Physics, Tradition and Common Sense: Issues in Environmental Sustainability in Sensitive Cultural Contexts

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ABSTRACT: This paper addresses some issues (conflicts, possibilities, contradictions, ironies) raised by the complexity of the concept 'environment' as applied to the design and construction of buildings and precincts / landscapes in the context of the requirements of historical and cultural conservation. Good intentions for designing, 'recycling', retrofitting or altering buildings in response to the demands of energy and resource conservation can come into tension with socio-cultural objectives (and regulations) for the preservation of historical / traditional buildings in their original landscapes. I discuss in the paper a number of examples involving small-scale buildings in Australia, Italy and Nepal. As an Australian designer specialising in energy / resource-efficient buildings, when presented with a project in an unfamiliar, 'Other' environment, I see in relief the differences in conditions, traditions and socio-cultural assumptions. The paper explores how specific socio-architectural attitudes combine with history, traditional construction practices, and material availability, to influence the potential for environmentally responsive / responsible building.

Conference Topics: 6 Recycled architecture;
Keywords: energy, conservation, technology, knowledge, people, culture, Nepal, Italy, Australia

INTRODUCTION

This paper develops further some ideas I presented at PLEA 99, discussing basic questions about the built environment raised by my work in rural Nepal, where knowledge of building is embedded in a pragmatic mix of ceremonial customs, affirming and celebrating the natural world and humans’ part in it. ... [Despite — or because of (?) the] material living conditions of poverty and a low level of technological development ... Nepal retains a reservoir of skills and knowledge demonstrating diverse responses to the demands of individual needs and physical and cultural context, the pressures of nature and the imperatives of economy of means, unmediated by technological 'fixes' available in the West. ... [The peasant past is only one generation away ..., and... [The] capacity to derive maximum benefit from minimal means manifests in modern guise in improvisation and 'making do', a sort of mechanical wizardry. [Culturally alien industrial forms and techniques superimposed on indigenous traditions, ... [produce] new solutions. .... [The] influence is neither a necessary or sufficient condition for the good life or for good architecture. Rather, not only is conspicuous consumption in architecture bad for the earth, but, as JK Galbraith reminds us, "wealth is the relentless enemy of understanding." [1] The pleasures of modernity are often seen as dependent on waste and prodigality, incompatible with care for the earth. So a crucial project for architects must be to make an architecture of 'frugal hedonism'. [2] This paper represents an investigation, not of the technicalities or economics of energy conservation in architecture, but of the intersection between physical environments and human socio-cultural meanings, assumptions and expectations, and their institutional manifestations. The context for the discussion involves building in environments which raise specific social, cultural and historical conservation concerns, in Nepal, Italy and Australia.

1.1 The barriers to effective action

In the context of domestic scale buildings, those of us engaged in practice and teaching in the field of environmentally responsive / responsible buildings have long recognised that barriers to effective action are chiefly social, cultural and political — not technical. Research and development continue, for instance in glazing and solar collection, and such technological factors will make a difference at the margin, but appropriate application of existing materials and technologies are already more than adequate for the climatic demands of Australian climates.

The problem is not fundamentally economic either. Good design does not necessarily cost more than
poor design. Rather, good design and construction in the long run, by utilising renewable resources and reducing waste, save non-renewable resources and money, even in an economic system which takes little or no account of ‘the long run’, and often discourages good husbandry of resources. Furthermore, in spite of the common claim that environmentalists calling for limits on consumption of resources wish to condemn people to ‘freezing in the dark’, good environmental practice has the potential to improve the quality of life. However relatively few people take the opportunity offered by this no-risk investment. Why is this so?

