Architecture, ethics and sustainability – an exploration

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ABSTRACT: Globally we are grappling with the concept of sustainability. What does it mean and how should we respond to ensure that the planet and its ecosystems survive? While the problem of living in a sustainable way must be addressed by all sectors of society, architects are arguably in the ‘front line’ because of the impact of buildings in terms of resource use and waste generation. Most definitions of sustainability are unhelpful because of their wordiness, lack of detail or ambiguity. Others distort the concept of sustainability to allow business-as-usual (i.e. unsustainable) activity to continue. Using one particular model of sustainability, this paper explores the apparent contradictions between architectural practice in the residential sector, ‘sustainable’ housing and the desire to behave ethically. The paper begins with definitions of sustainability and ethics, together with some guiding principles. The literature examining the ethics of sustainable architecture is then reviewed. Two indicators are suggested to make a broad-brush assessment of sustainability. Current practice in Australian residential architectural design, both mainstream and ‘green’, is then critiqued against these indicators. Finally, some practical options for a practising architect faced with a client, who wants an ‘unsustainable’ house, are briefly explored.

Conference theme: The indicators of sustainable building
Keywords: sustainability, ethics, architecture

INTRODUCTION
Globally we are grappling with the concept of sustainability. What does it mean and how should we respond to ensure that the planet and its ecosystems survive in their present form? It has become apparent that the lifestyle of most of the populations in industrialised countries is unsustainable. Our ecological footprint (EF) is defined as “the area of land required to produce the natural resources a population consumes and to assimilate the waste that population produces” (Simpson et al., 2000). In Australia, the EF is 8.1 global hectares (ha) per capita (ABS, 2001). Wackernagel and Rees (1996), however, calculated that there was the equivalent of approximately 1.5 ha per capita available for humans to use assuming a population level of 5.8 billion. Footprint analyses indicate that for everyone to live at the level of affluence enjoyed by the OECD countries would require more than four planets. This figure contrasts sharply with the footprint of those living in the non-OECD countries, where levels are still approximately within the limits that could be supported by the resources available (Figure 1).

Clearly those living in the industrialised countries must radically reduce the impact of their lifestyle. While the problem of living in a truly sustainable way must be addressed by all sectors of society, architects are arguably at the ‘front line’ in terms of the impact of their decisions. Buildings last for 50-100 years and the impact of their construction and use can therefore be considerable. In 1990, 28% of Australia’s energy-related emissions were attributable to the building sector (AGO, 1999). End-use energy is predicted to rise by 40% and 91% in the residential and non-residential sectors respectively, assuming business-as-usual. The resource use and waste generation of buildings is also considerable. It is estimated that 30-40% of all Australia’s solid waste disposed at landfill comes from the construction and demolition of buildings (Newton, 2001).

Only three percent of residential homes are designed by an architect (ABC, 2000). This figure could imply that the influence of architects on residential housing stock is small. Yet the work of architects continues to be promoted. While an architect-designed home is the aspiration of many Australians, their major influence is in establishing design trends, which are then adopted by producers of mass housing. Confronted by any client with the means, but not necessarily the concern to achieve their desired home in a sustainable manner, places the architect in a difficult ethical position. This dilemma must present itself regularly to any architect who is serious about producing designs that can be regarded as truly sustainable.

This paper explores this apparent contradiction between architectural practice in the residential sector and the need for truly sustainable housing. It takes up two broad themes – one that assesses the ethics of the situation through a quantitative analysis of the problem, the other that connects ethical decision-making to self-interest at a level that architects as designers can work with. The paper begins with definitions of sustainability and ethics, together with their guiding principles. The literature, which explores the ethics of sustainable architecture, is reviewed for the insights they may offer. Objective indicators of sustainable housing are then established against which current
practice in residential design in Australia might be critiqued. The paper finally explores some of the options that practising architects might employ if they attempt to resolve the contradictions between their clients’ desires and sustainability. This situation might occur, for example, if a client proposed a large house that, on a per capita basis, clearly exceeded a sustainable level of resource use and waste generation.

