautiful city	low crime, social mix, imageability	shelter and safety, open space for social interaction, healthy, secure, comfortable	local community facilities, surveillance, privacy, mixed and inclusive communities	secure, healthy, equitable, cohesive, with privacy, supports social capital, human scale, balanced economy,	
<b>5. Resilience</b>	process and change	resilience				flexibility		ability to adapt and change		adaptability	adaptable, extendable	long-term maintenance	adaptable built form	
<b>6. Pollution Reduction</b>		cleanliness	ameliorating pollution through planting		climate/ water/air quality		water strategy			low pollution and noise	pollution and waste strategies		pollution avoidance, support microclimate	green urban drainage
<b>7. Concentration</b>		vitality	compact development	containment/ intensification		concentration	linear concentration	a critical mass of activity	a compact, polycentric city	containment, densities to support services	high density	polycentric urban structure, density gradients, reduce parking	compactness, density to support public transport	Compactness density to support transit
<b>8. Distinctiveness</b>			regional identity		heritage	creative relationships, organic design		sense of place		sense of centrality, sense of place			beautiful, distinctive, identity, sense of pride, respects heritage	diverse architecture
<b>9. Biotic Support</b>			open space	urban greening	open space, bio-diversity		open space networks			green space - public/private, symbiotic town/country	ecological wellbeing, natural habitat integration		integrated landscape, biodiversity, green structure	greening, biodiversity
<b>10. Self Sufficiency</b>	environmental literacy				self sufficiency	democracy, consultation, participation	self sufficiency			some local autonomy, some self sufficiency		walkable community, shared surfaces, participation	integrated networks and systems, pedestrian and cycle networks	walking and cycling

**Figure 3: Sustainable Tenets and Design Principles Compared**



## **From Theory to Practice**

In theory therefore, urban design has a direct and potentially important role to play in realising the fundamental aims of sustainable development. Moving from theory to practice, however, what do sustainable urban design principles imply? Rowley (1994, p186) has argued “Urban design considerations arise over a spectrum of spatial scales extending from the very local to the metropolitan scale of urban form and city image”.

City urban design strategies often provide the best illustrations of the multi-levelled nature of the discipline. In the UK, the best known design strategy - the ‘City of Birmingham, City Centre Design Strategy’ (Tibbalds, Colbourne, Karski, Williams, 1990) - provides a case-in-point. The strategy develops a ‘spatial framework’ for the city centre within which a set of urban design objectives are outlined. This recognises the distinct character of individual areas in the form of a number of ‘city quarters’ (areas of character). Large scale city-wide ‘spatial’ qualities are then defined to develop and protect existing and potential views across the city and to reinforce the city’s topography. Medium scale principles are established next at the level of individual urban spaces or groups of spaces, aiming to help people find their way around the city by redefining a network of barrier-free streets with well articulated public and private realms and activities at street level, and by softening and enhancing the city’s open spaces. Finally, small-scale architectural and urban management issues are discussed focussing on sweeping away the clutter and the enhancement of prominent facades.

The second volume to the Urban Design Compendium confirms this approach, arguing that urban design operates across building, block / street, neighbourhood, town / village, city and regional scales (Roger Evans Associates, 2007, p6). The remainder of this paper therefore turns to consider what the ten identified sustainable principles of urban design (from Table 1) imply across the spatial scales, in this case at the building, urban space, quarter and settlement-wide scales (summarised in Table 2). The paper concludes by briefly examining how more sustainable patterns of design might be delivered and by whom.

**Stewardship** - Urban design, like architecture and planning represents a process, as well as a series of end products, and an ongoing process through time that begins long before a development is conceived and continues long after it is completed. Indeed, urban design is concerned above all with the careful and ongoing stewardship of the built environment through a myriad of contributions - public and private - only some of which concern the actual development of new buildings and spaces. Thus, processes of urban maintenance, traffic management, town centre management, regeneration, planning and conservation, and individuals personalising their own properties, all impact on the quality and therefore collective public perceptions of particular places (Carmona & de Magalheas, 2007). In this regard, sustainable places are those where at all scales of development, these ongoing processes of adaptation and change are positively channelled in an integrated manner towards achieving a better quality built environment. This requires “taking a broad and long-term view of the cost and benefits of any change, and understanding what makes towns and cities sustainable” (Urban Design Group, 1998, p45). Typically such an approach will need to respond to any positive contextual characteristics of the building, space, quarter or settlement and address any negative aspects. Sustainability implies recognising where quality exists, achieving sustainable quality in new development and maintaining that

quality thereafter. In turn this requires governance regimes that are able to establish clear and measurable targets for each aspect of sustainability, whilst maintaining a sense that each target contributes to greater, integrated, economic, social and environmental goals (Roger Evans Associates 2007, 33).

