ENVIRONMENTAL ISSUES AND HOUSE DESIGN IN AUSTRALIA:  
images from theory and practice

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# Table of contents

**CHAPTER 1: Introduction**

1.1 Overview  
1.2 Environmental issues in house design  
1.3 Design advice about housing and environmental issues  
1.4 The role of images  
1.5 Aims of the thesis  
1.6 Methodology  
1.6.1 Analysis of images  
1.6.2 Cross-disciplinary nature of environmental and design issues  
1.7 Organisation of the thesis

**CHAPTER 2: Images**

2.1 Introduction  
2.2 Definitions of images  
2.3 Sources of images  
2.3.1 Individuals' images  
2.3.2 Public images  
2.3.3 Images of the environment: 'global' view  
2.3.4 Images of the environment: fields of significance  
2.4 Images in architectural design  
2.4.1 Problem framing  
2.4.2 Conversation and communication  
2.4.3 Decision-making  
2.5 Discussion  
2.6 Summary

**CHAPTER 3: Four 'framings'**

3.1 Introduction  
3.2 The interviews  
3.2.1 Interview participants  
3.2.2 Interview process  
3.3 Seaside “dream house”
3.3.1 "Little cells of rammed earth"
3.3.2 "Not just bricks out of an oven"
3.3.3 Thermal and lighting strategies
3.3.4 "Waves" and "dunes"
3.3.5 Environmental issues as design generators

3.4 Sitting lightly
3.4.1 Sunshine and breezes
3.4.2 Environmental delight
3.4.3 Environmental issues: resources and pleasantness

3.5 "Distinctively modern"
3.5.1 Consideration of thermal issues
3.5.2 "Cafe culture"
3.5.3 Material considerations
3.5.4 Environmental issues and place

3.6 Environmental stewardship
3.6.1 Minimal intervention
3.6.2 Material properties
3.6.3 Air flows
3.6.4 Environmental issues and empowerment

3.7 Discussion
3.8 Summary

CHAPTER 4: The architects’ images of ‘what should be’
4.1 Introduction
4.2 The architects
4.3 The images
   4.3.1 Value images
   4.3.2 Goal images
   4.3.3 Strategic images
4.4 Discussion
4.5 Summary

CHAPTER 5: Design advice images of ‘what should be’
5.1 Introduction
5.2 Housing and greenhouse gas emissions
5.3 NatHERS
5.4 AMCORMD
5.5 BDP Environment Design Guide
5.6 The images
   5.6.1 Value images
CHAPTER 6: The architects’ images of ‘what is’

6.1 Introduction

6.2 Sources of images of ‘what is’

6.3 The architects’ images
   6.3.1 Images of environmental issues
   6.3.2 Images of housing issues
   6.3.3 Images related to the practice of design

6.4 Discussion

6.5 Summary

CHAPTER 7: Design advice images of ‘what is’

7.1 Introduction

7.2 Sources of images

7.3 Images of the environmental impact of housing
   7.3.1 Statistical information
   7.3.2 Models of energy use
   7.3.3 Monitoring
   7.3.4 Summary: Dominant images of the environmental impact of house design

7.4 Images of ‘environmentally appropriate’ house design
   7.4.1 The solar-efficient model
   7.4.2 The tropical model
   7.4.3 Summary: House models
   7.4.4 Specific houses
   7.4.5 Summary: Dominant images of appropriate house design

7.5 Images of the occupants
   7.5.1 Built-environment research: comfort studies
   7.5.2 Built-environment research: energy use
   7.5.3 Psychological and sociological studies of energy use
   7.5.4 Summary: Dominant images of the occupants

7.6 Examples of alternate images
   7.6.1 Alternate images of the nature of environmental issues
   7.6.2 Alternate images of ’environmentally appropriate’ solutions
   7.6.3 Alternate images of the occupants

7.7 Discussion

7.8 Summary
Abstract

This thesis proposes that there are fundamental and inadequately recognised differences between architectural practice and the basis of much design advice about environmental issues in house design. These differences have implications for the consideration of environmental issues in house design in Australia. These ideas are explored by examining the images, or subjective knowledge, that a group of architects used to describe houses that they had designed and comparing them with the images embodied in three key sources of design advice about environmental issues and house design.

The importance of images for conceptualising 'the environment' is identified and the role of images in the design process is described. Two broad categories of images are identified as important for the consideration of the environmental aspects of house design: images of what is known or believed to be true ('what is') and images of 'what should be'. These categories are used to analyse images from the sources of design advice and from the transcripts of interviews held with ten architects.

Significant differences between these images are identified. The architects' images are largely based on experience and are vivid and value-laden. They are also broad, encompassing concerns to do with built-form, people and environment. Environmental issues are identified as important for affective, emotional and symbolic reasons as well as for the 'meaning' they provide for design. By comparison, the images embodied in the design advice are largely derived from scientific techniques and reflect a narrow range of concerns. They are dominated by a 'global' view of the environment that is considered largely in terms of problems and in particular the relationship between built-form and energy use. There are scant images of people. While playing an important role in the architects' understanding of environmental issues it is revealed that these images can be misleading or unhelpful during design.

This thesis concludes by discussing the implications of these differences for understanding how environmental issues are currently addressed in house design in Australia. Three issues that emerged from the study are highlighted: the importance for both theory and practice of the framing of environmental issues, the influence of the status quo on the practice of house design, and the role and limitations of existing design advice in informing the consideration of environmental issues in house design.
Signed statement

This thesis contains no material that has been accepted for the award of any other degree or diploma in any University. To the best of my knowledge and belief, it contains no material previously published or written by another person, except where due reference is made in the text. I consent to this thesis being made available for photocopying and loan if applicable if accepted for the award for the degree.

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* * * * * * * * *

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Tables and figures

Table 5.1 Contributions to carbon dioxide emissions in Australia  
Table 7.1 Average annual energy consumption - NEEHA Survey  
Table 7.2 Six competing logics of green buildings

Figure 2.1 Earth seen from Apollo 17  
Figure 2.2 Beginning the ascent through the fourteen spheres of the world  
Figure 7.1 Architect's own house: Gabriel Poole  
Figure 7.2 Housing by Troppo Architects  
Figure 7.3 Simpson-Lee house: Glen Murcutt
1. Introduction

1.1 Overview

A realisation that human beings can have a devastating and sometimes irreversible impact on the environment is a defining feature of the late twentieth century. Although the focus of this concern has changed over the last thirty years or so, the idea of environmental concern is now a part of the cultural landscape. The global impact of many environmental problems – such as acid rain, depletion of the ozone layer and potential global warming – has been recognised. There is co-operation at the national and international level to attempt to address some of these issues. In many countries, including Australia, ‘green’ political parties have been established that are now represented in government. Australian state and federal governments have adopted ‘environmental’ policies. Environmental impact statements are a common legislative requirement for large development applications. The environmental lobby groups that emerged in the early 1970s have multiplied. At an individual level, a recent survey in Australia revealed that, in the preceding year, more than a quarter of the population donated time or money to an organisation that helped protect the environment (ABS 1996). In the same survey nearly 70% of the Australian population reported that they believed environmental protection to be as important as economic growth.

Despite the fact that concern about environmental issues has become pervasive, there is no clear consensus about what is meant by ‘the environment’. The Shorter Oxford English Dictionary defines environment as “the conditions or influences under which any person or thing lives or is developed” (SOED 1984). The broadness of this definition explains why the same term can be used in everyday language to refer to landscape (for example, a house in the environment), the atmosphere (for example, CFCs damage the environment) or the interior of a building (for example, it was a pleasant working environment).

In Australia people are likely to have various images of what they understand by ‘the environment’ even if communicating them is difficult. These images are likely to change constantly under the influence of such things as media campaigns, specific events, education and information. They will develop through the experience of attempting to accommodate environmental considerations into various facets of the life of both individuals and the wider society. The ongoing exploration of environmental issues serves to reveal ideas about the ways individuals and groups wish to relate to the world and their conceptions of what the world is.
This thesis will consider one slice of these concerns – images of environmental issues\(^1\) connected with house design in Australia. It has been claimed that even though there is adequate knowledge to address environmental issues in house design "Australian architects do not appear to include sustainable design principles and features to a noticeable extent into their work" (Wittmann 1997, p. iii). This thesis explores this proposition from two perspectives: by investigating the idea that there is adequate 'knowledge' available to architects and building designers in the form of design advice about how to address environmental issues in house design; and by exploring the way such issues are addressed in the practice of house design. It does so through an examination of the images used in the practice of house design and the images embodied in current sources of design advice about the environmental aspects of house design.

This approach was developed after the author accompanied a fellow researcher interviewing architects about their use of environmental 'prototypes' during design. In the course of these interviews it became clear that these architects did not see themselves as 'using' much environmental design advice at all. Some were vaguely apologetic about this (possibly in deference to what they imagined the researchers' viewpoint to be) and others were dismissive about the usefulness of much of the available information. Nonetheless they obviously were aware of, and used, many theoretical concepts in their work and were designing environmentally thoughtful buildings. It appeared that rather than using design advice in a prescriptive or instrumental way these architects worked with an image of what was embodied in such information and what this meant for their particular designs. They also referred to images from other sources that appeared to be useful during design, such as their previous experiences or knowledge of other buildings. It seemed apparent that these images were an important factor in the architects' consideration of the environmental aspects of design. And yet, on investigation, it was apparent that there had been little research into the role of images in architectural design and even less into their role in the consideration of environmental issues related to design.

### 1.2 Environmental issues in house design

The concept of the environment, or that which surrounds, is a vital consideration in the design of a house whether it be in the sense of the house that surrounds and creates an environment for the occupants, or the house and the way it resides in a larger environment such as the social, material, cultural, political or geographical milieu. Indeed, the designer of a house can be thought of as an 'environmental facilitator': someone who translates the particular concerns and desires of the future occupants of the house, and the wider society, into built form.

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\(^1\) The term environmental issues will be used throughout this thesis to refer to those concerns connected to the relationships between people, the built environment and the wider world. Terms frequently used by other authors in similar contexts include: 'green', sustainable, and ecological.
There are many environmental issues arising during the design of a house that may be of concern to individuals such as the future occupants’ need to control internal environmental conditions in the dwelling, symbolic and practical issues to do with the way housing operates in relation to the wider community (encompassing issues of control and power), and affectional issues such as the desire for a sensory connection with the wider environment.

In Australia in the late 1990s there is also an increasing expectation that designers should address a range of environmental ‘problems’ of wider (or global) concern that are associated with the design and operation of housing. These problems are characterised by two main strands:

1. Environmental degradation. This is a cultural valuation at local and regional levels, dealing with the levels and kinds of environmental manipulation and contamination that are acceptable. . . The level of concern becomes global when the results of some scientific studies of the atmosphere are evaluated. This is especially so with those which concern ‘greenhouse gases’ and ozone depletion since the models predict considerable consequences for most of human society.

2. Resource depletion. This is a highly complex matter since it involves not merely the physical amount of the resources but its price and its cultural acceptability. . . But the high material expectations of many societies have lead to immense demands for energy and materials at rising per capita rates of use. Many writers have argued that the world cannot sustain these burgeoning rates for very long: there are differences between long-term stability of some ecosystems and the short-term demands of some human societies. . . This concern links in with the first since much environmental manipulation takes place in the cause and course of garnering resources (Simmons 1993, p. 16).

The building and operation of houses involves the use of resources, both those deployed on the site and at a distance. The extraction, production, transportation and use of building materials raises questions regarding pollution and depletion of resources. The energy sources used for domestic heating, cooling, water heating, ventilation, lighting and to run appliances have implications related to their production and use. Therefore, there are a range of issues related to both environmental degradation and resource depletion associated with housing. At this time in Australia, the reduction of greenhouse gas emissions (and the related issue of energy consumption) dominates government rhetoric about buildings and the environment. Addressing this environmental problem is the subject of many reports and is referred to frequently in the growing network of codes, regulations and design guidelines aimed at addressing environmental issues in housing.