![Bar chart showing ecological footprint by region in 1999](source: WWF, 2002, ABS, 2001)

**Figure 1: Ecological footprint by region in 1999**

1. **SUSTAINABILITY**

There are many definitions of sustainability and certainly there is no universally accepted definition of this overused word. Mitchell et al. (1995), cited in Palmer et al. (1997), have however, identified four principles from the sustainability literature (Figure 2). These four principles and how they might impact on architectural practice are explained below.

![Diagram showing four principles underlying sustainable development](source: Palmer et al., 1997)

**Figure 2: Four principles underlying sustainable development**

The Futurity Principle originates from the original 1987 Brundtland definition of sustainability, which broadly envisaged sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". In industrialised countries, our needs for food, clothing and shelter were met and passed a long time ago. The average new house built in 2002-3 in Australia was approximately 228 m² (ABS, 2005), compared with approximately 100 m² in the 1950s (Freeland, 1970). Assuming most architecturally designed houses are as large as this average and also generously fitted and appointed, the increased use of resources in meeting this desire is antithetical to the concern for future generations.

The Environment Principle reflects the notion that sustainability must ultimately be measured against the ability of the biosphere to absorb the consequences of human activity. Up to now, this has been the main concern of environmental groups and those that eschew an anthropocentric view of the world. Measured against this principle,
architecturally designed housing could score well. There is now a considerable body of knowledge available to architects about the life cycle of materials, from ‘cradle to grave’, to assess their use in residential housing over the long-term. An architect following sustainability principles could potentially design a house with minimal environmental impact.

The Equity Principle has been added to the sustainability model by those who argue that the finite resources on the planet should be shared far more equitably than is currently the case. Disparity in the use of energy exemplifies the current inequities. In 2001, primary energy use in the OECD countries with their population of 1.1 billion was 4.68 tonnes of oil equivalent (toe) or 6.5 kW per capita (UNDP, 2004). In the non-OECD countries, with a population of 5 billion, per capita energy consumption was 0.95 toe or 1.33 kW i.e. 20% of the level in affluent countries. In comparison with all but the elites of the populations of developing countries, the level of affluence enjoyed by the average citizen in industrialised countries is spectacular. Against this principle, architecturally designed houses, which are likely to be larger than the average dwelling in most developing countries, and also affluenty appointed and uniquely constructed, will score poorly.

The Participation Principle was added to the sustainability debate at the 1992 Rio Earth Summit. It acknowledges that the public should participate in any process of change and was enshrined in Principle 10 of the Rio Declaration. This should not however be confused with the traditional one-on-one relationship enjoyed within the typical architect-client relationship. Fowles (2009) discusses how community participatory design in architecture strengthens "social sustainability". He even suggests that when ecological and participatory designs are intertwined that the characteristics of a new paradigm can be observed. Although at the wider community level, meaningful participation is unknown, it is not unknown and some examples of environmentally sensitive group housing are starting to appear e.g. Christie Walk in Adelaide (Robertson, 2006). Other examples with longer histories exist such as Moora Moora outside of Healesville. These examples of community participation encourage paradigm change that go beyond housing design. To play a more effective role in changing community expectations requires that an architect move beyond responsibility for individual projects and become involved as public intellectuals in local planning and urban design initiatives to help build community-level responsibility for setting and meeting sustainable housing standards.

2. ETHICS

Architects are faced daily with professional choices based on value judgements. These may range from design to career-related decisions. Research shows that value systems and the ethical decision-making derived from them are culturally malleable and that these systems are fundamentally based on self-interest through concepts of self (Layar, 2005). The realistic view, according to Layard, is that we take others into account, partly out of pure selfishness (expecting them to reciprocate), partly out of genuine sympathy, and partly out of principle. Narrow individualism is a contemporary phenomenon found largely in Westernised culture and linked to deepening levels of neurosis (Eckersley, 2004). Contemporary studies of health and well-being indicate that happier and more successful individuals consistently express a widened sense of self-interest (Layar, 2005).