**Table 2: Sustainable Design by Spatial Scale**

	<b>Buildings</b>	<b>Spaces</b>	<b>Quarters</b>	<b>Settlements</b>
<b>Stewardship</b>	Responding to and enhancing context Design for easy maintenance	Responding to and enhancing context Managing the public realm Allowing personalisation of public space Traffic calming	Design for revitalisation Developing a long term vision Investing necessary resources	'Joining-up' governance regimes - design, planning, transport, urban management Governance that supports stakeholder involvement
<b>Resource Efficiency</b>	Using passive (and active) solar gain technologies Design for energy retention Reduce embodied energy - local materials and low energy materials Use recycled and renewable materials Design for natural light and ventilation	Layouts to allow sun penetration Spaces that reduce vehicle speeds and restrict vehicle circulation Design spaces that reduce wind speeds and enhance microclimate Using local, natural materials Capture and recycle water	Reduced parking standards Urban block depths that allow sun and natural light penetration and which encourage natural ventilation Using combined heat and power systems Local access to public transport	Investing in public transport infrastructure Utilise more efficiently before extending the established capital web (infrastructure)
<b>Diversity and Choice</b>	Provide opportunity to mix uses within buildings Mix building types, ages and tenures Build accessible, lifetime homes and buildings	Mix uses along streets and in blocks Design for walking and cycling Combat privatisation of the public realm Remove barriers to local accessibility	Mix uses within quarters Design a fine grained street and space network (micro scale) Support diversity in neighbourhood character Localise facilities and services	Integrate travel modes Connect route networks (macro scale) Centre hierarchy to boost choice Variety in services and facilities between centres Remove barriers to accessibility
<b>Human Needs</b>	Support innovation and artistic expression in design Design to a human scale Design visually interesting buildings	Provide high quality, legible, public spaces Combat crime through space design and management Enhance safely by reducing pedestrian/vehicle conflict Design for social contact and for safe children's play	Design visually interesting networks of space Enhance legibility through landmark and space disposition Socially mix communities Support social capital	Enhance legibility through quarter identity and disposition Promote equity through land use disposition Build settlement image foster sense of belonging
<b>Resilience</b>	Build extendible buildings Build adaptable buildings Build to last Use resilient materials	Design robust spaces, usable for many functions Design spaces able to accommodate above and below ground infrastructure requirements Design of serviceable space	Design to allow fine grained changes of use across districts Robust urban block layouts	Build a robust capital web - infrastructure to last and adapt Recognise changing patterns of living and work
<b>Pollution Reduction</b>	Reuse and recycle waste water Insulate for reduced noise transmission - vertically and horizontally On-site foul water treatment using SUDs	Reduce hard surfaces and run-off Design in recycling facilities Design well ventilated space to prevent pollution build-up Give public transport priority	Match projected co <sup>2</sup> emissions with tree planting Plant trees to reduce pollution Tackle light pollution	Question 'end-of-pipe' solutions to water/sewerage disposal Control private motorised transport Clean and constantly maintain the city
<b>Concentration</b>	Design compact building forms to reduce heat loss i.e. terraces Bring derelict buildings back into use Consider high buildings where appropriate	Reduce space given over to roads Reduce space given over to parking Increase vitality through activity concentration	Intensify around transport intersections Raise density standards and avoid low density building Build at densities able to support a viable range of uses, transport and facilities Respect privacy and security needs	Enforce urban containment and reduce expansion Intensify along transport corridors Link centres of high activity
<b>Distinctiveness</b>	Consider surrounding architectural character when designing Enhance locally distinctive building settings Retain important buildings and heritage	Reflect urban form, townscape and site character in design Retain distinctive site features Design for sense of place - local distinctiveness Retain important building groups and spaces	Reflect morphological patterns and history - incremental or planned Identify and reflect significant public associations Consider quarter uses and qualities	Protect any positive regional identity and landscape character Utilise topographical setting Preserve archaeological inheritance
<b>Biotic Support</b>	Provide opportunities for greening buildings Consider buildings as habitats	Design in robust soft landscaping Plant and renew street trees Encourage greening and display of private gardens	Provide minimum public open space standards Provide private open space Create new or enhancing existing habitats Respect natural features	Link public (and private) open space into a network Green urban fringe locations Integrate town and country Support indigenous species

**Resource Efficiency** - underpins all notions of environmental sustainability, implying care in the use of energy and care in the use of non-renewable or environmentally destructive materials. For urban design this implies a concern for the use of both energy and resources in and by the fabric of the built environment, and at the larger scale, an increasing concern for energy use through preventing unsustainable spatial patterns of building and their implications on energy consumption through travel demands (Thorne & Filmer-Sankey 2003). It is clear that mainstream technological means exist to reduce much of the current resource profligacy - in the use of more sustainable building materials, in designing for natural light, sun and air and for solar gain, in more efficient heating and power systems, and in more efficient use of existing infrastructure (Mandix, 1996). It is also clear that many of these technologies can be applied immediately across the various design scales to retrofit established environments as well as in building more resource efficient new environments (Terence O'Rourke plc, 1998). Active technologies such as the micro-generation of power through wind turbines and installation of photovoltaic cells are increasingly cost effective and widespread, with, for example, savings in energy consumption of up to 80 per cent achievable if combined with passive technologies (Power 2008), but even modest programmes of wall insulation and the fitting of modern boilers in homes can reduce energy use by 50 per cent at a relatively modest cost (Lowe and Oreszczyn 2008).