Designers of houses are likely to have to address various ‘levels’ of environmental issues as they are agents of, and are part of, the wider society and at the same time they act as individuals and deal with individual clients. However, it is often difficult to determine the appropriate way to address environmental issues during design because there is a high degree of uncertainty surrounding many aspects of environmental problems and the scope of the issues involved is potentially vast. Holland and Holland (1995) describe the complexity
facing designers with the seemingly 'narrow' problem of deciding what sort of timber to specify for house framing in the Australian state of New South Wales – imported or local, old or regrowth. Apart from the issues of price and ease of construction other concerns relate to environmental impacts (wildlife conservation, soil conservation, water quality and the global carbon budget), energy consumption (embodied and operational) and economics (related to balance of payments and regional employment).

1.3 Design advice about housing and environmental issues

Designers may look to design advice to help them make decisions about how to address environmental issues in house design. In this thesis the term, 'design advice', is used to refer to information that is intended to explain aspects of environmental issues related to housing and/or describe how design should address these issues. There are many sources of information about the environmental aspects of house design currently available in Australia.

One source of such design advice is theory that aims to describe and explain the world (or aspects of the world) as it is, sometimes called positive theory (Lang 1987). Many branches of theory may have relevance to the environment such as the sciences, aspects of mechanical engineering, philosophy or psychology. An example of relevant positive theory is research describing the relationship between household energy use and greenhouse gas production. Positive theory arising from the design disciplines is likely to originate from building science and a tradition of research into material properties, lighting and energy use or from physiology and the development of comfort theories. These are by far the greatest sources of design-related theory about the environmental aspects of house design due in part to the privileging of scientific approaches to questions to do with the environment.

Theory addressing the issues of how house design ought to address environmental issues, is sometimes called normative theory. Such theory;

... involves prescription for action through standards (or norms), manifestos, design principles, and philosophies stemming from an ideological position on what should prevail in the world: it is quite clearly value-laden. The logic of normative theory is not that of science because science does not deal with creation (Johnson 1994, p. 19).

Jon Lang maintains that;

... normative theories are built on positive ones. They are based on perceptions of how the world works, but they are based also on perceptions of good and bad, right and wrong, desirable and undesirable, what is working well and what is working badly (1987, p. 16).

Normative theory in the form of rules-of-thumb, design guidelines, standards and regulations is a common source of advice for designers about the environmental aspects of house design. In recent years a number of government organisations and professional bodies have published design guidelines that outline ways of addressing environmental issues in house
design. (See for example, Ballinger, Prasad et al. 1992; Energy Victoria 1994; Department of Housing & Regional Development 1995.) The advice is often presented in the form of a prescriptive series of ‘rules’ that, it is suggested, will achieve a desired outcome if applied to the practice of house design.

1.4 The role of images

Kenneth Boulding (1961) likens the notion of ‘the image’ to subjective knowledge, or what one believes to be true, and maintains that images encapsulate not only verifiable ‘facts’ but values and emotions. Mental images are built up from a wide range of sources including personal experience, education and training, through the media and our relationships with others. During the design process architects draw on what architectural researcher, Frances Downing, calls an image bank (1992a): a repository of stored images of buildings, places, events and experiences. These images help the designer recognise patterns and they can be mentally manipulated and transformed during the design process to suggest new possibilities.

Such images can be useful during design. For example, a mental image of the heat flow through materials may be far more beneficial than the knowledge of specific U-Values of the materials. This image may involve sensual aspects such as the feel of a masonry wall warmed by the sun in winter, or a metal sheet roof baking on a 40° day. It could incorporate a sense of thickness, of durability, of appropriateness, and of availability – all helpful concepts for design. This image may be related to technical information learnt as a student overlaid with direct experience, information gleaned from the media and conversations with associates. It is, therefore, dynamic and constantly evolving. Such an image appears to be more comprehensive than any ‘design information’ (in the conventional sense) could hope to be as it encompasses such things as visual, technical, emotional and affective issues, design conventions, common building practices, the designer’s and client’s values, and their experiences.

Although images are held by the individual, there are shared or public images that reflect the concerns of larger groups or of the society in general. These public images invariably produce a record or transcript of some form. Design advice about environmental issues and house design is an important aspect of public images associated with these concerns. An example of a public image of particular relevance to this thesis is the image of what can be called the solar-efficient model of house design. Since the 1970s the solar-efficient model has been advocated in temperate Australia (to the virtual exclusion of other models) as an appropriate way of addressing environmental issues in housing. It has been promoted through design advice such as design guides, environmental regulations, journal articles, as well as in public awareness campaigns and through the education of several generations of building designers.
The rationale of the solar-efficient model is essentially that the building structure is designed as a solar collector to reduce winter heating requirements and is massive to also reduce internal summer temperatures. The solar-efficient strategy is based on using appropriate window area, orientation and shading for solar gain in combination with internal mass to modify temperature swings and insulation to reduce unwanted heat loss and gain. The belief that a solar-efficient house is ‘good for the environment’ is based on the idea that if the principles of the model are followed it is possible to design a house that can maintain internal comfort levels while using less purchased energy (which, in Australia, equates to fossil-fuel based energy) than a similar ‘poorly designed’ house. Therefore, it is reasoned that a solar-efficient house can conserve resources and reduce pollution particularly the emission of greenhouse gases. The idea that the solar-efficient model is ‘good for the environment’ is so strong that the ‘environmental friendliness’ of housing is likely to be judged according to whether a house (or house design) exhibits components of the solar-efficient model rather than other criteria such as its actual performance in operation. For example, a number of local councils in New South Wales have developed policies related to the energy efficiency or environmental sustainability of housing that essentially consist of a ‘checklist’ of factors (Glendinning, 1996; Sutherland Shire Council, 1997). These favour elements of the solar-efficient model such as concrete slab-on-ground floors, north facing windows and massive walls.

Many building designers use images of the solar-efficient model when thinking about environmental issues related to housing. And yet it is an image that often may be misleading, unhelpful or simply irrelevant. The solar-efficient model frames environmental issues in a particular way; in terms of resource use and specifically the fossil-fuel based energy used for heating and cooling. This point is rarely made explicit, however, and if other environmental aims are important for a particular house design this may lead to confusion or conflict.

The solar-efficient image presents the idea that energy use is dependent on the form of the building fabric and this denies the significance of other determinants of energy-use that are arguably far more important, including the occupants and their lifestyle, and even the size of the house. Other contextual issues of vital concern during the practice of design, such as temporal and locational issues, are often rendered unimportant in this view. The dominance of the solar-efficient image also downplays other images of houses that could be considered good for the environment; for example the small house, a house that is self-sufficient in energy, a house of low embodied energy, a house that uses recycled materials, a healthy house or one that allows an intimate and affectional relationship between the wider environment and the occupants.

These examples suggest ways that images may be helpful or misleading conceptual tools for designers who are considering the environmental aspects of house design. Images appear to encapsulate and represent many issues thereby enabling a holistic consideration of, for
example, building form and performance, occupants' wants and needs and environmental issues. On the other hand, the very attributes of images that make them useful for design can lead to problems when aspects of the images are inappropriate for a particular design situation.

1.5 Aim of the thesis

It is a contention of this thesis that designers draw on images when they consider the environmental aspects of house design and that these images play an important role in design decision-making. The sources of these images are complex but include current design advice about so-called environmentally responsible design. However, there are fundamental and inadequately recognised differences between images arising from the practice of house design and the images that form the basis of much design advice. These differences have consequences for how environmental issues and design issues are framed in practice and in design advice, and for the applicability of design advice in practice. Images related to the environmental aspects of house design are currently little understood. The aim of this thesis is to improve understanding of the current consideration of environmental issues in house design in Australia by:

a. identifying the images that a group of architects used when thinking about the environmental aspects of house design,

b. reviewing the images embodied in sources of existing design advice about the environmental aspects of house design, and

c. contrasting the images identified in (a) and (b) and discussing the implications of the differences found.

A greater understanding of the images related to the environmental aspects of house design will inform future considerations of the way house design can address environmental issues and how design advice might assist this process.

1.6 Methodology

Images are subjective and while they can be talked about in general terms it is impossible to objectively describe specific mental or cognitive images that reside in the head of the imaginer. The background to how people in general – or a sub-group of Australian architects designing houses in particular – form images, is vast on one hand and very particular to the individual on the other.
Sources of ideas about the environment, what it ‘is’ and what should be done about it, include:

*the media* – information campaigns, documentaries, images of the environment that suffuse films

*formal study* – at primary, secondary and tertiary level, of ecology, environmental studies, cultural studies, architecture, botany, biology

*direct experience* – living in the country, the city, the suburbs, camping, hiking, exploring, in one’s own area/state/country or elsewhere, buildings seen and visited, participation in activist groups

*other people’s expressions* – reading books, viewing paintings and films, through discussions

*intellectual pursuits* – from thinking about it

*religious/ spiritual /ethical beliefs* – as part of a wider belief system

Similarly, ideas about design will be influenced by the background, experience, education and proclivities of the individual.

The scope and individuality of these influences indicates the difficulty of talking about designers’ images of the relationship between the environment and design in a general way. And, given that, as Boulding (1961) maintains, images are akin to what an individual *believes* to be true rather than ‘objective’ knowledge, the investigation of them needs to be undertaken partly at the site of the individual designer. This thesis focuses on a particular type of designer – the architect – and a particular design problem – that of the design of a house where the client is the future occupant. This situation is unique in bringing together;

- the architect/s, with their ethics and morals, design expertise, knowledge and experience,
- housing both in terms of the house as a home with the associated role it fulfils for the occupants, and the house as commodity, a unit of both production and consumption,
- the occupant/s, their values, beliefs, expectations and attitudes and their role as consumer, and
- the wider community and the values reflected through various institutions.

The core of this thesis is a series of interviews with architects identified as being interested in environmental issues (either by themselves or by others) and who had designed buildings that, in some way, express these ideas. During the interviews the architects were asked to discuss a house or other small building they had designed. Although the architects were aware that the author was interested in ‘environmental issues’ and house design, these issues
were not defined for them, neither were they predetermined by the author. One of the aims of the interviews was to discover the images that the architects had of these issues.

The interview technique borrows from ethnographic methods that explore an issue in depth with a small sample group. These approaches are valuable for the investigation of the practice of house design as they recognise the importance of every-day knowledge and understanding in context. Each design project involves a unique set of inter-related contexts (architects, client, site, budget, time, etc.) and understanding the ‘meaning’ of particular issues is inseparable from these contexts. Focussing on the architects’ descriptions of design projects accounts for many contextual issues that are important in the practice of house design.

It is not suggested that the sample group of architects is statistically representative of the wider population. The intention is to look in depth at how these particular architects consider the many interrelated issues that comprise the environmental aspects of house design. Nonetheless the architects’ descriptions of the issues that arise in practice should be recognisable to those familiar with the profession. Similarly, it is not suggested that architect-designed housing can be considered representative of the wider housing situation in Australia: such housing accounts for only a small percentage of new housing in Australia each year. Nonetheless, the influence of such housing is often proportionately greater than its actual numbers through representations in various media. Architect-designed housing often introduces formal, constructional and stylistic innovations that are later taken up on a wider scale. For the purposes of this thesis, focussing on architect-designed housing where the future occupants of the house are known, enables the examination of many issues including how the architect determines, and responds to, his or her clients’ environmental aims.