Singer (1995: 5), the ethicist and animal rights advocate introduces the phrase "the ultimate choice" and positions this against the everyday choices that we make through narrow self-interest. Singer's "ultimate choice" is the antithesis of narrow self-interest in that one's sense of well-being has been extended to include the interest of others. These 'others' include future generations, the poor in developing countries, living and non-human species. Singer's "ultimate choice" can be identified according to Layard's theory of happiness as an extensive form of self-interest. The lessons Layard draws from an overview of clinical data related to cognitive-behavioural therapy is that sense of self lies on a continuum of happiness from its weakest expression when in a neurotic state, to its strongest expression - selflessness - that matches Singer's "ultimate choice". The very malleability of our sense of self indicates ethical decision-making is intrinsic to self-reflection and being human.

Various authors have grappled with ethical questions when trying to pursue sustainability in architecture. Guy and Farmer (2000) suggest that there are six compelling logics of green buildings, each with its own dominant ethical concern. The logics are: ecological, smart, aesthetic, symbolic, comfort and community. In each case, they suggest a one-word identifier to cover each of 13 distinguishing features of these six logics. Ethical concern is one of these features. So, for example, the ethical concern of a green building where ‘community’ is the dominant logic will be equity. Due to the seriousness of the ecological crisis, the authors of this paper believe that an ecological logic should take precedence. Guy and Farmer (2000) suggest that the ethical concern of those who adopt this logic is ecocentric. Some of their commentary (and supporting quotes from other authors) on the ecological logic is somewhat extreme e.g. 'each building is an act against nature'. They do, however, correctly (we believe) state that this ethical demands that we should live within the limits of nature itself i.e. to provide the resources and process the wastes indefinitely and that in design the starting point should be to reduce the ecological footprint of a building.

Williamson et al. (2003) present the complexities inherent in valuing ecological sustainability arising out of a long history of privileging an anthropocentric perspective of ethical decision-making in their book 'Understanding Sustainable Architecture'. The differences in instrumental and non-instrumental value are first presented, the former being those that are dependent on some utility or usefulness. This utility may not necessarily be that valued by humans. It may be required for animals, plants or the general self-renewal of an ecosystem. A non-instrumental or intrinsic value is one that is inherent of itself and not dependent on its recognition by humans. Williamson et al. (2003) then explore whether something of either value has rights and whether such rights must be taken into account in sustainable design. For these authors, however, sustainable building solutions will not come about from prescriptions of duty or from rules and regulations, rather they should be 'beautiful acts' (their emphasis), which will follow if
architects are encouraged to conceive sustainable architecture to be 'a protection of ourselves'. The thinking behind this idea appears similar to that promoted by deep ecologists, who would argue that once we truly reconnect ourselves with nature, we will not commit unsustainable acts because to do so would be to harm ourselves.

Valuing beauty seems especially problematic in contemporary culture. While we can all relate to beauty when we experience it, we seem to have lost our ability to respect it for its life-affirming and generative purposes that provide the natural link to ecological sustainability. Christopher Alexander (2002), the architect and internationally acclaimed critic of design thinking, believes that all situations have "degrees of life" to them. His studies expose how beauty is an inherent property of those situations that we commonly experience as being most alive - and he goes on to demonstrate how closely linked our own sense of self is to this. Beauty is the natural expression of aliveness (or well-being). Alexander suggests that our sense of self expands (in the sense explained above) when we experience beauty and that this is its true value. When we confuse the beauty that arises through well-being and aliveness with less intuitive, more contrived concepts then we lose an appreciation of beauty's expansive, life-giving properties and dismiss its power when it is actually the key to ecological sustainability. Alexander argues that our loss of respect for beauty and our distraction with shallower models is tied up in our loss of respect for the mystery of nature. Our scientific approach to exploring life's mysteries -- through mechanistic modeling and reductive methodology and our industrialised mindset that has arisen as a consequence -- is seen to be responsible for stripping nature of its beauty and power to fill us with awe and respect.