However, in reviewing the take up of energy efficient technologies in the residential sector in US, Sathaye and Murtishaw (2004) identify both market failure and consumer preferences as decisive factors in limiting the take up of such measures. The latter (consumer preference) stems from ignorance amongst consumers about the resource choices they make, including, for example, a disconnect between their use of, and the price paid for, energy (GoS, 2009, pp90-91). The former (market failure) follows from this and reveals itself in resistance amongst market players to adopt design innovations that are seen as costly to produce and for which there is no corresponding up-lift in value, leading to potential market disadvantage. In this area then, until the economic imperative reflects the sustainable one, either by market, fiscal or regulatory means, the fact that it is cheaper over the short-term to build and live unsustainably with destructive use of resources - particularly high energy consumption - ensures that the incentive to look long-term and to reduce resource consumption remains weak (Hatherway 2000). The challenge for urban designers will be to convince their clients – as consumers and regulators – that the long-term benefits outweigh the short-term costs.

**Diversity and Choice** - Environmental diversity is a key tenet of sustainable development (see Figure 3). In a natural context this implies bio-diversity (see below), and in the built context, diversity and choice. Choice is also frequently cited as a key tenet of urban design, which in that regard seeks a freedom of choice in movement, in the facilities and amenities available to people and in how they use the public environment (Bentley et al, 1985, p9). In sustainable terms this implies the need to tackle processes in the built environment which in the post war period have acted to undermine choice. These include the increasing domination of urban areas by cars at the expense of pedestrians and those without cars, the zoning of the environment into mono-use areas with an associated reduction in diversity of use, and the increasing 'privatisation' of parts of the public realm leading to the effective exclusion from these areas of significant portions of society (Carmona et al, 2003, pp110-111). These patterns are compounded by the ongoing ignorance of the design

needs of certain sections of society such as the elderly and disabled (Imrie & Hall 2001). At the various scales across which urban design acts, the reintroduction and designing-in of diversity and choice in the built environment therefore represents a key aim: through mixing uses and tenures; by removing barriers to access and designing for walking; by connecting up the different spaces and networks that constitute the public realm; and by supporting diversity in the character of what results (Lang, 2005, p368-374).

**Human Needs** - Hand-in-hand with choice comes a concern for human needs. Indeed, on the grounds that environmental needs are never likely to be met if human needs are ignored, increasingly conceptualisations of sustainability have been underpinned by notions of social and economic sustainability - equity, opportunity, quality of life and participation (CAG Consultants, 1997, pp7-8). Drawing from Maslow's (1943) well used hierarchy of human needs, sustainable environments should cater for physiological (warmth and shelter), safety and security, affiliation (belonging and acceptance), esteem (status) and self-actualisation (expression and fulfilment) needs in that order, although the most civilised societies will cater equally for each (Lang 1994, pp156-162).

Relating such broad concerns to the sustainable urban design agenda, human needs encompass access to varied economic opportunities, and also the creation of comfortable environments that are of a human scale and visually interesting, that allow safe and crime-free human contact, ease of movement and navigation (legibility), that are socially mixed, and that through their design and the disposition of uses are available to all (Montgomery 1998). At the larger scale of settlement and quarter design, human needs can increasingly be met through positive image building to foster the identification with place so necessary to build commitment to, and sense of ownership of, the environment (Chaplin 2007). Taking just one example, with global warming, increasingly inhabitants of urban areas suffer from the tendency of hard built-up areas to store and retain heat longer than surrounding green areas. These urban heat island effects (a form of environmental pollution) can leave city centres 10 per cent warmer than surrounding suburban areas, and were blamed for 35,000 deaths across Europe in August 2003. The example illustrates one very direct example of how environment can directly impact on human health and comfort, and how simple design measures can help to rectify the situation, , for example increasing tree cover by 10 per cent can reduce the surface temperature of a city by between three and four degrees centigrade (CABE, 2009, p19). At the same time streets trees can improve biodiversity, provide daily shade and shelter, filter dust and pollution, and, critically, reduce CO<sub>2</sub>.