2. THE IMPORTANCE OF PEOPLE

2.1 The invisible occupant

In many jurisdictions in Australia a minimum ‘star rating’ under the Nationwide House Energy Rating scheme (NatHERS) is now mandatory for building approval. Researchers in the Adelaide University School of Architecture, Landscape Architecture and Urban Design have evaluated the scheme’s simulation program. Comparing NatHERS predictions with actual energy use derived from utility accounts and firewood consumption in a representative sample of Adelaide houses over 3+ years, they found no significant correlation between NatHERS ‘star rating’ (based on the sum of heating and cooling loads) and actual measured energy use. Because the scheme does not include consideration of appliance/plant type [or fuel type] and has built-in exaggerated occupant assumptions [my italics], NatHERS cannot predict actual or typical household energy use (for heating and cooling). This ignores the well-documented fact that the thermal behaviour of people is contingent on the context (see for example, Cloher [3]). [4]

2.2 People and energy consumption

The potential for energy conservation in the built environment depends not only on buildings, but on the relationship between buildings and people, behaving ‘thermally’ or otherwise. The basic physics of the interaction of climate and buildings with their inhabitants is of course universal. But the art of design for environmentally responsive and responsible buildings which satisfy the socio-cultural needs and desires of their inhabitants certainly requires more than a computer program, however useful a good program can be for evaluating and comparing alternative solutions (if it employs intelligent — and transparent — assumptions). Ideally, the task of the environmentally responsible designer is to create buildings which provide for low-environmental-impact dwelling on the earth, in Heidegger’s terms. [5] This implies that designer, builder and house-dweller understand, respect, and find pleasure in the natural environment of their building: the earth, the rocks, the plants, the sky, the sun, the wind. Australian examples of designers with such an approach to building design are Gregory Burgess, 2004 winner of the Royal Australian Institute of Architects Gold Medal, and Richard Leplastrier, 2004 recipient of the Finnish Spirit of Nature Wood Architecture Award.

The conveniences and comforts of technology and the ‘pressures of modern life’ increasingly cushion and distance people from the natural world. In affluent countries, growing personal wealth and easy access to credit have led to an increase in house size. In Australia between 1985 and 2003 average house size doubled to 200+ square metres, for an average household size of 2.6. [6] Post-occupancy surveys by the Australian house building company AV Jennings show that internet access and large plasma-screen ‘entertainment centres’ allow their house-buyers to avoid the need to confront the outside world. In the light of this increasing affluence and increasing profligacy, the question arises whether ‘satisfying needs and desires’ is either possible or desirable. [7]

In Adelaide I teach a fourth-year studio course entitled ‘Energy-efficient House Design’. The project-based course requires students to design a house, evaluate its thermal performance in providing comfort conditions, and its energy and water use, and prepare working drawings. The students design for real people and real sites, so they find that the nostrums and generic ‘rules of thumb’ which at times underlie dubious claims for energy efficiency in buildings seldom provide appropriate answers. [8]

2.3 Problem people?

A spin-off of the course has been exposure to a range of attitudes among the ‘client’ group who respond to my advertisement, which clearly describes the project as involving energy-efficient house design. Many, as expected, are eager to develop with the students ideas for their environmentally sustainable dream house. However some ‘clients’ find it extremely difficult to accept any proposals for energy- and water-conservation measures in the design and construction of their house which confront their firmly held attitudes (prejudices) for or against certain aspects of houses. They cling to what they see as the characteristics of a ‘normal’ house. “What will the neighbours think?” lies behind many client responses, in spite of evidence that the alternatives proposed by the designers will provide better comfort and/or greater convenience at lower cost. I attempt in interviewing prospective clients to weed out the most recalcitrant, but, perhaps hoping for free architectural services, some dissipate well.

How are we to understand the phenomenon of the ‘anti-environmental’ client: people who cannot see the ‘hedonism’ in environmental ‘frugality’, who apparently seek happiness in conforming with the norm (being like ‘everyone else’), or in consumption, the more conspicuous the better (being better than everyone else). For such people frugality, hedonistic or
otherwise, may even be a sign of failure. Is there a contradiction between these attitudes? On reflection, resistance to abandoning peer approval, gained in either mode, is not surprising in a consumerist culture concerned with image, the construction of identity, and self-promotion. Architecture has always had to do with ritual and ceremony: the Taj Mahal or Stonehenge, anthropomorphic Dogon dwellings or prim cream brick veneer suburban houses. Ritual is implicated not only in spiritual ceremonial acts, but in all attempts to mediate between our condition and the world around us. And at a more philosophical level, attachment to personal, social or cultural meanings in the built environment has always been basic to architecture, as it is to any human activity — such as choosing a coffee, clothes, a car or a companion.