Despite theoretical complexities, ethics is ultimately about how we should act as individuals or groups of individuals. Singer's distinction between types of choice is a good starting point. However, it will not be theoretical arguments from a few that will lead to a change in the health and well-being of the planet; rather it will be the actions and behaviour of millions. If the theoretical arguments are so qualified and complex as to be inaccessible to the majority, then they are of little use. Ethics is (or should be), as Williamson et al. (2003) state 'a practical matter', and so should be applicable to our architect's dilemma.

Ethics as a practical matter is about practising through one's value systems. That ethics seems so complicated nowadays is considered to be the result of a system of values that has been transformed by modern thinking (Plumwood, 2002; Alexander, 2002). The European Enlightenment gave rise to two profoundly important movements - humanism and the modern scientific method. The essential logic of humanism that 'man' was an autonomous and rational being free to control his own destiny gave rise to secularism. The success of the new scientific methodologies in prizing open nature's secrets furthered this sense of new-found freedom and control. Value systems evolved that reflected increasingly mechanistic views of the world in tune with the rising power of science over older knowledge systems. These older forms of thinking, based on intuition and concepts of divinity, were evocative systems connecting humanity to a world filled with intrinsic value through an expanded sense of self. As the framework within which to know the world narrowed, so too the view of self narrowed. The scientific historians Toulmin and Goodfield (1962) track how the rise of scientific thinking inevitably fostered the belief that our humanity (including our mental world) could eventually be explained away through the sum of our mechanisms -- a belief that is still widely held today.

Self-interest and sense of self are life-affirming when our value systems are inclusive and holistic, and become life-destroying when they are not. Ultimately, self-interest remains the key to sustainability. Environmental thinkers e.g. Plumwood (2002) argue that a discordant mesh of presumptions about land, property ownership and hence architecture and building have arisen through narrowed concepts of self-interest. This had led to a situation where considerations of moral and economic probity now tend to ignore the contribution of wider systems of life to resource wealth and ecosystem well-being, and this has become deeply embedded in a globalising system of ecologically irrational behaviour. The rise of the industrial age freed humanity of many of nature's constraints, and in so doing fundamentally changed our relationship with the natural world. Our mainstream interactions have become systems of command-and-control. Because of this, an ethics based on constraint, humility and selflessness can be seen to be at extreme odds with the norm. This sets up dilemmas within society at large and for practising architects in particular when making choices that do not mesh with the dominant paradigm. Singer's logic of ultimate choice helps architects reflect upon how they are caught up within this situation and how affected their personal values must be. Alexander's methods for enhancing intuitive design abilities helps step architects out of a mechanistic-rationalist paradigm to bring them closer to wholeness in their daily deliberations upon equity, utility and beauty -- deliberations central to the design process.

3. MEASURING SUSTAINABILITY

In 2004, Robert Caulfield, Managing Director of the Archicentre, called for an end to the 40-square "McMansions" (sic), describing them as "environmentally and financially unsustainable" (Age, 2004). We have become all too familiar with this type of housing in Australia and its proliferation. Caulfield believes that smaller cleverly sited, solar-powered and water efficient homes would make major contributions to limiting Australia's greenhouse gas emissions (refer also to Goad, 2005). Caulfield's statement begs the question of how we might measure the sustainability (or otherwise) of our housing.

Most texts dealing with the complex issue of sustainability in architecture seem reluctant to propose any objective indicators against which a design can be evaluated. While some of the principles of sustainability e.g. futurity and participation are hard to define objectively, others e.g. equity and environment lend themselves to objective measurement. An ethical approach to genuine sustainability might arguably use as a starting point the ability of the earth to support the current and future population level equally and to absorb and process the waste generated by human activity without detriment to the environment. This approach might at least begin to address the Futurity,
Environment and Equity Principles described earlier. Design strategies such as that promoted by Alexander engage with these principles, but through a phenomenological approach to measurement in which subjective experience, refined through appropriate training, becomes the direct measuring device. While phenomenology as a scientific technique is not yet widely appreciated or practised, it nevertheless constitutes an approach that is both anti-reductionist and deeply engaging for the designer — in other words it offers a more ecologically attuned methodology. This approach does not preclude its partnering to an understanding of the situation through quantitative analysis.