This thesis is not concerned with evaluating the end product (the house designed) in relation to current societal ideas of what constitutes an ‘environmentally responsible’ house. Neither does it set out to prove a necessary relationship between certain types of images and an ‘environmentally responsible’ house. The consideration of evaluation in these terms warrants another thesis. The architects were chosen on the basis of their interest in environmental issues and because the houses they had designed showed evidence of sensitivity to these issues rather than because these houses were identified as ‘environmentally responsible’.

The images used by the architects to describe environmental aspects of house design were identified from an analysis of the transcripts of the interviews. It is presumed that the images referred to by the architects reflect their understanding of environmental issues arising from design. These images are discussed and compared with images embodied in selected sources of design advice currently available to architects in Australia. Extensive extracts from the interviews are used in the thesis with the intention of generating images in the reader’s mind in such a way that the idea, the scope and the usefulness of the images will be ‘recognised’.

The architects’ images are, on the whole, presented in a non-critical way. The aim was not to
establish the ‘rightness’ or ‘wrongness’ of the architects’ images but to identify them in order to compare them with the images embodied in current sources of design advice.

Design advice is examined in relation to this perspective. The historical, cultural, political, epistemological and pragmatic contexts surrounding the development, content and formats of sources of design advice are not explored in great detail. The investigation of these issues is beyond the scope of this thesis but does warrant further work. The sources of design advice are considered critically in terms of the images of environmental issues that they embody and how these images compare with those of the architects. These images are evident in the way ‘the environment’, and design issues to do with people, are portrayed in the design advice. Often these issues are not dealt with explicitly but are revealed through such things as the way that environmental issues are framed in the design advice, the nature of the proposed built-form solutions, assumptions made about the role of the architect and the nature of the design process, and assumptions about the way people (notably the architects and the future occupants) interact with buildings and the wider environment. The images presented in the design advice are not necessarily those intended by their authors or by the researchers whose work the design advice is based on. A range of factors can contribute to simplifications or distortions in the design advice, such as the appropriation of research for uses for which it was not intended, restrictions related to the format or the style of the presentation, and insensitive editing.

One of the contentions of this thesis is that a defining aspect of architectural practice is its specificity. This thesis confines itself to the situation during the late 1990s in Australia, with particular emphasis on the situation in South Australia.

1.6.1 Analysis of images

This thesis draws extensively on the image theory of Lee Roy Beach to discuss and analyse the images identified from the interviews and the design advice. Beach’s theory, described in his book, *Image theory: Decision making in personal and organizational contexts* (1990);

\[\ldots\textit{assumes that decision makers pursue plans in the attempt to achieve goals, and that decisions consist of accepting or rejecting new goals and plans in light of what the decision maker considers to be the right thing to do (p. xiii).}\]

This theory describes the role in decision-making of three images (the value, strategic and trajectory images – or images of why, what and how) in decision-making. There are a number of aspects of this work that make it particularly relevant for this thesis, but most notable is the emphasis placed on the role of the decision-makers’ values. Decisions about design and environmental issues are largely determined by the values of the participants.

[The theory] assumes that most decisions are made in an attempt to do what is ‘right’, rather than in an attempt to maximise – where ‘right’ is defined in terms of the decision maker’s values, ethics, beliefs, and morals, not all of which are necessarily admirable (Beach 1990, p. xiii).
Beach acknowledges the messy, non-linear nature of much decision-making; a comment that might equally be applied to design.

*Decision making proceeds by fits and starts. Opportunities (plans) beget goals. Goals are modified as plans are refined. Principles that at first seem irrelevant turn out to be relevant, often painfully so. Plans that at first seem straightforward turn out to be impossible to implement or to fall short of achieving their goal. Goals that look desirable become less so when the requirements for their achievement become clear. Moreover, there usually is more than one decision under consideration at a time, with deliberation switching from one to another and back again* (Beach 1990, p. 15).

Beach’s theory assumes that;

...most decisions are made quickly and simply, on the basis of ‘fittingness’, and only in particular circumstances are they made on the basis of anything like the weighing and balancing of gains and losses that is prescribed by classical decision theory (Beach 1990, p. xiii).

Further, Beach discusses the difficulty of changing the status quo – and the strong tendency for things to stay pretty much as they are. He maintains that events that comprise the status quo are viewed differently from the events that comprise alternatives to it.

One important short-coming of Beach’s theory in relation to design situations is the lack of recognition of the role of creativity in decision-making. While suggesting that goals can arise from “spontaneous creativity” he goes on to say that his theory does not have much to say about creativity “if only because, for all that is written about it, creativity is not generally well understood” (Beach 1990, p. 44). In this thesis this shortcoming is addressed by supplementing Beach’s work with a number of other sources that explore the role of images in architectural design; notably the work of Downing (1992a; 1992b; 1994), Rudolf Arnheim (1993) and Donald Schön (1987).

### 1.6.2 Cross-disciplinary nature of environmental and design issues

The cross-disciplinary nature of environmental and design issues introduces methodological issues for this thesis. The domain of the relationship between the environment and the design, construction and operation of houses is potentially vast, incorporating a complex and rich blend of inter-related issues such as:

- Sciences, including:
  - The identification of threats to biodiversity,
  - the identification of ecological problems related to the extraction or production of building materials,
  - the prediction of long-term climatic affects associated with the burning of fossil fuels, and
  - the identification of physical properties of building materials including heat storage capacity, insulation properties and toxicity.
Politics, including:
- The determination of environmental problems at international level, the national response and the implications of environmental and housing policies on house design,
- the relationship between national energy policies and household energy usage, and
- the impacts of housing and transport policies.

Design, including:
- The environmental implications of material selection, siting and layout of houses,
- the aesthetics of design that is 'good for the environment', and
- the thermal properties of building materials.

Geography, including:
- The relationship between house design and the topography, climate and microclimate of particular locations.

Ethics, including:
- The values held by individuals and the community and how these are reflected in house design.

Psychology, including:
- The relationship between peoples' beliefs about the environment and about their home, and their behaviour.

Economics, including:
- The direct costs to the home owner of incorporating environmental features into their house, and
- the economic value of environmentally responsible design.

Medicine, including:
- The relationship between 'sick building syndrome', allergies and asthma and common building materials and methods.

Any design situation could potentially involve aspects of all these issues (and more).

Grounding this thesis in the words of practising architects confines the scope of the field by considering the environmental aspects of house design in terms of the issues that are important in practice. Nonetheless, research into the environmental aspects of house design bridges many of the arbitrarily defined boundaries that exist between disciplines. Although this thesis has its origins in the area of architectural science that deals with the relationship between energy, design and environmental issues it also draws on work from the fields of sociology (studies of the cultural and societal issues affecting individuals' energy-using behaviour), psychology (behaviour and attitudes towards home, energy-use and the environment), architectural theory (design methods), and to a lesser extent, philosophy, visual
art theory and cognitive science. Many of these disciplines or fields of study lie outside the author’s principle area of expertise. However, given the transdisciplinary natures of design, and of environmental issues, and the comprehensive and holistic nature of images there is a need to draw on work from many sources. It is the images represented in this material to the ‘non-insider’ that is of interest to this thesis.

1.7 Organisation of the thesis

Chapter 2 investigates the idea of ‘the image’. It outlines work from the visual arts, decision-making and cultural studies that has a bearing on this thesis and discusses the role of the image in the design process.

Chapter 3 describes the interviews conducted with the architects. The architects’ images of design, and of housing and the environment were investigated. Long extracts from four of these interviews are presented to provide a sense of the inter-relatedness of the issues being discussed and to illustrate the way images allowed the connection between these issues to be made in an architecturally-focussed way.

The following four chapters discuss images in more detail. The analysis of the transcripts of the interviews revealed two broad categories of images related to the consideration of the environmental aspects of house design; images of what is known or believed to be true (‘what is’) and images of ‘what should be’. This division has been adopted as an organisational device in this thesis. These are in some senses arbitrary divisions in that aspects of one sort of image are evident in the other; our ideas about what ought to happen are inevitably influenced by our knowledge and beliefs about what exists at the moment and what strategies are available to us. Similarly, it is hard to disentangle images of ‘what should be’ from our images of what we believe to be true. Many of the extracts from the interviews illustrate that the architects’ ideas about ‘what should be’ and ‘what is’ are intertwined and are aspects of a total image. Consequently there is some repetition in these Chapters as quotations from the architects are used to illustrate different issues. There is also some necessary cross-referencing between the Chapters describing sources of design advice, as here, too, it is difficult to disentangle images of ‘what should be’ and images of ‘what is’.

Chapters 4 explores images of ‘what should be’ from the viewpoint of the ten architects interviewed. These images are discussed in terms of value images, goal images and strategic images.
Chapter 5 reviews images of ‘what should be’ in three key sources of design advice about the environmental aspects of house design in Australia;

- the Nationwide Home Energy Rating Scheme (NatHERS) (see Appendix A 1-16),

- *The National Resource Document for Residential Development* (known as AMCORD) (Department of Housing & Regional Development 1995 – see Appendix B 1-37 for extracts), and


Extracts from these documents are included in the Appendices. Although familiarity with the documents is assumed in this thesis it is the images they present and not the particular detail that is of interest here. These examples should be ‘recognisable’ to those familiar with the architectural profession as many other sources of design advice, from both Australia and overseas, contain similar information and take similar approaches to design information about the environmental aspects of house design.

The images of ‘what should be’ presented in these sources of design advice are discussed in terms of value, goal and strategic images and compared with those arising from the interviews.

Chapter 6 investigates images of what is known or believed to be true (‘what is’) concerning the environmental aspects of house design from the point of view of the architects interviewed. It begins by reviewing the sources of these images and then outlines images related to ‘the environment’, and to housing and to the practice of design.

Chapter 7 investigates images of what is known or believed to be true (‘what is’) that form the basis of the three sources of design advice reviewed in Chapter 5. These images are largely derived from what can loosely be termed ‘research’. Three key aspects of these images are reviewed: the environmental impact of housing; ‘appropriate solutions’; and people and the way they relate to housing and environmental issues.

Chapter 8 summarises, in the light of the previous Chapters, the major differences between the images arising from practice and embodied in design advice. The implications of these differences are discussed and suggestions for further work are made.
2. Images

2.1 Introduction

The English word, image, comes from the Latin term, imago, and derives from the same root as imitari, or to imitate. The Oxford English Dictionary (OED 1989) lists seven meanings of the substantive form of the word, image, each related to representation in one form or another. Jonathan Miller maintains that “the word ‘image’ is conventionally applied to configurations presented to the eye – photos, paintings, engravings” (Miller 1990) that have an objective, physical presence. Much has been written about these sorts of images (see for example, Arnheim 1969; Gombrich 1982, 1998; Ross 1994; Aumont 1997). This thesis, however, is concerned largely with images that occur ‘behind the eye’ or the way we represent ideas to ourselves and to others and the impressions we have of other people, products and things. It is about memory and imagination; connections to the past and to the future.

When discussing images and imagery in relation to a field such as architectural design confusion often arises because of the intertwined nature of issues to do with ideas (held by individuals and groups) and representations of these ideas (verbally, graphically or in built form). This confusion is compounded because of the range of commonly accepted uses of the term, ‘image’ and the variation in terminology used by authors referring to images. Sometimes the same term (such as the word ‘image’ itself) is used in ways that imply different meanings (to refer to a pictorial representation or a mental picture) and sometimes terms that vary (such as visual image and optical image) are used to refer to similar concepts.

For many years, images have been a topic of interest in a number of fields, including cognitive psychology (see for example, Barlow, Blakemore et al. 1990), decision-making (Beach 1990) and education (Allender 1991). This chapter will draw selectively on work from several fields to explore the way images are written about, to clarify terms used and to illustrate the range and scope of images used in connection with the environment and design.