It is my experience that as architecture students learn, a distance opens up between them and ‘the rest of the world’ — that is, non-architects. This is hardly surprising, given that acculturation into the habitus of architecture is a central objective of the demanding, absorbing, time-consuming educational world they experience for five or more years. However, in the design teaching studio, two phenomena are evident, each ironically reflecting one of the client attitudes. In my course, students are required to engage with energy efficiency as part of the curriculum, and the evaluation criteria are explicit. However even in this context some students appear to lack the imagination to think beyond ‘the normal’, and often fall back on the familiar when designing — ‘Why did you design this particular space or element?’: “Well, it’s like that at my Grandmother’s house,” or “That’s how it is at home.” By contrast, for others the lure of architectural self-expression appears to overwhelm energy-efficiency concerns. In both cases, the students have difficulty developing solutions which satisfy the criteria for good environmental performance, while providing delight and functional effectiveness — and pleasing the client.

3. THE MANY MEANINGS OF CONSERVATION

The notion of conservation has many meanings. In architecture and urban design, it may mean conserving an individual building of architectural, historical or urban design value; or conserving a precinct, perhaps of minor architectural merit but of historical and/or typological significance. This may demand compliance with regulations, which often require not only the preservation of existing buildings, but the design of new buildings ‘in sympathy’ with existing urban contexts. Whether by retaining the existing building fabric, or by constructing new buildings in the same ‘spirit’, this can have the positive outcome of preserving vernacular building forms, modes of construction or building skills. In Australia, whose architectural history began with the arrival of Europeans, special issues arise. Buildings and precincts of historical and architectural value often exist literally on top of sites of aboriginal significance, and/or in fragile natural environments, so the preservation of one implies the destruction or at least significant disturbance of the other.

Approaches to conservation of buildings and precincts may come into conflict with conservation of resources and eco-systems. Contextual requirements may constrain the possibilities of solar orientation and/or retro-fit. However it could be claimed that in countries with almost static populations, such as Australia and much of Europe, there are already enough buildings, and that the energy and material resources embodied in them should be retained and given new life by re-use, altering and retrofitting them to improve their environmental performance.

Whatever approach to conservation is chosen, a building design’s potential for conservation depends on how much it is in concord with the aspirations and resources of the people who make the decisions. A Nepalese wattle and daub hut is a very low-energy building indeed; in the nineteenth century so was the stone house to which I have made a twentieth century energy-efficient addition. But the level of comfort such buildings provide is not compatible with the aspirations and expectations of a ‘typical’ Australian family, or of the aspirational Kathmandu middle class.

4. ELSEWHERE

In the 1990s I spent months each year working in Nepal (in the Himalayan ‘Mid-Hills’, the Kathmandu Valley, and the Terai). For some years I have lived half the year in Italy, the other half in Adelaide.

4.1 Nepal

In Nepal, by invitation from the permaculture-inspired Institute for Sustainable Agriculture Nepal (INSAN), I worked in both rural and urban areas. My task as INSAN educator was to give the imprimatur of ‘western’ approval to traditional technologies, in the face of government and commercial pressure to adopt what INSAN considered inappropriate chemical-based agricultural and animal husbandry methods and ‘modern’ building methods. As architect my task was to develop designs and construction methods in keeping with the surrounding regional traditions, while addressing the issues of durability and maintenance.

The Nepalese are heirs to a rich tradition of knowledge and skills which had served them well over centuries, living in a challenging environment in the face of scarcity and poverty. My architectural and general philosophy of ‘frugal hedonism’ derives from this experience. I have not achieved the Fatalistic Serenity, even Merriment, in the face of adversity which seem so natural to the Nepalese, but I have retained an appreciation of the value and significance...
for life of ceremony, ritual and shared meanings. [2] However, even in rural areas of Nepal, the attraction of industrialised materials is evident. ‘Many traditional materials, especially ‘natural’ materials such as thatch, an effective insulator, and bamboo, which has high flexural strength, require intensive maintenance, are vulnerable to vermin, rot and fire, and have relatively short life-spans, and these difficulties are being compounded by the … loss of traditional skills.’ [9]