Ecological Footprint (EF) analysis was used at the beginning of this paper to demonstrate the demands of our lifestyle on the planet. In order to produce a single number to represent a very complex issue, EF analysis makes many assumptions, and there are certainly criticisms made of the approach used. Some of these are listed in Simpson et al. (2000). Despite its weaknesses, however, EF can be used as a guide to the impact of our actions (UNEP, 2005). EF takes account of the many factors that reflect our lifestyle, including food consumption, travel and housing. Currently the housing (or shelter) component might represent about 15% of an individual’s total footprint. Figure 3 gives some indication of the impact of housing size, occupancy level and energy efficiency + conservation on the shelter component of an individual’s footprint (ha) using a typical footprint calculator (EPA, 2006). The data for Figure 3 has been determined by assuming constant values for all parameters used in the EPA calculator except house size (Question 5), number of occupants (Question 4) and type of electricity supply (Question 7).

House size is clearly the dominant factor. The ‘shelter’ component of the footprint of an individual living in a 250 m² house (using conventional electricity) with three other people is 1.5 ha. This is five times that calculated if the same four people lived in a 50 m² space. The latter scenario is not uncommon in many parts of the world. For example, Mathews et al. (1995) state that the average house size amongst the poor of South Africa is 41 m². The next biggest influence on the shelter component of an individual’s footprint is the number of people sharing the household. Adding a fourth person to a 250 m² house will decrease the shelter component of an occupant from 1.9 ha to 1.5 ha. The least influential of the three factors is energy conservation and efficiency. In a 250 m² house, the individual’s shelter component drops from 1.5 ha to 1.3 ha by practising energy conservation.

The British Prime Minister, Tony Blair, has called climate change “the world’s greatest environmental challenge” (Blair, 2004). How we approach the problem and the solutions we adopt exemplifies our approach to sustainability. Global warming raises ethical issues because the effects of the carbon dioxide we emit into the atmosphere today will impact on those not yet living on the planet i.e. future generations. It also will impact on the poor in developing countries. These populations are the most vulnerable to the effects of climate change.

![Figure 3: Shelter footprint requirements for various house sizes, occupancy levels and energy consumption](image)

The concept of ‘contraction and convergence’ has become influential as a methodology to underpin a simple and equitable system to achieve climatic stability (Pearce, 2003). The two key components of this philosophy are that there is an absolute level of atmospheric carbon dioxide, which is within safe ecological limits and that nations (and hence their populations) have a ‘right’ to generate a certain level of emissions, which is consistent with that absolute limit. The absolute limit has been identified as 450 ppm. This atmospheric concentration level should limit mean global temperature rises to 2°C or less. It is proposed that an equal level of individual carbon emissions be achieved by the year 2050 and that this level will be 0.3 tonnes. This figure is equivalent to the current per-capita emissions of Bangladesh. Australians are currently the highest emitters of CO₂ with an annual emission rate of 27.9 tonnes per capita (Turton et al., 2002). It is proposed that convergence by all countries to 0.3 tonnes per capita will take place gradually over the coming decades.
Energy is used in the manufacture of all housing materials and is known as embodied energy. The energy used to heat and cool a house is a function of numerous factors (e.g. design, climate, occupant behaviour) and is often defined as the operational energy. The greenhouse gas emissions associated with house design can be gauged using the figures calculated by Fuller and Treloar (2004). These authors calculated that a typical 270 m² brick veneer house would have an equivalent annual embodied energy content of 52 GJ and annually require 92 GJ to heat and cool it. In terms of greenhouse gas emissions, this embodied and operational energy usage annually generates 3.7 and 4.7 tonnes respectively. These figures were compared with those of a typical 1950s weatherboard house measuring 93 m². In this case, annual greenhouse gas emissions were 1.1 and 2.7 tonnes for embodied and operational energy usage respectively. Fuller and Treloar (2004) also calculated the embodied energy coefficients (EEC) for the various houses designs. They found that the EEC for the 270 m² house was only 13% greater than the 1950s weatherboard. Because of its size, however, the emissions due to construction and use from the larger house increase by over 200% compared to typical post-war housing. Notwithstanding any inaccuracies from the imperfections of the hybrid input-output analysis used to determine embodied energy, these past and current level of emissions associated with house design also indicate the challenge ahead to bring individual total emissions down to a global level of 0.3 tonnes per capita. Assuming optimistically that all operational energy can be supplied by a renewable energy system and that the house is occupied by four people, the annual share of the emissions from the embodied energy component from the 93 m² house alone is 0.28 tonnes. This level of house occupancy is far from the current practice, however. The average household size has been steadily declining for decades. The last time the average household size was four persons was in the mid-1930s (ABS, 2001) and in 2001, the average Australian household size was 2.6 people (Haberkom et al., 2004).