2.2 Definitions of images

One of the definitions given in the Oxford English Dictionary for the term, image, is;

... [a] mental representation of something (esp. a visible object) not by direct perception but by memory or imagination; a mental picture or impression; an idea, conception ... a mental representation due to any of the senses (not only sight) and to organic sensations. (OED 1989).
Images are difficult to analyse because they are subjective and intangible, nonetheless this does not make them any less real or less powerful. We recognise them: we all have them and use them. Boulding, who began writing about images in the 1950s, likens them to subjective knowledge, or what one believes to be true, as opposed to knowledge per se that, he maintains, has implications of truth and validity (1961, p. 5-6). He discusses many dimensions of the image (including the spatial, temporal, relational, value and emotional) and says images encompass both ‘facts’ and ‘values’.

Beach differentiates between mental and cognitive images:

*Mental images are psychologically (centrally) generated quasi-pictorial events... For example, you can call to mind your mother’s face... Moreover, these images can be mentally manipulated — imagine your mother starting to frown and then breaking into a big smile...*

*Cognitive images... are a combination of mental image and non-image knowledge. That is, cognitive images have some features that are pictorial, some that are semantic and some that are emotional (for surely emotions must be regarded as a form of knowledge).

To understand cognitive images, try to recall a conversation you had yesterday. Notice that, in part, the image you conjure up has a visual component — perhaps the setting or the faces of the other participants — although the image may be indistinct and fragile... The image also consists of the content of the discussion, which is encoded semantically rather than visually. And, the image consists of the emotional tone that accompanied the discussion or that you added later when you thought about what had taken place (Beach 1990, pp. 16-17).

These definitions may be useful for indicating the scope of images rather than drawing clear distinctions between them as, in practice, it is difficult to determine when an image is ‘mental’ rather than ‘cognitive’ and writers frequently use the term ‘mental image’ in ways that suggest both of these types. In a recent work about visual databases for architects, Gabriela Goldschmidt refers to mental images simply as “‘picture[s]’ that one sees in one’s ‘mind’s eye’” (1995, p. 56) and Koutamanis et al. say mental images of architecture are:

... memories of existing designs the architect knows either from personal experience with the built environment or from publications, that is, external conventional design representations (Koutamanis et al. 1995, p. xiii).

Downing defines a mental image as:

...the sensation of environmental phenomena through vision, movement, sound, smell, or taste, captured and held in abeyance for moments of time in the mind of an individual... A mental image helps codify and order the endlessly complex world of human experience (1992b p. 442).

Elsewhere Downing says:

*Mental images are an active, vital repository of information gathered through sensual experience — through sight, sound, smell, touch, and taste. A mental image presents more than an initial remembered percept to the mind; it contains multiple versions of involvement that stretch beyond the experiential to the emotional and intellectual realms (Downing 1994, p. 235).
Kevin Lynch has written extensively about the images that people have of cities and how these help in way-finding and 'reading' a city. He talks of the environmental image as:

... the generalized mental picture of the exterior physical world that is held by an individual. The image is both the product of immediate sensation and of the memory of past experience, and it is used to interpret information and to guide action (Lynch 1960, p. 4).

Lynch maintains that the mental images that people have of a place:

... are organized structures of recognition and relationship. They are also suffused with meaning, feeling, and value, and these meanings are more complex and subtle than are the dry bones of structure (Lynch 1976, pp. 112-113).

The very nature of images means that they cannot be defined rigidly in a meaningful way. Rather, these descriptions serve to highlight certain common elements identified by relevant authors and to indicate the scope and possibilities of images: their multi-faceted nature, the importance of the pictorial or visual element, the ability to incorporate values, meaning, beliefs, and emotions, and the strong connection with memory.

2.3 Sources of images

As suggested by the definitions above, an individual’s images are derived from his or her experiences, learning and values. The following section discusses some aspects of the sources of images that have implications for design, especially for the consideration of environmental aspects of house design.

2.3.1 Individuals’ images

Boulding says that the image that an individual has of the world and the way it works is particular to that individual and “is built up as a result of all past experiences of the possessor of the image” (Boulding 1961, p. 6). This image is constantly subject to change under the influence of new events or information.

From the moment of birth if not before, there is a constant stream of messages entering the organism from the senses. At first, these may merely be indistinguishable light and noises. As the child grows, however, they gradually become distinguished into people and objects ... The conscious image has begun. In infancy the world is a house and, perhaps, a few streets or a park. As the child grows his (sic) image of the world expands. He sees himself in an increasingly complex web of personal relationships (Boulding 1961, p. 6-7).

Lynch talks about structuring and identifying the environment using cues such as:

... the visual sensations of colour, shape, motion, or polarization of light, as well as other senses such as smell, sound, touch, kinesis, sense of gravity, and perhaps of electric or magnetic fields (Lynch 1960, p. 3).

Sensory information may be associated with particular places; this is an important source of images for architects. Downing has written a number of articles about the place-imagery used by architects and architecture students (Downing 1992a, 1992b). She maintains that
designers “tend to control and define complex problems by using some past place experience to test and fully understand future possibilities” (Downing 1992a, p. 446). One of Downing’s studies investigates the place-imagery of three groups – pre-entry architecture students, architectural students about to graduate and architects who had been practising for about ten years (Downing 1992b). Participants were asked to recall places that had been memorable at different times of their lives. The places mentioned range from formal exemplars of modern architecture such as Frank Lloyd Wright’s Falling Water to informal spaces such as ‘grandma’s porch’. These places were recorded on cards that the participants sorted into categories. Cards were grouped together under a title; for example, one title used by a participant was ‘degrees of lightness/darkness’. More than one meaning could be associated with a place-image.

Downing analyses the categories and identifies three basic frameworks used by the study’s participants for understanding and defining memorable places: objective, experiential and emotive. The objective framework defines the constructs in an intellectual manner referring to physical properties such as “scale, detail, geometry, organization, proximity, enclosure etc.” or typologies of place such as “houses, office buildings, schools, natural landscapes, urban, suburban etc.” (Downing 1992b, p. 303). The experiential framework relates to qualities of the place such as comfort, intimacy and privacy while the emotional framework is a “highly personal response to place” (Downing 1992b, p. 301).

While Downing’s early work centred on place-imagery, a later study (1994) outlines six different categories of mental images that designers draw upon for ideas:

Specific places are those places that can be named . . . [and] can range from grandmother’s garden to Frank Lloyd Wright’s Fallingwater (sic) . . .

Specific events . . . are events that can be named. Specific events can also be formal, as in rituals, or informal, as in occurrences. These kinds of images can range from father’s burial to an evening spent reading Swann’s Way . . .

Place types are places linked together as a group, class, or taxonomy identifiable through shared attributes, rules of formation, or cultural manifestation. An example would be New England connected farmhouses . . .

Scripted behaviour is a portrayal of an abstracted, normative response to typical situations. . . One example of scripted behavior is the interactions of a patron in a restaurant . . . Designers and clients alike rehearse scripted behavior in their minds as they come to some understanding of the program or walk through paper designs . . .

Concepts . . . refer to a person’s understanding of logical forms that are manifested in different types of places (like an axis down the middle), or events (like people gathering in a circle for discussion). These concepts are based in experience but have become so abstracted or generalized that they exist as independent ideas . . .

Essential constructs are generally taken from the meaning contained in the nature of the project. Built forms can present us with their meanings, the connotations of which must be carefully teased from obvious physical and specific denotations of place. . . Through the negotiation of ideas the designer and client set the “tone” or theme” that can guide future physical manipulation of the design (Downing 1994, pp. 238-241).
Downing’s categorisation illustrates one way of describing the sources of the images that are used by designers. They are largely derived from the experience of, and ideas about, places and events. Other sources of images may relate to other aspects of ‘the world’: for example to the experience of, or ideas about society, personal relationships, culture, politics or environmental issues.

2.3.2 Public images

Boulding maintains that, although images are held by the individual, there are shared or public images.

Part of our image of the world is the belief that this image is shared by other people like ourselves who are also part of our image of the world. In common daily intercourse we all behave as if we possess roughly the same image of the world. . . . It is this shared image which is “public” knowledge as opposed to “private knowledge” (Boulding 1961, p. 14).

The basic bond of any society, culture, subculture or organization is a “public image”, that is, an image the essential characteristics of which are shared by the individuals participating in the group (Boulding 1961, p. 64).

The Oxford English Dictionary (OED 1989) defines this use of the term image as “[a] concept or impression created in the minds of the public, of a particular person, institution, product, etc.” and maintains that it developed from “advertising parlance in the late 1950s”. At the time he wrote, Boulding recognised the importance of mass media in the form of radio, television and cinema (and foreshadows the importance of the internet) for the creation of public images. In the intervening years the use of the term ‘image’ in the sense of a public or shared image has become common. It is accepted that politicians have public images that are manipulated by media advisers and honed through training, or that sport shoes are marketed, not as utilitarian protection for the feet, but as an essential component of a ‘hip’ young lifestyle. This image is ‘sold’ through advertising, endorsed by desirable public figures and adopted amongst peer groups.

Boulding maintains that when an image is held by the public:

. . . it invariably produces a ‘transcript’; that is, a record in more or less permanent form which can be handed down from generation to generation. In primitive nonliterate societies the transcript takes the form of verbal rituals, legends, poems, ceremonies and the like. . . . The invention of writing marks the beginning of the “disassociated (sic) transcript” – a transcript which is in some sense independent of the transcriber (Boulding 1961, p. 65).

Transcripts provide a record of public or shared images. They also provide messages that can affect an individual’s image. For example, Downing (1994) identified exemplars of modern architecture as an important source of images for architects and yet many architects may know of these buildings only through representations in architectural journals and books. These transcripts present not only information about the physical characteristics of the buildings, but also convey a sense of their architectural and cultural value (even simply through their selection as worthy of representation). Such information can influence an
individual’s image of ‘good’ architecture. Boulding notes that transcripts have limitations as “we have no direct means of transcribing sensations, emotions, or feelings except through the crowded channels of symbolic representation” (Boulding 1961, p. 65).

An example of a public image, and its associated transcripts, of particular relevance to this thesis is that of the solar-efficient model of housing that was referred to in Chapter 1. There is a public perception that this is the ‘best’ model for addressing environmental issues related to housing in temperate Australia. This perception is reflected, and reinforced, through documents such as design guides, environmental regulations and journal articles, and in public awareness campaigns and the education of building designers.

The relationship between public and individual images is dynamic. An individual’s images are inevitably influenced by public images portrayed through the media, the education system and by other individuals or groups; and as individuals’ images change with exposure to these ideas, new public images gradually emerge. Boulding notes, however, that once an image has become absorbed into the institutions of a society it can be difficult to change.

*Curiously enough, it is often the most successful images that become the most dangerous. The image becomes institutionalized in the ceremonial and coercive institutions of society. It acquires thereby a spurious stability. As the world moves on the image does not* (Boulding 1961, p. 79).

### 2.3.3 Images of the environment: ‘global’ view

‘The environment’ is something that is known to us through both individual and public images and their transcripts. The idea that ‘the environment’ can be thought of in ‘global’ or ‘local’ terms are important public images. The ‘global’ view is based on the understanding that many modern environmental problems such as acid rain, ozone depletion in the upper atmospheres and the potential for global climate change through increased greenhouse gas production can affect the whole planet. The environment considered in these terms is common to all inhabitants of the planet. Many global environmental problems cannot be experienced directly: they are defined for the general population by experts who use ‘hi-tech’ equipment or who make predictions using computer simulations. This reflects the fact that science has become one of the most influential ways of understanding the world in the late twentieth century. Information about these environmental issues is spread via journals, magazine articles, books, television documentaries, formal education and special interest groups, and by environmental crusaders, and is reflected in the rhetoric of governments and even in the advertising for products ranging from soap powder to nuclear power. This information becomes an important source of knowledge, not only about the nature of these environmental problems but also about what ‘the environment’ is.