Successful traditional building techniques and affordable indigenous … materials are rejected in favour of more expensive, often less effective, ‘industrial’ materials and methods, frequently used without the necessary … expertise. … In rural areas galvanised iron roofs replace the effective insulation afforded by traditional thatch, while in the city, concrete slabs … and roofs [and walls of brittle, porous and poorly fired bricks] are constructed without moisture barriers, cavities or insulation. The … buildings are cold in winter and hot in summer, damp and unhealthy. [10]

4.1.1 Rural Nepal

In the southern plains of the Terai, the jungle has been almost totally replaced by cultivation over the last 50 years, and half the Nepalese population lives in the region. The advent of modernity, technological development, and the resulting demands on the environment are eroding not only the physical and natural environment of country and city, but also the indigenous culture and its knowledge and skills base.

At Amaduwa in the Terai, the INSAN permaculture demonstration farm included a convention centre and a compound with kitchen and staff meeting room, simple living accommodation and houses for the individual farmer families who ran the three INSAN demonstration farms. I was asked by the farm manager to design a multiple latrine to be connected to the methane digester which serves the compound’s kitchen, for cooking and lighting. The digester mixes animal waste (from pigs, goats, ducks and hens), with human faeces to produce methane, piped to the kitchen nearby. By-products of the process are fertiliser for the vegetable garden and rice paddies, and mixed with water, an adhesive additive for the decorative coloured mud plaster used on the mud brick and wattle-and-daub walls by the women (building tasks are strictly gender-allocated). Much discussion took place with the men and women; cow dung partakes of the sacred nature of the cow, while human faeces are considered unclean, so the cow dung was kept separate for use as fertiliser on the fields. It had been used as a cooking and heating fuel, but was now not needed, replaced by the methane.

The building is built in Australian-style mud bricks laid on edge in partial circles, the plan the shape of a four-leafed clover, giving privacy for four occupants without the need for doors. (Bamboo curtains rattle if a newcomer arrives at an occupied compartment.) It was completed with a bamboo framed and banana-leaf-clad thatched roof in the pre-fabricated conical shape used on the traditional-wattle-and-daub stilted granaries. With a large water drum beside it, and the use of beer bottles, it needs no other water supply, and the multiple use facility (waste disposal, and efficient production of fertiliser, fuel and wall finishing material), functions well. Not only is it comfortable and bio-degradable, but due to a cultural ‘accident’ it is easy to find in the dark. I had intended the small building to be plastered with mud, and merge into the landscape. But cultural sensitivity works both ways. During my next absence the workers painted it in my honour with bright white paint — their idea of the modern and hygienic — so it stood out like a beacon. We eventually negotiated with minimal loss of face to repaint the outer walls with mud, as background to a typical Australian motif of white surf waves and foam; the inner walls remained white. Concepts of environmental appropriateness are culturally specific.

4.1.2 ‘Progress’ and environmental design in Nepal

Urban Nepal is preoccupied with material ‘Progress’. Around Kathmandu, middle class suburbs and smoke-producing brick works now extend over previous rice paddies. In the suburbs of Kathmandu I was asked to design a house for the family of the director of INSAN. I produced a design evoking the rich traditional architecture of the Valley, in particular in terms of window and door treatment. I then had to leave for Australia, and on my return I found that the family had rejected my project and built a house to the design of a sanitary engineer. This house was starkly concrete and ‘modern’ in a Nepalese engineering sense, with no reference to local building traditions. The concrete eventually cracked and leaked. The house was poorly sited on the block, faced the wrong way, was completely uninsulated, and was dark, cold and damp. The most inviting place in the house was the sunny south stairway, which was soon discovered and monopolised by the family dog. Nepalese houses are not usually heated: in Winter, evening visitors were entertained in the master bedroom, on the bed or the floor according to status, and were offered a quilt to envelop themselves in.