The mass produced housing of the modern Australian estate is easy to criticise. How does the work of Australian architects actively promoting sustainable house design compare? The first issue of 'Sanctuary – sustainable living with style’ showcases the work of fifteen of Australia’s leading practitioners of sustainable house design’ (Sanctuary, 2006). Unfortunately, the reader is offered no evidence of the genuine sustainability of the designs and there are no statements from the architects, which indicate that they have considered the two indicators for sustainability suggested in this paper. House size is only stated for two of the house designs. One measuring 230 m² is described as ‘not a large house’ and ‘at only 123 square metres’, the other is labelled ‘small is beautiful’. All of the houses include some of the features that we have come to associate with ‘green’ houses, such as rainwater capture, solar systems, thermal zoning, recycled materials and low toxicity products. However, it is not so much a question of which resources but how much that matters. High levels of resource use in large houses with low occupancy levels is the most obvious and continuous reminder of this behaviour in our daily lives. Until all of us, architects included, address this issue, then we are evading the question of genuine sustainability and fostering the illusions that we do not have to change our behaviour and values.

While the level of resource use and greenhouse gas emissions attributed to a design can clearly be influenced by the architect, the client is likely to have the greatest impact through their lifestyle choices. Other factors, however, are outside the influence or control of either party; for example, the energy used in the manufacture of building products. If the carbon intensity of the energy used in the industrial sector was to fall, then the picture with respect to greenhouse gas emissions would improve. However, even if the individual share of global resources were to fall, this could be offset by rising global population overall.

4. PRACTISING SUSTAINABILITY

As described in the introduction, a practising architect is faced with a dilemma if they are seriously trying to offer advice and designs that could be described as genuinely sustainable to their clients. The main problem arises when a client wants a large house with average occupancy levels. The review of the literature showed that this was not very helpful in resolving this specific dilemma. How then might a practising architect, who espouses sustainability, resolve this dilemma? What actions are open to them? This section of the paper explores some possible options.

- **Reject the client and tell them to go elsewhere.** Obviously this option involves ‘the ultimate choice’ and therefore perhaps represents the most ethical position. But commercial reality means that the business will be lost, and this may eventually lead to the failure of the architectural practice. Being ethically correct but out of work is not a position many can afford to take.

- **Confront the client, and seek design changes or compromises.** This option presents the opportunities for client education and continued business survival. If the business is not lost, a genuinely sustainable design might result. If not, then at least the client is aware that they are not living in a sustainable house and the architect has at least fulfilled the important role as an educator of the client.

- **Confront the client and ask for an ‘offset’.** In this option, the ‘unsustainable’ design is offset by another ‘sustainable’ action e.g. by planting trees or paying for a solar system in a developing country. These examples would alternatively raise the Environment and Equity Principles with the client. As previously, this option presents the opportunities for client education and continued business survival.