**Resilience** - relates to the need for resource efficiency, in that built form once constructed represents a considerable investment in energy and resources. Furthermore, if all the embodied energy in the infrastructure of a typical a town or city is calculated it will represent many times more energy than the ongoing processes of development and redevelopment consume over decades. For their part, buildings will continue to use energy once constructed – studies of conventional new houses indicate that the accumulated energy costs in use exceed the embodied energy of the actual basic construction within five years (Barton et al, 1995, p133) – but as more energy efficient construction techniques are adopted, so the energy and resources invested in the construction process become more and more significant. Building to last also reduces the pressure on sources of construction materials, reduces the waste

from, and energy used in, demolition, and encourages the construction of more adaptable buildings, spaces, urban forms and infrastructure (Moughtin & Shirley 2005, pp36-39). This last concern is significant because to be long-lasting, patterns of development need also to be adaptable, in the case of buildings to be able to adapt to different functions and to be extendible if required; in the case of public space, to cater for the many overlapping and sometimes incompatible functions required of urban areas; and in the case of quarters and settlement patterns, to be able to adapt over time to changing technologies, patterns of life and work, and movement (Barton 2000, pp130-132).

Research conducted for the British Government has concluded that public spaces will have a key role in the future delivering resilience of another type – energy resilience – through hosting micro-generation technologies (wind, photo-voltaic and heat pump) as countries search for ways to reduce their reliance on high carbon fuel sources (Government Office for Science, 2008, pp148-150). It is likely, however, that whatever measures are put in place to reduce climate change, the delayed effects of greenhouse gas emissions will be increasingly felt; in Western Europe, for example, ushering in more extreme weather conditions, including hotter and drier summers, warmer and wetter winters, rising sea levels and flooding. This will require the design of buildings and spaces now that can adapt to these changed circumstances over time, and still provide comfortable environments, For CABE (2008, p1) this requires working with the natural processes of the city (see Sustainable Inset 4): “Spaces that are softer, greener, more organic and natural will store water and are critical to modifying urban temperatures. Green spaces with a generous planting of trees link to form a network offering cooler, cleaner air. Adaptation demands that we start really understanding how our towns and cities work naturally. How water courses through a town, for instance, and so how to manage it”.

**Pollution Reduction** - If settlements are viewed as living organisms which ingest resources and eject waste products, then reducing waste emissions represents a key role of sustainable urban design - to use resources more efficiently, to reduce the impact of development on its surroundings and to reduce the energy expended in waste removal and disposal (Ritchie 2003). Pollution reduction potentially also has an important role to play in improving quality of life in urban areas. This is because some of the most negative collective perceptions about urban areas and a major factor driving migration out of cities to more suburban and rural areas concerns the pollution, dirt and noise characteristic of many central areas (Mulholland Research Associates Ltd, 1995).

The key objective across all spatial scales is to tackle pollution by reducing it in the first place - insulating against noise, ventilating against fumes, designing-out light pollution, designing-in filtration by trees, and investing in public transport whilst (as far as possible) controlling private car use. Following reduction efforts, the reuse and recycling of waste products (energy, water, materials etc.) should form a second objective (Edwards, 2000, pp12-29). Where possible this should occur on site, for example the filtration of foul water through Sustainable Urban Drainage (SUDS) schemes, or in the local neighbourhood, such as the collection and burning of waste as a fuel source for local combined heat and power stations. Removal of waste from sites should be a last resort, although investment in cleaning and maintenance is a necessary dimension of good urban management as well as a necessary component of urban renewal (Carmona et al, 2004). To take just one example, the purification of

water is an expensive and energy intensive process, yet only 7% of purified water provided to homes in England is used for drinking and cooking, a third is simply flushed down the toilet. At the same time, most storm water is washed into sewers (CABE, 2009. P18). Pollution reduction will therefore require urban designers far more attuned to the first three 'R's, 'reduce', 'reuse' and 'recycle', 'removing' only when necessary.

**Concentration** - is perhaps the least straightforward of the design principles. Concentration across spatial scales is widely held to be a desirable strategy to reduce travel demand, energy use and land-take and to increase the vitality and viability of established centres. Nevertheless, in a challenge to those advocating higher density living it has been argued that a renewed emphasis on higher density development could mean more congestion and pollution and probably the demolition of at least part of the historic fabric (Hall, 1995). Furthermore, that higher-density living, although technically sustainable in the short term, may be individually unacceptable and perhaps unsustainable in the long term as working at home becomes more the norm, as non-polluting motorised transport is developed and as the reduced supply of greenfield sites drives up densities at the expense of open space in established urban areas (Davison, 1995). Research sponsored by the retail industry has even shown that in some circumstances new out-of-town shopping development can result in a reduction in car journeys over town centre alternatives on the basis that customers will travel to such developments come-what-may, and therefore that the more such developments there are, and the closer they are to each other, the less individuals will need to travel to reach them (JMP Consultants, 1995).