Visual images are an important component of this shared image of ‘the environment’. Maarten Hajer (1995) links the nature of modern environmental issues to the photographs of planet Earth taken from outer space during the Apollo space missions (see Figure 2.1).
The earliest of these photographs, taken during the Apollo 8 mission of 1968, was the first time that mankind had travelled far enough from Earth to obtain an image that represented the whole of planet Earth. Hajer sees this image as marking a "fundamental shift in thinking about the relationship between man and nature" (1995, p. 8). This idea is also explored by anthropologist Tim Ingold (1993) who maintains that the world view that locates the viewer outside the world with the Earth seen as a globe carries implications that the Earth is something that can be conceived of as a whole, known objectively and 'managed'. This 'global' imagery is associated with the triumph of modern science and technology.

Andrew Ross, in his book, *The Chicago Gangster Theory of Life* maintains that:

\[ \ldots \text{[t]he cliches of the standard environmental image are well known to us all: on the one hand, belching smokestacks, seabirds mired in petrochemical sludge, fish floating belly-up, traffic jams in Los Angeles and Mexico City, and clearcut forests; on the other hand, the redeeming repertoire of pastoral imagery, pristine, green and unspoiled by human habitation, crowned by the ultimate global spectacle, the fragile, vulnerable ball of spaceship earth} (1994, p. 171). \]

These familiar representations highlight common attitudes to the role of humans in relation to environmental issues; they are readily identified as part of ‘the problem’ but often absent from images of an ideal future. Some of the most potent images of future worlds appear in science fiction films and from those of the 1970s that reflected concerns about the ‘oil crisis’ (for example *Silent Running, Westworld, Dark Star, Water World*) through to the post-apocalyptic style of the 1980s and 1990s (for example *Mad Max, Blade Runner, Brazil, The Matrix*) “the ecological ‘look’ of the future has been governed by a dark dystopian imagination, feeding off the imagery of global degradation” (Ross 1994, p. 187). These films
often depict a technology-centred future in which natural landscapes are non-existent suggesting that the current environmental problems were not able to be solved.

2.3.4 Images of the environment: fields of significance

Philosopher, David Cooper (1992) maintains that the notion of the environment embodied in the "scientific perspective" is too big. The expression 'the global environment' makes this largeness of scope explicit "but even when the adjective is omitted, the definite article and singular noun indicate that there is just one big environment" (Cooper 1992, p. 167). Many people, while recognising 'global' environmental problems, do not view 'the environment' in these terms in their day-to-day lives (Hinchliffe 1996, Myers and Macnaughton 1998).

Ingold contends that the difference between 'global' and 'local' perspectives is:

... not one of hierarchical degree, in scale or comprehensiveness, but one of kind. In other words, the local is not a more limited or narrowly focused apprehension than the global, it is one that rests on an altogether different mode of apprehension – one based on an active, perceptual engagement with components of the dwelt-in world, in the practical business of life, rather than on the detached, disinterested observation of a world apart (Ingold 1993, p. 40).

Many ancient views about the relationship of the individual to the world were conceptualised as a person at the centre of a series of "nested spheres" (Ingold 1993). The individual's view of the world grew from his or her local knowledge and personal and immediate experience and was drawn ever deeper into the world (see Figure 2.2).

Figure 2.2 Beginning the ascent through the fourteen spheres of the world


The medieval Judeo-Christian view of the universe placed the static spherical earth at its centre with the stars attached to a surrounding, rotating sphere that marked the edge of the
universe. The cosmology was rich in sign and symbol with one of the central motifs being that nature was a book through which God's word could be read. Cooper (1992) maintains that these earlier notions of the environment were 'local' not so much in terms of geographical proximity or causal impact, but rather because one's environment was where one was 'at home', knew one's way around and knew what things meant and stood for. He gives the example of a school pupil's environment where:

[the pupil knows how to get from A to B, how to address people, whom to avoid, what to wear and which feelings to express or disguise. He or she is, one might say, 'at home' there (Cooper 1992, p. 170).

Cooper maintains that '[a]n environment is what a creature knows and knows in a certain way ... The relevant knowledge is practical, unreflective familiarity' (Cooper 1992, p. 169). Items within a creature's environment acquire significance through "occupying places within one's everyday practices" (ibid.). For example, a tree may have significance for a schoolgirl because it marks the halfway point of the walk home. Any creature's environment consists of a network of such meanings creating what Cooper calls a "field of significance".

In calling an environment a field of significance I mean ... that the items within it signify or point to one another, thereby forming a network of meanings. It is this which confers cohesion, a certain 'wholeness', on an environment rather as the episodes in a novel belong to a coherent narrative through pointing back and forth (Cooper 1992, p. 170).

Cooper refers to Heidegger's description of the 'referential totality' of a farm where items such as a cow's udder and a milk pail "take on significance only as parts of a whole" (Cooper 1992, p. 170).

The image of the environment as a field of significance encompasses the idea that there can be many 'environments': an individual may recognise a work environment, a home environment, the school environment, and different individuals will recognise different environments. This is in contrast to the image of a global environment common to all.

Cooper maintains that the importance for a creature of having an environment is an ideal so ancient and taken-for-granted that it is only articulated when threatened. He argues that the conscious recognition of this 'ancient ideal' may provide the basis for confronting modern environmental problems

The concerns of people conscious of the ancient ideal will begin 'at home', with their environments, the networks of meanings with which they are daily engaged. And these concerns will be directed at whatever threatens to separate them from their environment, to make their milieu alien. They will be directed, say, at the proposed erection of a factory farm, the squawking and stench from which expel the familiar sounds and smells of their surroundings; or at the planned construction of a motorway which will render impossible the old intimacy between neighbours on opposite sides of the valley.

But these concerns will not remain purely 'local'. While my environmental concerns begin with my environment, I recognize that other people (and animals, too) have, or should have, their environments. If I appreciate the importance for my life of a place I know my way about I must appreciate the importance this has for others as well, and I will want to defend their efforts to preserve such places (Cooper 1992, p. 170).
This brief outline highlights two important aspects of images of 'the environment'. The first is the view associated with 'modern' environmental problems that are of global concern, and are identified using scientific methods and involve international cooperation and national institutions to solve them. This view is characterised by the visual image of planet Earth and the implicit message that there is one environment and that it is possible to know, understand and, hopefully, to manage environmental problems. The second view of the environment, as a field of significance, acknowledges that there are many environments that are defined in relation to their significance to 'that which is environed'. These environments are known through the senses, and experientially, as well as understood intellectually. Being at the centre of things, it is difficult for an individual to define the extent of his or her environments.

For many people, their images associated with the term 'environment' encompass both views, shifting focus easily depending on the context in which environmental considerations arise. For example, the term 'work environment' is likely to conjure images associated with the physical characteristics of a workplace, its furnishings, lighting, internal climate, relationships between workmates, work-load, etc. The term 'good for the environment' is more likely to suggest the 'global' environment discussed above with images associated with the state of natural vegetation, and the 'cleanliness' of the air and water.

2.4 Images in architectural design

As has been outlined, images may incorporate pictorial and visual information as well as having emotional overtones, suggesting processes and incorporating values. The strength of the concept of the image is that it is multi-layered and multi-faceted and can accommodate an understanding the various, inter-related aspects of a problem. Thus it is a powerful tool for understanding how the architect considers and deals with the complex amalgam of visual, cultural, functional, constructional, structural, economic and environmental issues during the design process. The following section discusses the role of images in design and highlights those issues of importance in the consideration of environmental issues in house design. Particular emphasis is placed on the role of images in framing problems and enabling dialogue between the participants of the design process and for decision-making.

2.4.1 Problem framing

Design often involves a high degree of uncertainty: questions range from whether a proposed building can be built for the available budget to whether a particular bathroom fitting will be readily available. Design also tends to be unique: each design situation brings together a particular combination of time, site, clients and brief. And it is a process with many participants: including the client, neighbours, the builder, sub-contractors, local council representatives, and the wider community, all of whom have, or represent, values that often conflict.
Horst Rittel refers to design problems as “wicked problems”:

\[\ldots \text{a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing (quoted in Buchanan 1992, p. 15).}\]

These problems differ from the problems generally faced by scientists and engineers.

The problems that scientists and engineers have usually focused upon are mostly “tame” or “benign” ones. As an example, consider a problem of mathematics, such as solving an equation; or the task of an organic chemist in analyzing the structure of some unknown compound; or that of a chessplayer attempting to accomplish checkmate in five moves. For each the mission is clear. It is clear, in turn, whether or not the problems have been solved.

Wicked problems, in contrast, have neither of these clarifying traits (Rittel & Webber 1973, P. 160).

One of the distinguishing features of wicked problems is that their subject matter is potentially universal in scope. Therefore some strategy must be employed for making the problem ‘manageable’. When faced with a new design problem, designers draw on their store of images to identify or recognise key features of this situation and to determine what portion of their knowledge is likely to be pertinent to it. This knowledge can be thought of as a “frame”; a term used in various branches of the cognitive sciences as well as design.

Donald Schön maintains that the process of framing or defining the problem is part of the artistry displayed by competent practitioners.

Skilful practitioners learn to conduct frame experiments in which they impose a kind of coherence on messy situations and thereby discover consequences and implications of their chosen frames. From time to time, their efforts to give order to a situation provoke unexpected outcomes – “back talk” that gives the situation a new meaning. They listen and reframe the problem. It is this ensemble of problem framing, on-the-spot experiment, detection of consequences and implications, back talk and response to back talk, that constitutes a reflective conversation with the materials of a situation – the designlike artistry of professional practice (Schön 1987, pp. 157-158).

An architect embarks on a design project “with a store of knowledge about what has lead up to it, what is going on and why, and what his or her role is to be in the proceedings” (Beach 1990, p. 51). The new situation will have certain features:

\[\ldots \text{some of which derive from the knowledge the [architect] brings to it and some of which are unique to the moment. These features are the cues the [architect] uses to frame the context (Beach 1990, p. 51).}\]

Architects probe their memories for portions of their knowledge with similar features in order to recognise or identify aspects of the new situation. In the case of architects designing housing a portion of their knowledge will involve images of what they believe to be true regarding the environmental aspects of house design. These images of ‘what is’ are derived from the architects’ experiences of, and ideas about, environmental issues, housing, the role of the architect and the nature of design in Australia. They will be an important determinant of how the architects frame the contexts of the new project. In turn, this framing will influence what actions and outcomes are considered possible, necessary or appropriate.
Contexts and frames are not static. New ideas and information will influence the way issues are framed. For example, ideas about housing that is ‘good for the environment’ have changed over the years. Once this concept suggested a house that was *suitable* for the environment — one that would adequately protect the inhabitants from the climate. More recently it is ‘the environment’ that has been seen as needing protection (Shove 1995). Determining whether a house is ‘good for the environment’ involves considering the impact on ‘the environment’ of the construction and operation of the house. Similarly, findings in other fields have influenced ideas related to house design. For example, ecologists’ concerns regarding decline in biodiversity have alerted architects to the implications of specifying rainforest timbers in house construction. Work done by physicists, biochemists and geographers on the relationship between so-called greenhouse gases and the potential for global climate change is leading to a re-examination of energy use in housing. Health professionals investigating the increasing incidence of childhood asthma have alerted designers to the health problems associated with the use of some common building materials and indoor air quality.

Contexts also change during the design process as the designer and clients’ ideas develop and as the project moves from sketch design, through design development to the supervision of construction and completion. As the contexts change, frames need to be updated accordingly (Beach 1990, p. 53). The dynamic, sense-making nature of this process has been represented in terms of story-making in relation to decision-making (Beach 1990) and, in relation to design, of reflective conversation (Schön 1987) and argument (Buchanan 1992; Arnheim 1993).