In Nepal, Architecture is seen as an arcane matter with a purely aesthetic agenda. My friends’ view of the architect as unquestioned authority precluded their asking me to amend my design to include the crucial religious puja (temple) in the kitchen. Mea culpa that I had not recognised the ceremonial, religious and symbolic importance of food and its preparation in Hindu culture. For them the puja was so obvious a requirement that they had not thought to mention it. Discussions ensued about the complementary roles of designer and client, and the necessity for consultation and openness. Their resulted in a two-storey addition
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forms and construction methods in local stone or brick. (In some regions, such as the Murgia dei Trulli and oast houses. These buildings present a variety of other working buildings such as tobacco curing barns above storage and shelter for animals (a useful heat source for the dwelling above), or barns, stables and other work / storage spaces; and there are ancillary buildings, whether the simple dwellings of rural worker-tenants in which the family generally lived above storage and shelter for animals (a useful heat source for the dwelling above), or barns, stables and other working buildings such as tobacco curing barns and oast houses. These buildings present a variety of forms and construction methods in local stone or brick. (In some regions, such as the Murgia dei Trulli in Puglia, animals and people all live on ground level.)

the ground to clear the land for cultivation. They were considered ‘primitive’ and unfit for living in, merely impediments to efficient farming, and allowed to fall into ruin; many were demolished and the stone thrown into pits. In the 1970s the Istituto Federale di Credito Agrario per la Toscana provided low-interest loans for the modernisation of farm dwellings; to be eligible, proprietors were required to replace all traditional timber floor and roof construction with concrete. Great timber beams, cut from trees of an age and size no longer found on the peninsula, were thrown into manure pits or used to stabilise terraced fields.

4.2. Italy

4.2.1 Old buildings as a resource

Embodied energy issues lie at the intersection of historical, architectural and resource conservation. Embodied energy computations in the life-cycle energy accounts of a pre-industrial building can be paradoxical. The non-renewable energy embodied in such (labour-intensive) buildings is low, but the situation changes if replacement embodied energy is computed. Such buildings can be a resource for sustainability if re-used with care and knowledge.

Italy, like Nepal, has emerged relatively recently from a past of rural and urban poverty and economic and social inequality. Industrialisation has meant large population movements from rural areas to the cities, and from agricultural work to employment in the secondary and tertiary economy, and has produced an ‘aspirational’ middle class. The countryside abounds in old buildings, often dating back centuries. Many were abandoned after World War II, as people achieved undreamt-of levels of education and income, and many headed for the urban ‘good life’. There are the casali, former homes of propertied farmers, with the dwelling on the upper floors above cellars and other work / storage spaces; and there are ancillary farm buildings, whether the simple dwellings of rural worker-tenants in which the family generally lived above storage and shelter for animals (a useful heat source for the dwelling above), or barns, stables and other working buildings such as tobacco curing barns and oast houses. These buildings present a variety of forms and construction methods in local stone or brick. (In some regions, such as the Murgia dei Trulli in Puglia, animals and people all live on ground level.)

Until quite recently such rural buildings were not valued, whether as potentially useful constructions, or as contributors to the visual environment. In Puglia, conical stone dwellings and other farm buildings (trulli) were built, originally without mortar, of stone dug from the ground to clear the land for cultivation. They were considered ‘primitive’ and unfit for living in, merely impediments to efficient farming, and allowed to fall into ruin; many were demolished and the stone thrown into pits. In the 1970s the Istituto Federale di Credito Agrario per la Toscana provided low-interest loans for the modernisation of farm dwellings; to be eligible, proprietors were required to replace all traditional timber floor and roof construction with concrete. Great timber beams, cut from trees of an age and size no longer found on the peninsula, were thrown into manure pits or used to stabilise terraced fields.

4.2.2 Regulatory responses

In recent years, rural Italy has attracted ‘outsiders’ who buy and restore old, often ruined, buildings as permanent or holiday dwellings. In thirty years attitudes have changed dramatically. Such buildings are recognised by the market and by regional and central government as a resource. They are clearly very important to the Italian economy, both directly as sources of foreign currency and taxation revenue, and indirectly as elements in the rural environment which contribute to Italy’s attractiveness to tourists. Old trullo stones are being retrieved by the sons and grandsons of the old farmers, and the trade of trullista has been rescued just in time for its practitioners to make a good living from the influx of outsiders, whether Italian or foreign, who want to own and restore a trullo.