- **Don’t confront client, and seek design changes or compromises.** This option would require the adoption of the rationale that the (assumed) improved design is a step in the right direction along the path to genuinely sustainable housing. An alternative rationale could be that the client might go elsewhere and the resulting design might be worse.
• Practice self-selection. This option might take the form of clearly and publicly establishing an ethical stance through vision statements and objectives. In this way, the architect can prepare any clients for what is on offer i.e. an ethical agenda that includes ecological sustainability. A condition of engagement might be adhering to this. This might lead to a small client base and limit the opportunities to educate and earn a living. A reputation for genuine and principled sustainable design, however, might be established.

None of the above represents an ideal solution to the dilemma discussed in this paper. This lack of a clear definitive, yet practical, solution is typical of most ethical questions raised in our society. At this point we must ask, can we really expect to find generic and ideal solutions? According to the environmental skeptic Robert Kirkman (2002), it might be worth reconsidering this expectation through a chemically based metaphor. In chemistry the idea of a solution is understood as a substance in which things are suspended in a dynamic state of coherence and dissolution. Our thinking, however, is usually governed by ‘the puzzle metaphor’ (2002:153) through which any given problem ideally is supposed to have a single, correct solution. Using Kirkman’s approach, we feel it useful to acknowledge that what we are in reality presenting in this paper is our considered support for an architectural service in which Alexander’s life-affirming design paradigm becomes the solution within which Mitchell’s four sustainability principles are expressed as a meaningful constraint and cross-check. The designs that arise in this manner engage the architect in a holistic approach to sustainable design and in so doing offer firmer ground upon which to engage with clients about expectations and their ethical implications.

5. CONCLUSIONS
This paper suggests both quantitative and qualitative methodologies for a broad-brush assessment of sustainable design. A sustainability model based on participation, equity, environment and futurity principles utilises a quantitative methodology to assess the ethics of the situation, namely through ecological footprint and greenhouse gas emissions. In this respect, Robert Caulfield was correct when he called for smaller houses. House size is the dominant variable in determining resource use and greenhouse gas emissions. The occupancy level is also critical in determining per capita resource use and waste generation. Based on their size alone, current house designs, whether for the mass-produced marketplace of housing estates or for clients seeking ‘sustainable living’ appear to fall well short of the level of resource use and emissions that would qualify them to be described as genuinely sustainable. This criticism is valid even allowing for inaccuracies in calculating the indicators. Does the design use more than its fair share of global resources and emit more greenhouse gases over its lifetime than can be safely absorbed by the earth’s atmosphere? If the answer is ‘yes’ to either of these questions, then the design is simply not sustainable. The role of architectural science is critical in the education of current and future architects to answer these questions honestly.

Developing an intuitive sensitivity to the life-affirming qualities of architecture links design aesthetics to ethical decision-making. A phenomenological approach utilises both intuition and logic to engage the designer through an expanded sense of self and personal well-being. It enables a more holistic measurement paradigm upon which to base one’s ethical decision-making. Does the design reach below shallow concepts of beauty and touch us with its sense of aliveness? If not, the chances are that it fails as life-affirming architecture even if it meets the other criteria. To answer these questions with any confidence assumes a respect for the integrity of the different methodologies through which the raw statistical and sense data are evaluated.

Assuming that most of the profession are sincere in their desire to produce sustainable designs, the ethical dilemma explored in this paper must be a real one for many architects. For a practising architect, there appear to be only a limited number of actions or positions that can be taken when confronted by a client wanting to build an unsustainable house. Some of these have been briefly critiqued in this paper. We need to make a realistic appraisal of our current housing, both popular and ‘green’, through a quantitative analysis of its impact rather than to devalue both the client and ourselves. It is also better to make a realistic appraisal of our current mindset that prefigures our ability to engage holistically in design activity. Because architecture is both an art and a science, it is an architect’s imperative to design sustainable architecture that strikes a balance between equity, utility and beauty. In this respect, the options presented throughout this paper to achieve this balance also rest on the development of intuitive skills that respond to our deepest understandings of beauty as a life-affirming quality in the natural world. This is a skill in as much need of practice and refinement as any other, but one which is yet to receive proper consideration amongst the initiatives that currently dominate the professional approach to sustainable design.

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