Despite the debates, Breheny (1992) has reflected a broad consensus on these issues by arguing that urban containment policies should continue to be adopted and decentralisation slowed down and that this should go hand-in-hand with the rejuvenation of existing urban areas, with intensification prioritised around transport nodes, but with extreme 'compact city' proposals rejected as unreasonable. Later work confirmed this advice, arguing that if nothing else, intensification can support urban living and reduce land-take, although the case for widespread compaction has yet to be convincingly made (Jenks et al, 1996, p342). Furthermore, concentration can help to reduce space given over to the cars and increase pedestrian movement and the viability of public transport, therefore helping to support other sustainable urban design objectives such as reducing the need for personal travel (Clarke 2003, pp19-21). At the building scale, compact building forms such as terraces are clearly more energy efficient than, for example, detached ones (the higher the ratio of floor area to external skin area, the lower the loss of energy – Chalifoux in Farr, 2008, pp189-92), whilst factoring in all consumption patterns has shown that denser patterns of housing design act to reduce the environmental footprint of housing due to differences in household size, private lawns and parking (Moos et al 2006). The variation in impact that the concentration of urban form can account for is illustrated by Newman (2006, p285) who concludes that most Chinese cities consume around two GJ [gigajoules] of transport energy per person at population densities of around 100 persons per hectare. By contrast, Atlanta in the USA consumes 103 GJ per person through its density of six persons per hectare. Thus the 200 million Chinese who moved into cities between 1996 and 2006 are equivalent to just over one Atlanta with its 4 million people.

**Distinctiveness** - Supporting local distinctiveness as an objective is intimately tied to achieving other sustainable objectives: to careful stewardship, in that conservation of



the built fabric is a process of management and maintenance through time; to the delivery of human needs, because perceptions of place are intimately tied to the familiar and cherished local scene; and to resilience, because distinctiveness inevitably requires that built and natural assets are valued over the long-term. It also represents a key objective of progressive planning systems through legislation covering the protection and enhancement of valued buildings, townscapes and natural landscapes (English Heritage, 1997). Fundamentally, however, distinctiveness is concerned with the preservation and enhancement of what is special about places (Clifford & King, 1993), in that places can be viewed as constructs of often unique geographic, physical and environmental characteristics, combined with unique cultural circumstances manifest in a settlement's original form and purpose and subsequent human interventions over time – the interconnected parts, as described by (Philips 2003, p42-45). The result are environments of distinctive character in building design, space composition, mix of uses and spatial layouts, which once damaged are difficult to repair. This should not imply that change is inappropriate and should be resisted, merely that to be sustainable the precautionary principle should be applied (Biddulph 2007, p70) and careful consideration given to identifying what is special, to resisting ubiquitous pressures for homogenisation, and to ensuring that new development across all scales respects and enhances the best of what already exists (Moughtin & Shirley, 2005, pp25-30).

**Biotic Support** - is fundamental across the different design scales in meeting the challenge of maintaining environmental diversity. Landscape design is often the forgotten dimension of the urban environment, too often being treated as an afterthought or as a purely visual concern, for example, to reduce the impact of ugly buildings or acres of parking, or alternatively forced and overly conceptual, losing in the process its human connection (Denton-Thompson 2005, p126). However, more fundamental approaches to landscape have long been advocated in which urban areas are seen as just one part of a wider functioning ecosystem, and in which the biotic environment (fauna and flora and space for it to flourish) exist side-by-side, and even dictate the form of the human-made environment (McHarg, 1969). Therefore, like the associated need to reduce pollution and the use of natural resources, the need for biotic support equates to support for the ongoing natural processes in and around human settlements. CABE (2009, p21), for example, argues that in a context where urban gardens often feature greater biodiversity than surrounding intensively farmed countryside, space needs to be consciously provided for flora and fauna within urban areas to supplement the already important role these areas perform in supporting wildlife.

At the level of buildings and spaces, this might include the integration of soft landscaping and trees and the nurturing of habitats in new and established developments, the revised Urban Design Compendium 1, for example, argues that urban blocks of about 90 by 90 metres allows for permeability whilst providing adequate space for biodiversity and wildlife support (Llewelyn Davies, 2007, p58). At the scale of the urban quarter, the concern extends to respect for existing and provision of new open spaces within settlements and to their nurturing as natural habitats (Wooley 2003, pp36-44). Finally, at the settlement-wide scale, the concern relates to the integration of town and country through the design of open space networks and the careful transition between town and country at the urban fringe (Von Borcke 2003).