Beach maintains that:

...the knowledge (image constituents) that constitutes a frame is largely represented in the form of stories, however fragmentary, and that it is this quality that gives continuity and meaning to the events that occur in that frame (Beach 1990, p. 22).

The decision-maker’s knowledge of the conventions of stories (plots, contexts, aims, characters, etc.) and knowledge of similar situations (for example, the design of a house) allows them to deal with scant information initially and to assess what other material is needed to give ‘the story’ completeness, continuity and plausibility (Pennington & Hastie 1988). Thus an architect will have an image of ‘the story’ of the design project he or she is about to undertake. This image enables an appreciation of the various aspects of the project and suggests where there may be ‘gaps’ in the story and where he or she is likely to have to draw on design advice to clarify issues. Most importantly, it provides a frame within which the architect can project into the future and imagine what could be.

*Forecasting the future usually consists of extrapolating the past and present to construct a plausible story about the future in which the [architect] is an active participant – a pretend-like, active, version of the story that constitutes the frame of the context* (Beach 1990, p. 38).
2.4.2 Conversation and communication

The metaphors of conversation, argument and story-telling highlight the importance of the dialogic nature of the practice of design. John Forester maintains that design can be thought of as a process of “making sense together” (quoted in Fleming 1996).

David Fleming argues that:

... social relations and physical artefacts in design cannot be accounted for in essentialist terms, ... such things are neither given nor objectively ‘out there’, available to all concerned. Rather, these phenomena are worked out in the practical and social action constituting design itself (Fleming 1998, p.157).

Although individuals frame contexts differently according to their knowledge, position and world-views there is usually a shared repertoire of images that enables the communication of ideas. Shared images are important when discussing issues that may have various meanings or that are vague or inherently subjective as is the case with many of the terms arising in the design of a house (for example, environmentally sensitive, comfortable, modern, grand). Downing (1994) outlines the importance of images in the initial phases of the design process when an architect is trying to determine the clients’ wishes. This period of discussion, of drawing out ideas, is a definition-seeking process that she likens to the way “a doctor probes a patient’s history and body to reach a diagnosis” (Downing 1994, p. 237).

All participants in the design process bring their specific experiences with them to formulate a collective understanding of what is wanted. The designer often reformulates information gathered from his or her own mental images that in some way displays kinship to what the client describes as a needed feature, feeling or experience. Mental images can present a variation on themes – intellectual, emotional, or experiential – where a kernel of essential meaning is understood by all parties but is coloured differently by each participant’s own filters (Downing 1994, p. 237).

Public images are also important in this process. For example, discussions about comfort may involve the client’s and architect’s ideas about what this term means to them affectively, spatially or formally based on their own experiences. They may also be influenced by public images of comfort promoted through the media in advertisements for such things as air-conditioning, carpet, and furnishings, or through articles about particular houses. Discussions about the environmental aspects of house design will be influenced by public images of the nature of these issues and of how they should be addressed.

Often it is only after the architect has presented initial sketches that ideas start to be clarified. “After seeing what is possible, what is desired becomes clearer” (Downing 1994, p. 236). Peter Bosselmann maintains that for designers the relationship between visual perception and representational images is “necessary and intimate . . . Their representations capture elements of reality for manipulation (that is, design) and for presentation to others as a substitute for reality” (Bosselmann 1998, p. xiv). Through the representation of ideas verbally and visually the initial ideas gradually take on form.
As designers rehearse with clients the physical, experiential, and emotive possibilities of a future place, both parties become more adept at seeing the consequences of paper architecture (Downing 1994, p. 237).

Goldschmidt (1991) refers to creative design as the interaction of arguments and moves; the arguments being the labours of the designer’s mind and the moves being the physical motions (for example, sketches) engendered by the arguments. Thus the architect’s moves produce the drawings that in turn feed the arguments. Drawings provide a reflection of the mental image.

By making a sketch, the designer supplies the mental image with the assistance of an optical image, which has all the properties of such visual precepts. It is as tangibly concrete as all other things exposed to the eyes. Even when left vague, it shows that vagueness with a desirable precision. It persists objectively, while mental images are dependent on the wilfulness of the mind, which makes them come and go. Although the sketch stands for a passing stage of the design process, it stops that process and makes the designer examine at leisure what has been done and in what direction further work must proceed (Arnheim 1993, p. 72).

Downing maintains that mental images can provide the raw data for conjectures in design. These images:

... are aligned to the project at hand through two types of referential comparisons, prototypical and precedential. These referents become constructions through which the designer imagines and manipulates the design of a future place (Downing 1994, p. 234).

She states that innovation in design occurs through the use of analogous thinking (where the things compared are more similar than dissimilar) or metaphoric thinking (the things compared are more dissimilar than similar). These images are used as precedent, metaphor or exemplar during the development of the design.

2.4.3 Decision-making

The importance of images lies in their connection to understanding and behaviour. Boulding (1961) discusses the relationship between information, image and behaviour in individuals and organisations. He maintains that the behaviour of an individual depends on the image that the individual has of the world and the way it works. This image enables action. The image may alter under the influence of new information and the individual’s behaviour will change accordingly.

For example, when a person is contemplating the best route to take to a new restaurant, spatial aspects may dominate the image that an individual has of his or her city. However, this spatial image may also involve a temporal aspect: some image of how long it will take to get to the restaurant based on previous experiences of similar journeys. The temporal aspect may be tied to knowledge of what the traffic is like at that time in that place. This in turn may be affected by ideas about what the weather will be like. The image leads to expectations that influence the behaviour of the individual. If, however, a weather bulletin announces the possibility of a hailstorm this message is likely to affect the individual’s image of how best to
get to the restaurant and how long it will take, not to mention what the journey will feel like. He or she is likely to change his or her behaviour as a consequence.

Boulding’s work appears to have been influential in a number of spheres. It is cited, shortly after its initial publication, by architectural theorists interested in urban design issues (Lynch 1960; Rapoport 1969). In a later work Rapoport refers extensively to Boulding’s concept of ‘image’ and its importance for “linking people and environment and affecting behaviour” although he goes on to say that “[i]n effect the image model is still incomplete because there is a gap between image and action” (Rapoport 1977, p. 45). Behavioural scientists Miller, Galanter and Prihham (1960) attempted to extend Boulding’s ideas by developing a “Plan” for the use of images partially based on the emerging field of cybernetics. Although their work ultimately was viewed as unsuccessful, it is claimed as the “immediate ancestor” by Beach for his theory of decision-making based on images (1990).

Image theory views the decision maker as possessing three distinct but related images, each of which comprise a particular part of his or her decision-related knowledge. One image defines how events should transpire in light of the decision maker’s values, morals, ethics and so on. The second image is about the kinds of changes the decision maker wants for himself, herself, or the organization – an agenda of goals and related time-lines for accomplishing them. The third image consists of the plans the decision maker has for accomplishing those goals as well as the decision maker’s projections of the effects of implementing the plans in terms of the chances of successfully attaining the goals (Beach 1990, p. 3-4).

Images derived from memory, such as those related to places described by Downing above (2.3.1), provide a source of architecture-focussed information about how the world works that is useful for design. However, design involves more than images of what has been before: it also involves ideas about what could, or should, happen in the future. Without being able to conceptualise in the abstract and to envision the future, design may not occur at all. Images are important for visualising the end-product, the process of getting there and connections between the two, whether this end product is a well-designed house or a future better world. These issues are reflected in the value, trajectory and strategic images of Beach’s theory that together form an important source of images of ‘what should be’.

Value images

The values that an individual has will influence how problems are framed, what sort of goals are considered important and what sorts of strategies are considered appropriate for achieving these goals. Beach defines the value image as the individual’s:

... prescriptive and proscriptive values, standards, ideals, precepts, beliefs, morals, and ethics which collectively are called principles. These are imperatives that serve as rigid guides for establishing the ‘rightness’ or ‘wrongness’ of any particular decision. Principles govern the adoption or rejection of goals as well as the choice of action for achieving these goals (Beach 1990, p. 6).

Principles are acquired in childhood through early experiences of interaction with the family and other people. “Parents, teachers, peers, and the media all provide instruction about which
principles are to be adopted and which are not” (Beach 1990, p. 42). Beach maintains that principles are similar to beliefs and that not all beliefs are of equal importance to the individual. Beliefs “vary along a central-peripheral dimension” (Rokeach 1968, p. 3). Some may be trivial and arbitrary while other, central beliefs, involve basic ideas about the self and the world, right and wrong. The more central a belief the more it is likely to have implications for other beliefs and the more resistant to change it is.

The values of individuals and groups are an important aspect of issues to do with the environment.

When we talk about the environmental problem, we are talking about the total state of the world and evaluating it from the point of view of human values. We are not talking about the nonhuman part of the system and evaluating it by its own values, because it does not have any (Boulding 1978, 33).

Environmental issues often involve central beliefs about such questions as humankind’s relationship to nature, the taking of life, justice and equity. It is no surprise then that many people feel passionate about environmental issues, and some are willing to fight, be gaoled or even die for their beliefs.

Values are important in the debate about the environment not because some value or other in itself can or should be described as ‘right’ or ‘wrong’, but because value systems refer to underlying principles about the ‘proper conduct’ of life in general and about ways of interpreting specific events in terms of more extensive commitments to particular social arrangements and political orders (O’Brien and Guerrier 1995, p. xiv).

Attitudes to the environment cover a range of views from utilitarian concerns about current human interests (or the interests of a particular group of people), to concerns about future human interests, and for other living creatures and natural systems. A number of writers have attempted to describe a spectrum of so-called environmental values (see for example, Pepper 1984; Harding 1998). A common starting point is the division between the broad categories of technocentric and ecocentric environmentalism described by Timothy O’Riordan (1981).

Technocentrists believe that science and technology can provide the solutions to environmental problems and, critically, think that economic priorities can be meshed with environmental objectives (Pepper quoted in Guy & Farmer 1999, p. 7).

The technocentric approach is characterised by the belief that modern industrial processes and development are necessary, that the overall objective of maximising profits is valid and that in most cases the free market and emerging technologies will be capable of fixing up any resulting environmental degradation (with the occasional need for regulation). The natural environment is recognised for its instrumental value for humans (an anthropocentric view). Variations in this approach are recognisable with some technocentrists believing that resource exploitation and economic growth can continue only as long as appropriate mechanisms (such as taxes, fees, standards) are put in place. A feature of a technocentric approach is that utilitarian economic concerns would take priority in cases where a conflict between economic and environmental aims cannot be resolved.
Ecocentric environmentalism, on the other hand is characterised by a belief in the intrinsic value of nature and that non-human species and nature itself have moral rights. Within the ecocentric realm many believe in zero economic growth and zero population growth and have a preservationist rather than conservationist attitude to resources. They value self reliance, local and community identity, and small scale development, and place primary value on the whole ecosystem rather than the components. Many of these traits are also evident in deep ecology although here there is a greater belief in ecological and other natural laws and the moral rights of nature.

This deliberately simplified overview of environmental ideologies is presented to illustrate the range of attitudes to environmental issues. In real life individuals (and groups) may exhibit aspects of more than one of these ideologies. Further divisions may occur along political or spiritual grounds or around specific issues. The values held by different groups or individuals may conflict. For example, in Australia there are many recent examples of environmental confrontations that have arisen because the values of an organisation conflict with those of other groups or individuals (for example, the flooding of Lake Pedder in Tasmania, uranium mining in Kakadu National Park, the logging of old growth forests for wood chipping). The differing values of architects and their clients may affect their attitudes to aspects of design such as security, climate control, the relationship of internal to external spaces and even the size of housing. People’s professed normative stance may differ from what happens in practice. For example, an architect may believe that it is important to address global environmental problems such as the production of greenhouse gases but may not exhibit these values in practice for a number of reasons ranging from the attitudes of his or her clients to the conventional nature of the existing status quo regarding power supplies, development policies and construction practices.