The regions have reacted in different ways to the pressures of development in rural areas. Regulations have been drafted of varied stringency, rationality and consistency. Tuscany has become very strict, and in some cases forbids alteration to buildings of doubtful historical, architectural or even picturesqueness value. The stated reason is the preservation of the visual character of zones of historical or landscape value, for tourism, and in the interests of the national heritage, but it can be counter-productive. There is little room to manoeuvre in design, and the regulations' inflexibility of the militate against adaptation for new uses.

Regulatory inflexibility can lead to Catch 22 situations. I have designed alterations to a number of buildings in regulated conservation zones in rural Tuscany. In each case I chose buildings with potential for energy-efficiency in orientation and fenestration. Insulation could be added to roofs and internally to some external walls. One building was a semi-ruined stone dwelling above a ground-floor barn/stable, on a hillside, invisible from any public road. The Comune prohibited any increase in the building's volume, even by internal excavation on the ground floor (currently 'animal height'), yet this would have meant ceiling heights below the human residential minimum. The number of windows could not be increased: yet compliance would have produced a sub-standard living environment. Only with the help of a geometra (building designer / technician) with local knowledge
and contacts was a compromise found. The second case involved a small two-storey stone stable/barn, of little or no architectural or landscape value, and now too small to be of use as a farm building. Proposals to convert it into a dwelling, which would have involved excavating the ground floor, raising the first floor and adding some windows, were rejected on the grounds that the building could not be altered in any way, as it is in a historic conservation zone. When it was pointed out that without structural intervention the building would collapse, the official reply was that it could then be reconstructed — but only to return it to its current form, including a tractor shelter added in the 1950s. Without a change of use the building is of no practical value, so it will now be allowed to fall into ruin. The third project, currently on hold, is to add south windows (invisible from the road) to a large house modified crudely in the 1970s in such a way as to shut the dwelling away from the sun — and the view. (The 1970s alterations, including compulsory removal of its traditional timber and terra cotta floors and roofs, had already seriously reduced the house’s market value.)

I am now designing alterations to a 19C stone house in Umbria. It is on a steep slope, with a 270° view. The ground floor originally housed stables, cellar and hay barn, the upper floors a dwelling. It has been abandoned for decades, and has no electricity, water supply or sewerage, but there is the possibility of a well. The external fabric will remain unchanged apart from new window frames/sashes, and replacement of the ground floor solid doors with glazed doors. Its concrete seismic ring-beam is already (invisibly) in place, as is (minimal) roof insulation, now compulsory. The roof and intermediate floors have been reconstructed with the traditional methods, no longer viewed with suspicion, using heavy timber beams, hollow terra cotta ‘planks’ on battens, and coppi.

The major windows face south-west; not ideal, but with some passive solar potential. The traditional Italian windows with incorporated shutters can reduce air-to-air heat transfer through windows both summer and winter, and are ideal for summer shading. Installation of double glazing will depend on cost; local glaziers will replace single with double glazing in one day, if the frames are delivered to the factory. The walls are plastered internally, so they can be insulated in appropriate locations. A connected annexe faces due south, giving the possibility of an attached greenhouse as a source of winter heat (and for growing warm temperate plants). The greenhouse and annexe roofs offer a suitable location for a solar hot water service and photovoltaic panels for a grid-connected electricity supply. This may involve conflict between ecological objectives and regulations for the protection of the tourist image of the zone. My long-term hope is that the house can provide a demonstration site for the potential for sustainable architecture in recycled buildings, including ecologically sustainable sewage and grey water treatment. I am told that the Umbrian authorities are more flexible than the Tuscan.

4.2.3 Re-use and the quality of life

The arguments in favour of re-use of buildings are strong, in particular for buildings which incorporate materials of high environmental and/or historic value. The currently dominant modes of construction in both Nepal and Italy involve high levels of embodied energy: new buildings of all scales are constructed with concrete columns and floor and roof slabs, with walls of hollow terracotta blocks (Italy) and poorly burnt bricks (Nepal). Not only does reconstruction of old buildings using traditional and recycled materials, especially timber, reduce the embodied energy of building, but reconstruction of an old building usually requires more manual labour than mechanisation, and as in the case of the trullisti, can revive rewarding trade skills. (Modernised construction methods for new, more context-appropriate buildings, could also build on existing trade skills.) ‘Quality of life’ in this case relates not only to the inhabitants of the house but to the workers on the job. Buildings and people.

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