**Self-sufficiency** - relates back to human needs, but also encompasses issues of resource management. Pre-twentieth century, development of the built environment was in the main slow and incremental with most lives centred on local areas and utilising local resources - both human and natural. With increasing internationalisation and greater ease of communications and travel, patterns of living and development processes take place on an ever-expanding stage. The implications are unsustainable because of the loss of identification with place through development processes, because of the homogenisation of building types, forms, styles and landscapes, and because of the increasing distances that populations and resources need to travel to cater for everyday needs (Hopkins, 2005, p28-29). Although patterns of life will be difficult to change over the short term, design has a potentially important role to play in providing people the choice to lead more self-sufficient lifestyles in the future. This may include physical measures such as providing for cyclists to encourage greater self sufficiency in travel, providing fast internet connections to allow home working, or simply allowing space for local food production in less dense urban areas (Hopkins, 2000). More fundamentally, it will require key stakeholders and local populations to have a greater active involvement in developing a vision for their locality and in its ongoing management (Stewart, 2000). Participation (going beyond consultation) therefore represents a key tenet of self-sufficiency as it does of sustainable development more widely. It extends to the notion that in a democratic society, the actions of the few should not impact adversely on the amenities enjoyed by the many. This implies that development through its design should be environmentally benign, or that recompense be made locally to redress the balance (Dunster 2006). Inevitably not all members of the community will be engaged to the same degree in environmental behaviours, but it may be that urban design processes can encourage greater participation. A 4Es model (DETR 2006) can be utilised to maximise the likelihood of enduring behavioural change:

1. Engaging – by providing opportunities for the public to participate in debates, through community and social networks and marketing
2. Encouraging – by rewarding certain behaviours and discouraging others, for example through local award schemes, fiscal incentives or legislative controls such as on parking
3. Enabling – by delivering the infrastructure that allows sustainable behaviours to occur, for example the provision of safe, attractive routes to key local destinations, or space to store recycling bins.
4. Exemplifying – by actively demonstrating through exemplar schemes and local leadership.

### **Delivering Sustainable Design**

Discussion of the ten sustainable design principles at their different scales has revealed the complexities inherent in developing - let alone delivering - a sustainable urban design strategy. It also reveals the aspirational nature of much of the agenda which inevitably contains internal overlaps and contradictions that can only be resolved through practice. For example, the desire for more concentrated patterns of development might unintentionally design-out opportunities for increasing biodiversity or for sustainable drainage, design for passive solar gain may require more south-facing development, whilst human needs for a more sociable environment may necessitate a permeable grid. The principles outlined above can only ever represent a

start of a design process, therefore, with principles needing to be reconciled on the basis of local contextual factors and development aspirations.

More fundamental questions have also arisen about whether this new imperative for the design agenda can be addressed within the making places tradition of urban design that now dominates the theory and practice of urban design, and to which this article broadly subscribes, or whether an entirely new orthodoxy is required, one that places sustainability, rather than place-making, at its heart. One of the best known ‘sustainability exemplars’, BedZED in London (Figure 4), for example, is based on a continuous structure of south-facing terraces that deliberately eschews its suburban context and in effect establishes itself as a self-contained zero-carbon enclave. Other models are increasingly being put forward by high-profile architects that either see sustainable urban design as a return to object-architecture, for example Ken Yeang’s vertical ‘green’ skyscrapers, or as technology-driven settlements on a ‘Total design’ model (Lang, 1994, pp78) with designed lifestyles to match, for example Arups’ zero carbon city in Dongtan, Shanghai. Foster and Partners’ Masdar city in Abu Dhabi combines both where the whole city is viewed as a single object in which technology enables residents to live carbon-neutral lives in the middle of a desert.

**Figure 4: Looking from one residential enclave to the next**



All these examples suggest a break with urban design as place-making, at least to the extent that form and impact rather than people and place are the priority. However, none of the sustainable urban design principles outlined above necessarily imply that concerns for place-making can not also be met. Ritchie (in Ritchie and Thomas, 2009, p92), for example, concludes that ‘we need to analyse the ingredients that make a successful ‘place’ and work with them once again ... [whilst be aware that] ... we are now dealing with modern issues that affect the recipe: a changing climate and the need for more people to live in a more humane city environment’. The authors of the Urban Design Compendium 2 (Roger Evans Associates, 2007, pp72) conclude that ‘There is a common misconception that a conflict exists between principles of good urban design ... and an optimal approach to environmental sustainability’. They argue, for example, that it is perfectly possible to engage with street-based design whilst also achieving optimal thermal performance.

What may be required, however, is a more sophisticated and multi-functional view about urban environments and their constituent elements: people using their own

homes to generate power, green open spaces used for water recycling, neighbourhoods accommodating multiple land uses, and public spaces supporting wildlife, etc. (Thwaites 2007). Moreover, with climate change now impacting on and changing local environments around the world, there will be need for flexibility, and to learn the lessons from history about what characteristics of urban form can be used in different climatic circumstances to modify local climates. Golany (1996), for example, argues that urban morphology can be designed to cool or warm temperatures in urban areas as appropriate, without the need for active, energy-intensive technologies. He concludes, for example, that whilst in stressful climates (which with climate change may become more widespread) compact city forms will be generally desirable, continuous street grid systems will best suit hot climates to encourage air penetration deep into the city with closed irregular street systems more suitable in cooler climates. Golany (1996, p464) concludes that we need to combine innovation born through research with an in-depth knowledge of how our ancestors coped with climate – good urban design and modern good technology combined.