Values are an important consideration in the environmental aspects of house design. Both design and ‘the environment’ involve fundamental beliefs about what is right and wrong and what sort of future there should be. The values of designers and their clients will determine those environmental and design issues considered during the design process, and the goals that are deemed desirable, as well as how one issue is rated against another, how outcomes are evaluated and even how the design process is conducted. The expression of the values of designers and their clients is a fundamental aspect of the process of the design of a house.

Trajectory image

Beach defines the trajectory image as “the agenda of goals that the decision-maker has decided to adopt and pursue” (Beach 1990, p. 28).

Goals can be concrete, specific events, such as getting a particular job. They can also be abstract states, such as being a success in one’s field or being happy. Knowing when concrete goals have been attained is fairly straightforward. Knowing when abstract goals have been attained is less clear (Beach 1990, p. 6).
Goals are influenced by the values held by those setting them. Environmental goals can be expressed in many ways. They may be phrased in somewhat vague and contentious terms such as the desire to ‘heal the earth’. They may be related to a product, such as an ‘energy-efficient house’ or described in terms of a process or way of doing things. Environmental goals commonly associated with the built environment include efficiency (energy and water), conservation of resources, maintenance of biodiversity, health, comfort and equity. These goals may be combined under the over-arching concern of sustainability.

Arnheim (1993) maintains that in the early stages of the design process a guiding or goal image emerges; an image of what should or could be. This image “manifests itself at some degree of abstraction” and remains tentative and vague as long as it is developing. This allows for the emergence of a range of possibilities, variations, distortions and even quite radical changes of direction. As the design unfolds in the designer’s mind it is referred to the goal image. The goal image may be intellectual; Arnheim gives the example of the desire for the final design to be hierarchically structured. He notes, however, that:

... because all abstract thinking relies on some perceptual referent, even the most abstract theme is tied from the beginning to concrete images. These images supply the designer with the primary nucleus from which the actual structure develops (Arnheim 1993, p.71).

**Strategic image**

*The plans that are the constituents of the strategic image are adopted to achieve the goals on the trajectory image* (Beach 1990, p. 30).

Environmental strategies are the means by which the environmental goals or ends are to be achieved. The strategies adopted or proposed will depend on the values and role of the decision-maker and the contexts within which he or she is operating. For example, the strategies that a policy-maker may consider to address the goal of energy conservation could encompass such mechanisms as taxes, incentives, standards and regulations. Addressing the same goal, an architect designing a house may consider the use of natural ventilation and solar gain to reduce the need for heating and cooling energy, or reducing the size of the building, incorporating renewable energy systems or the use of energy-efficient appliances. Often policy and regulation documents concentrate on strategies and do not state explicitly the environmental goals that they are intended to address.

**2.5 Discussion**

The preceding section outlines the importance of images during the design process for framing problems, communicating ideas and making decisions during design. The concept of images is a valuable ‘tool’ for understanding the way designers consider environmental issues during the design process. Both design and ‘the environment’ are potentially infinite in scope, they are culturally and socially determined and they involve many unknowns and inter-related issues. ‘Objective’ techniques for defining the scope of these issues during a design project are inadequate for dealing with these qualities.
On the other hand images are able to define the scope of a design problem in a way that allows an appreciation of the various, inter-related aspects of the problem and accounts for the many contextual issues relevant to a particular situation. The subjective nature of images also accommodates the values of the participants of the design process in a way that many other techniques cannot. Design and ‘the environment’ involve issues that people often have idiosyncratic and deeply felt beliefs about and that may have implications for individuals and for the wider society. Acknowledging the values of the participants of the design process is essential for understanding how environmental issues are considered in design.

Images drawn from memory of ‘what is’ and images of what ought to happen in the future (‘what should be’) are vital aspects of framing problems, establishing goals and communicating ideas about the environmental aspects of house design. These processes are coincidental and emergent: as a design proceeds goals are refined or new goals emerge, these are represented and communicated, and contexts are reframed.

2.6 Summary

This chapter begins outlines the ways that authors from various fields describe images. It introduces the idea of images as subjective knowledge based on an individual’s beliefs, values and experiences, and their emotional and sensory responses to the world. Some underlying qualities of images are identified: they are multi-faceted, the pictorial or visual component is important, and they have a strong connection with memory. The idea of public or shared images is explored using the example of images associated with ‘the environment’. Two images of the environment are considered in detail: that of the ‘global environment’ and the environment as ‘fields of significance’.

This chapter draws on a variety of sources to develop a description of the ways that images are used in the consideration of environmental issues in house design. The role of images in the design process is described by supplementing Boulding’s study of images and behaviour (1961) and Beach’s image theory of decision-making (1990) with references to writers from design fields. The importance of images for framing design situations, communicating and representing ideas and for making decisions is highlighted. Sources of images related to ideas of ‘what is’ and ‘what should be’ are outlined. It is suggested that the ability to link images together in a story-like way allows an appreciation of the various inter-related aspects of a design situation. This can reveal to the designer where there may be gaps in his or her knowledge. It is also an important device for developing ideas of ‘what should be’.

In this thesis the term, image, is used in Boulding’s sense of subjective knowledge. Where a reference is made to an image that is specifically a visual image or graphical representation these terms are employed. Beach’s concepts of value, trajectory and strategic images are used in the following chapters although ‘trajectory’ is replaced with ‘goal’; a term that is more familiar in the design field.
3. Four ‘framings’

3.1 Introduction

This chapter describes the interviews conducted with ten architects that form the basis of this thesis. During the interviews the architects were asked to describe a house or other small building that they had designed. The interviews were intended to identify and explore the issues that these architects deemed to be important during the design of a house, and to determine the way they thought about and incorporated environmental issues into the design. This Chapter begins by describing the interview process and then presents extracts from four of the interviews. These extracts illustrate the inter-related nature of the issues discussed and highlight the role of images in this process.

3.2 The interviews

One interview was conducted with each of the architects. The technique adopted was that of a long qualitative interview where the intention is to understand an issue in depth rather than to determine how many or what kinds of people hold certain views (McCracken 1988).

3.2.1 Interview participants

Participants were sought who had a body of work in residential design and who were identified by themselves or others as interested in environmental issues. Names of potential interviewees were gathered through a number of sources. The author already knew the work of some of the architects either first-hand or through local publications. The South Australian branch of the Royal Australian Institute of Architects was asked to suggest names and as architects were contacted they were asked to suggest names of other likely participants.

All except one of the architects work in the state of South Australia either as a sole practitioner or with a small number of associates rather than for a large firm. A recent graduate who has worked for a small firm and been involved with house design was also interviewed. The age and experience of the participants varied: the youngest was in her late twenties and the oldest graduated in 1969. Although they were all educated in Adelaide and most of them work there, the architects were not particularly familiar with each other. At the time of the interviews, most of the architects did not know more than one or two of the other interviewees and in some cases they only knew any of the others by reputation.
Several of the architects are publicly identified as having an interest in environmental issues with clients who seek them out for this reason. One has a particular interest in healthy buildings and another in remote area power supply. The others, whilst obviously interested in general environmental ideas, did not see themselves, or believe that they were seen by others, as particularly identified with environmental concerns.

3.2.2 Interview process

Two blocks of interviews were conducted. After the initial series of interviews, the results were analysed and several themes and issues were identified that were given more focus in the second set of interviews. The format for both sets of interviews was similar. The interviews were conducted in the architect's studios and lasted between one and two hours. They were recorded with a cassette tape recorder and the tapes later transcribed. On initial contact the respondents were asked if they were interested in talking for approximately one hour about issues they consider when designing housing – particularly those issues that relate to "the environment". This term was deliberately left vague to avoid limiting the discussion. It was also hoped that the interviews would reveal the sorts of issues the interviewees associated with this term.

The interviews were loosely structured, starting with questions about the respondent’s background, architectural education and where his or her interest in "these things" stemmed from. The interview concluded with another question about "why these things are important to you". The bulk of the interview involved the architect describing a design. All the participants were asked to talk about a house although two of them preferred to discuss a different form of residential building – in one case an extension to a hotel consisting of a residential wing and in the other a small community development that incorporates accommodation. However, in both these cases it was decided that the particular examples were interesting for their locations – one is in outback South Australia and the other is in the tropics. Also both these examples have many similarities with housing: the scale is not much larger than domestic, accommodation is an important aspect of the design and the clients were individuals who were intending to live in the building at least part-time. Two other interviewees spoke about house extensions rather than the design of a whole house. During the interviews most participants described aspects of more than one building, often referring to other schemes to illustrate a particular point. In all except one case the designs were discussed over drawings and photos. The exception was someone who talked about the house he lives in, that he designed and in which the interview was conducted.

Many of the buildings described by the architects may not necessarily be publicly connected with 'environmental' concerns although it is likely that they would be identified as representing 'good design'. Evaluation of the buildings is not the aim of this thesis, rather the intention is to explore the architects' images of environmental issues involved in the practice of house design. It was presumed however that the architects would choose to
describe designs that they were proud of and that they considered to be good examples of how they address environmental issues in practice. Therefore the images associated with these designs are likely to have proved useful for the architects during the design process.

All the architects interviewed were very generous with their time. Most of them talked for longer than originally arranged and several commented that they enjoyed the opportunity to reflect on the process of designing. All the interviewees veered on to other subjects and one or two of the architects spent more time reflecting on related issues than describing an actual design. This was not detrimental to the overall aim of the interviews and some perceptive and pertinent points were raised in these discussions. Each interview was unique because the individuals involved are very different, the process of design so personal and many of the people interviewed feel passionately about design and/or the environment.

Drawings of the buildings discussed are not included in this thesis as it is considered that they would inhibit the imaginative reading of the architects’ stories. Illustrations would ‘define’ the buildings in a way that demands less involvement on the part of the readers than if they are required to draw on their own images of houses, dwelling, design and environment to create mental pictures of the houses described. Commenting on the lack of illustrations accompanying Vitruvius’s discussion of the origin of dwelling, author Dripps says:

If we try to picture the Vitruvian hut, an image arises new to us each time we summon it to mind. Compared to the many huts already rendered complete through illustration (thereby demanding little involvement on our part), an image that can only be recovered through our imagination is much more persuasive. The Vitruvian image becomes more compelling precisely because its sketchiness requires us to fill in what is missing. We participate in an imaginative reconstruction combining the particulars of our own lives and accumulated experience with the ideal state of his universal, unchanging tale (Dripps 1997, p. 12).

Many of the issues raised during the interviews were of a sensitive nature, relating to past and current projects, clients, financial issues and other professionals; therefore the interviewees were guaranteed anonymity. In the following Chapters they have been assigned pseudonyms and locations have been given fictitious names. Comments have been recorded verbatim except for minor corrections such as the elimination of repeated words (and aahs and ums, etc.) for clarity. Words in square brackets have been added by the author for clarification. Ellipses indicate material left out and underlining indicates emphasis of interviewees.

This section contains extended extracts from four of the interviews. These are intended to give an overall sense of the issues considered during the design process.
3.3 Seaside “dream house”

Michael discussed a house he designed on the outskirts of a seaside country town for a young couple who have lived in the area for some time; an art teacher who enjoys surfing and his partner, a nurse. The site is approximately 0.4 hectares of flat land, formerly part of a larger wheat-growing property, that is separated from the beach by a small cliff. Views are to the east over the sea with a lighthouse on some submerged rocks in the far distance. Farmland bordering the township is gradually being divided into small allotments and developed for housing. Much of the newer development in the area is conventional tiled-roof, brick veneer, project-type home construction common throughout South Australia and, with minor variations, Australia.