Clearly however, any conceptualisation of sustainable urban design is of little value unless it can be implemented. The drivers encouraging more active approaches to delivering sustainable design are well accepted and relate to the potential for lasting damage wreaked by increasingly unsustainable patterns of life and development and to a recognition that mankind holds both the potential to irreversibly damage the natural environment or to repair and enhance it. The decisions are essentially moral ones to be debated through international, national and local political processes for delivery through associated processes of development and governance.

The barriers to delivery are, however, formidable and may sometimes seem impossible to overcome. Some have already been mentioned, but together they encompass:

- Established patterns of living - which are frequently ingrained and difficult to change, for example, the reliance on car-borne modes of travel and the layout of the urban environment based on that premise;
- Public awareness and aspirations - which often aspire to unsustainable, high consumption modes of living, including aspirations (particularly in the Anglo-Saxon world) for low density housing and to own a car (and sometimes two or three);
- Economic and governance systems - which rarely reflect the true costs of development (particularly the environmental and social costs) and which tend towards decisions based on short-term economic gain rather than long-term investment;
- Lack of political will - to influence development processes because of the overriding pressures to deliver, first, economic goals, second, social ones, but only a poor third, environmental objectives;
- Lack of skills and vision - in either the public sector or the private sector to innovate new solutions and think beyond tried and tested - but often unsustainable - development processes;
- Selfishness - because too many stakeholders see the environment as ‘someone else’s problem’ and therefore fail to consider (and sometimes actively dismiss) the potential role they might play;

- Lack of choice - because many individuals have little or no choice in the way they lead their lives because of cultural, economic, educational and physical constraints;
- The scale of the problem - in that turning around unsustainable patterns of living and development is a massive long-term process dependent on fundamental changes to attitudes and to co-operation between many different stakeholders across spatial scales. In such a context, it is easy to think that individual contributions will have little impact and that positive action can be put off for another day.

This last point is significant and helps to illustrate the complexity of the task. Thus, even to deliver just one part of the wider sustainable development agenda - better urban design - a whole series of stakeholders are required to support a shared vision of a more sustainable future. Yet as the EU Working Group on Urban Design for Sustainability concluded, obstacles are widespread, commonly relating to a “lack of political will and awareness; difficulties with planning and administration systems, legislation and procedures; the need for appropriate training and education; lack of appropriate knowledge sharing systems; the persistence of the traditional, sector-based approach to urban planning and design; the complexity of the holistic vision of sustainable development and planners reluctance to accept it” (EU, (2004, p41). Clearly, therefore, the barriers are both international and endemic and extend across public and private spheres of responsibility.

Actual processes of urban design are diverse, sometimes led by the private sector and sometimes by the public, and increasingly through a partnership of public and private stakeholders. In this regard the private sector brings to the table expertise, resources and the drive to deliver inspired by the profit motive. The public sector acts as regulator, coordinator, manager, and often as landowner. Both will be involved in almost every urban design intervention although the balance of power between each and their exact roles and relationships will vary profoundly depending on local circumstances and development processes.

Table 3 attempts to identify the diversity of stakeholders who need to be engaged in the delivery of sustainable design, as well as the diversity of means across spatial scales through which to influence its delivery. The table demonstrates – in particular – the wide range of public sector agencies and potential influences on sustainable design, as well as the diverse interests across the four spatial scales of public, private and community sectors. It confirms the need for ‘joined-up’ approaches to governance in this area (perhaps above all others) where responsibility is spread so thinly. It also confirms the important role of agencies with plan-making and grant-making powers – planning authorities, highways authorities and regeneration agencies – in a central co-ordinating role to join-up public sector contributions and deliver a partnership of public and private interests focused on delivering sustainable urban design.

**Table 3: Delivering Sustainable Design - Stakeholders and Influences**

	<b>Buildings</b>	<b>Spaces</b>	<b>Quarters</b>	<b>Settlements</b>
<i>Private Sector</i>				
<b>Design Professionals</b>	Building design Urban design Design vision	Urban design Landscape design Design vision	Urban design Landscape design Design vision	Urban design Design vision
<b>Developers</b>	Building developments	Urban developments Public/private partnerships	Urban developments Public/private partnerships	New settlements Public/private partnerships
<b>Investors</b>	Project financing Long-term investment	Project financing Long-term investment	Project financing Long-term investment	Project financing
<i>Public Sector</i>				
<b>Planning Authorities</b>	Local plan policy Design guidance Design briefs Development control	Local plan policy Design guidance Design briefs Development control Planning gain	Local plan policy Design guidance Design frameworks Development control Planning gain	Strategic planning policy Local plan policy Design strategies
<b>Highways Authorities</b>		Road construction standards Road adoption procedure	Highways layout standards Road adoption procedure	Transport plans Traffic management
<b>Building Control</b>	Building controls			
<b>Fire Authorities</b>	Fire spread standards	Fire spread standards	Fire prevention access standards	
<b>Environmental Health</b>	Noise control	Refuse disposal/control	Vehicle emissions control	Pollution control
<b>Housing Authorities/ Providers</b>	Social housing provision/subsidy Design standards	Design standards/quality indices		Housing strategies
<b>Parks &amp; Recreation Departments</b>		Open space maintenance	Open space provision/preservation	Landscape/open space strategies
<b>Police Authorities</b>	Architectural liaison	Architectural liaison Public order Traffic control	Public order bylaws	
<b>Regeneration Agencies/ Authorities</b>	Design guidelines	Design guidelines Gap-funding/grants Public/private partnerships	Land reclamation Gap-funding/grants Public/private partnerships	Public/private partnerships
<b>Conservation Agencies</b>	Gap-funding/grants Listed building designations/controls	Enhancement schemes/funds Conservation area designations/controls	Enhancement schemes/funds Conservation area designations/controls	
<b>Urban Managers</b>		Urban streetscape management/ co-ordination	Urban promotion/ management/ co-ordination	
<i>Public/Private</i>				
<b>Utility Providers</b>		Road/pavement repair standards		Infrastructure provision
<b>Public Transport Providers</b>		Public transport management	Public transport provision	Public transport integration
<b>Educational Institutions/ Sector</b>			Local engagement	Raising environmental awareness
<i>Community Based</i>				
<b>Voluntary Groups/ Communities</b>	Consultation response	Actively engaging (participation, urban management)	Campaigning Actively engaging (design, appraisal, participation)	Campaigning
<b>Local politicians</b>	Statutory powers	Statutory powers Spending priorities	Statutory powers Spending priorities Lobbying	Statutory powers Spending priorities Lobbying
<b>Individuals/ Private Companies</b>	Home/building maintenance	Lifestyle choices Civic responsibility	Civic responsibility	

However, of greatest importance to deliver more sustainable urban design is the need to first establish an impetus for change. In delivering this objective not all is doom and gloom as increasingly, international, national and local government agendas are recognising that change is not only desirable, but is both necessary and inevitable (EU, 2004, pp30-38). In this, the paper has argued, sustainable urban design across all scales has a central role to play, whilst delivery is a shared public / private responsibility. Initiatives such as the LEED for Neighborhood Development rating system from the US Green Building Council, the UK Government's Sustainable Building Code, or CABI's [www.sustainablecities.org.uk](http://www.sustainablecities.org.uk) are beginning to put the necessary tools in place to deliver on the challenge.

## **Conclusion**

Fundamentally, good urban design is sustainable, but as the paper has shown this implies much more than simply reducing energy use and carbon emissions. Instead it implies a much more profound basis on which to make decisions which impact on the social, economic and environmental sustainability of the built environment.

It is also important to recognise that sustainable urban design is just part of the broader sustainable development agenda that seeks to create sustainable places: economically, socially, and environmentally. Allmendinger and Tiesdell (2004) have suggested that this requires getting the people (skills, resources and commitment, social infrastructure, and economic infrastructure) and place factors (communication, physical resources, economic structure, location, quality of life opportunities and local governance) right. Urban design relates to all of these, but is only part, albeit an important part, of this agenda. It is nevertheless vital that the contribution of good design is fully recognised in both the theories and practice of sustainable development.

Around the world, policy agendas (if not always practice) have been recognising this. Taking two examples from different sides of the world, New Zealand's Urban Design Protocol (Ministry for the Environment 2005) situates urban design within the country's Sustainable Development Programme of Action, calling for towns and cities which are competitive, thriving, creative and innovative, whilst being liveable and environmentally responsible. Similarly the UK's national planning policy now stipulates that "Good design ensures attractive, useable, durable and adaptable places and is a key element in achieving sustainable development" (ODPM 2005, para.33).

In the latter case, the ten design principles discussed above are now reflected across the national benchmark for well-designed housing and neighbourhoods – Building for Life (2008). This sets 20 questions that developers can use to write development briefs, or for local authorities to demand higher design standards. Table 2 can be used in a similar fashion as a simple means to assess whether urban design proposals are sustainable, and to indicate the range of relevant issues applicable at different spatial scales. Planners, designers, developers and other stakeholders might usefully ask:

1. Do proposals enhance their context, effectively join-up the range of contributions and therefore help to carefully steward in change over time?

2. Are proposals efficient in their consumption and long-term use of energy and natural resources?
3. Do proposals support diversity and choice in movement, access and land use mix?
4. Do proposals support human needs for security, social contact, comfort and artistic fulfilment?
5. Are proposals resilient enough to withstand and adapt to changes over time?
6. Do proposals minimise pollution of the wider environment both in their construction and long-term management?
7. Are proposals concentrated to reduce land take and energy use and increase urban vitality and viability?
8. Do proposals respect what is distinctive about their environment and help to build or preserve local sense of place?
9. Do proposals support the biotic environment through the careful integration of built and natural resources?
10. Are proposals likely to support the establishment of more self sufficient, involved local communities?

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