The clients were keen to have an active role in the building process – sub-contracting the work and in some cases acting as labourers for contractors or undertaking the work themselves. The design that evolved is a distinctive play of curved corrugated iron roof forms floating above rammed earth and corrugated iron walls. Michael said, “I guess they wanted to build a dream house.”

HELEN: Did they have ideas of what they wanted visually?

MICHAEL: No, I don’t think so at all. I don’t think there was any sort of preconception there.

HELEN: So what sort of brief did they give you? Was it to do with spatial relationships and numbers of rooms?

MICHAEL: Ah, well I guess it covered those. But I guess I tended to focus more on qualities which are actually useful, rather than quantitative stuff. So I think there was a clear desire for thermal qualities or passive solar qualities, obviously the view, landscape integration.

HELEN: . . . What do you think drove that [interest in thermal issues]?

MICHAEL: I think there was an awareness of the issues. I wouldn’t have thought it was particularly economically driven for example. They were living in a traditional cottage, cold.

HELEN: Some of it was a reaction to that?

MICHAEL: Yeah, I think so and I guess it was also a reaction to the sort of building that was happening around them.

Michael initially presented the clients with two designs. Of the two designs one reflected many aspects of a typical solar-efficient design (see 7.4.1): a long, thin building with living areas to the north. In the other design, the form was ‘broken’ into smaller units, and each section had a curved corrugated iron roof.

MICHAEL: [Of the two designs] one I guess is the standard linear building with the long axis east-west; kitchen and family and meals and living spaces to the north, bedrooms strung out behind there. And the southern half of the building lit by a clerestory to bring winter sun into both sides of the house. But essentially conventional in planning. And the other was exploring a much . . . stronger set of ideas.
The clients “were quite clear about going with the more adventurous floor plan”. When questioned about why he thought they choose this rather than the more conventional design Michael said:

MICHAEL: Well I guess in a sense they’ve lived in houses which have just been there I suppose and . . . and they obviously wanted to do something more than just create another series of boxes. So I guess at the beginning there was a definite desire to do something creative, something expressive and I would have thought that would have moderated their choices or in a sense determined those choices.

Although the clients did not have preconceptions about how the house would look, it is clear that what the house represented was important to them. This design is strongly influenced by the clients’ image of what they did not want the house to be: they did not want it to be conventional, they did not want it to be like the project-type houses around them. This image appears to have influenced their initial choice of the less conventional plan and later influenced material choices and constructional techniques. Incongruously, project housing is often marketed in terms of “the dream home” connected as it is with images of suburbia, stability and ‘the great Australian dream’. These clients had another image of their own dream home that influenced the form, layout and materials of the final design and was reflected in their desire to be owner-builders. They evaluated the emerging design in terms of this goal image and they were able to use their images of what they did not want to help guide their evaluation of the ‘look’ of the emerging design. The initial choice between two designs saw them choose the one that is visibly most different from conventional housing: with curved rooves, rammed earth walls and a more articulated form.

3.3.1 “Little cells of rammed earth”

Michael said of this design:

MICHAEL: [The] architectural concept is to build little cells of rammed earth – rectangular boxes for each function and to spread them out across the site.

The approach was inspired by traditional stone buildings in the area as well as a desire to get views from as many rooms as possible and to provide a sense of enclosure. The use of rammed earth as a building material provided a visual connection with the old limestone rubble walls in the area and this connection was also reflected in formal and structural considerations. The central image of little cells of rammed earth also suggested a predisposition to ways of dealing with certain environmental issues. Part of the motivation behind the ‘cellular’ layout related to views, sunlight and ventilation.

MICHAEL: So we end up with a plan where all but one of the enclosed spaces has a view through to the beach, to the coast. There are north facing lights on all of those rooms, so virtually every space has got access to northern sun even though the building is elongated north – south . . . Cross ventilation has been planned in each room with upper level opening windows and south facing conventional ones.
3.3.2 “Not just bricks out of an oven”

The floors are concrete slab-on-ground and most internal walls are rammed earth. The clients’ interest in using rammed earth as a building material appears to be connected to the desire to create a house that is noticeably unconventional in the context of the surrounding development, although from Michael’s comments this matter was not discussed explicitly.

HELEN: Were they interested in [rammed earth] from an environmental point of view or the way it looked or because it was solid . . .

MICHAEL: I couldn’t say. I would have thought visually the appearance would have been an important factor. Perhaps also because of in a sense what it isn’t; it’s not conventional, not just bricks out of an oven.

It appears that the clients had not seen a rammed earth building before beginning the design process but they obviously had strong ideas about what this material represented. Earth is an elemental material, there is a general belief that, as a building material, it is ‘good for the environment’ (Bennetts 1998a) and, in the context of the project-home development common in this area, it is an unconventional material.

In this case the image that the clients had of the building material had many aspects to it: some based on ‘facts’, and others that had sprung from emotive associations, but all of these aspects corresponded with their image of what the final design should be like.

3.3.3 Thermal and lighting strategies

Michael’s knowledge of the properties of rammed earth lead to the thermal and aesthetic strategy of combining lightweight and massive constructions.

MICHAEL: One of the thermal ideas was to use the lightweight walling to wrap around and enclose at least part of the external walls of the rammed earth because of their poor insulation value . . .

. . . so on the west side and on the south we have just small openings in the rammed earth and the rest of it is protected or enclosed by lightweight construction – wardrobes, pantries, bathrooms, laundry, that sort of thing . . .

. . . those early options even at that early stage had the rammed earth, the solid masonry and the lightweight, the contrast of the two. Where that idea came from I’m not sure but certainly it’s an idea that I’ve been pursuing for a while.

However, Michael did not see thermal considerations dictating the design.

MICHAEL: Some solar designs the whole lot hinges around this technical stuff of providing this north facing panels and so on. Which I think, in a sense, is just going too far, making that too dominant.

HELEN: This design is clearly expressing other aspects of solar design in the opening up to the north and the play of light and heavyweight materials.
MICHAEL: That’s right and the cross ventilation. High and low lighting, high level lighting, low level lighting. I think there’s a more basic level where I think a connection between the kind of thermal mass of these rooms and traditional construction gives that sort of sense of enclosure which these spaces clearly do. It’s working more on that aesthetic or emotional response. . . In a way its like having some of those qualities of enclosure of the traditional cottage but having the benefits of the light and the passive solar which is usually mutually exclusive. So I think we were able to make a compromise.

The architect brought strong ideas of how this house should function in relation to heating, lighting, ventilation and views. The thermal approach taken shows the influence of the solar-efficient model (see 7.4.1) through its use of the northern orientation for solar gain and massive materials for heat storage although other aspects of the usual ‘prescriptive rules’ for solar-efficient design are not followed. For example the prototypical solar-efficient house is rectangular – many design guides specify that proportions should be 1.5:1 – and zoned with living areas to the north and bedrooms and utilities to the south. In Michael’s design this concept of thermal zoning is not used, rather the plan and form are broken up with the aim of getting the thermal benefits and view to virtually every space.

Similarly the usual rule-of-thumb that there should be minimal windows to the east and west is not followed. The main view is to the east and there is also a desire to get balanced lighting. As well as windows to the north this design has windows in other directions to achieve balanced lighting and take advantage of the views.

MICHAEL: The other thing I guess this has done is provide very balanced lighting in all those spaces. So every space has windows on at least two directions as well as the high-level, north-facing skylight . . . I’ve got a concern to avoid the sort of high glare situation that you often get with north facing windows and no balancing lighting.

This design shows the interplay between a basic understanding of the principles of solar-efficient design and the particularities of site, clients’ and the architect’s interests. In this case the thermal aims are balanced by others to do with views and form. Rather than using the solar-efficient model in an instrumental way it has become a conceptual tool: an image that can be manipulated and adapted for this particular design.

3.3.4 “Waves” and “dunes”

Michael was questioned about what he thought the clients meant when they referred to a “dream home”.

HELEN: You were saying that . . . this was their image of a dream home? What do you think they wanted from that?

MICHAEL: Well, I think they wanted a house that was expressive.

HELEN: Expressive of them?

MICHAEL: I guess personality but also of site. So the wave shape of the roof or the sand dune or the curve shape of the roof was appealing.
Although most of the discussion in this interview centred around affective and emotive aspects of the design it was apparent that the visual aspect of the clients’ image of their dream home was also important. The external form of the building provides a reference to its beach-side site. The materials and form of the house reflect a connection to ‘traditional’ construction materials and techniques used in the area but at the same time create an image that indicates that this house is ‘personalised’ – designed for these particular clients and this particular site.

As pointed out in Chapter 2, the clients’ image of what they want from their future house is often vague, particularly in the early stages of design. In this case the design process involved the architect interpreting the clients’ image of a dream home and realising it in formal and constructional terms. The design was evaluated in terms of a consensual feeling of what was right and appropriate for this particular context.

3.3.5 Environmental issues as design generators

HELEN: Can you tell me why these issues are important to you?

MICHAEL: To me as an architect, these issues are important generators of design and important ways of locating a building in relation to a site. They are fairly fundamental organising principles for the design concept. But also they provide integral qualities to the space; qualities of light and qualities of the ‘feel’ of a space.

3.4 Sitting lightly

A very different conceptual approach is taken in the house discussed by Peter. This is a lightweight, elevated house designed for a sloping site of approximately 0.8 hectares in one of the foothills suburbs of Adelaide. A conservation park with large eucalyptus trees is on the eastern boundary and there are views to the west of the city. The site is at the end of a cul-de-sac and the surrounding houses are of tiled roof, brick construction dating back to the 1950s and 1960s.

The design was undertaken through Archicentre, a design service offered by the South Australian Chapter of the Royal Australian Institute of Architects. The clients, a young married couple with two children, approached Archicentre and were assigned an architect who it was believed would be sympathetic to them.

Peter’s initial description of the house centred on two aspects; budget and site.

PETER: This is a house at Brownston. It was a low budget house. When they came their budget was initially $70,000 and they had this stunning site at Brownston.
These two concerns were important influences. Peter went on to elaborate:

PETER: They wanted to build something that would suit the site because they knew the site was too special to mess up with an ordinary house. But they were concerned about the budget too. They had looked at project homes and they'd found to sit anything on the site would just wreck it by excavating and retaining walls. But they were obviously really concerned about costs.

The initial design ideas developed from the need for these two aspects to operate together — without the constraints of this particular site the image of an affordable house would have been different and conversely a larger budget would have immediately changed the image of what might be appropriate for this site.

In the initial discussions a response to these twin aims was presented to the clients in terms of a solution that encompassed constructional and material aspects and evoked a visual image. This image was distinctly different from the project homes the clients had looked at previously that all involved cut and fill to accommodate concrete slab-on-ground floors and external walls of brick.

PETER: I went to their house, and they took me to the block and took photos and they gave me the brief and we talked for a couple of hours that night. When I was talking to them I said, “You know you’re not going to be able to have the traditional sort of construction. What do you think about a pole frame house to suit the site? Cladding would have to be something economical” . . .

They said, “Something like that interests us. We don’t care what it looks like as long as it’s functional.” I said I think [corrugated steel walling] would probably be the cheapest way to go for wall and roof cladding. They said, well if that’s how it works out that will be fine. When I went back I took some sketches. They really liked it.

Thus from the first meeting the image of a design that would suit the site evolved based on a lightweight structure sitting above the landscape. This incorporated the idea that the site itself would not be ‘damaged’ through extensive siteworks and that the lightweight structure would not be a great ‘burden’ to the site. Siting, and material, constructional, functional, aesthetic and budgetary issues were intertwined in the initial concept and this was refined through the placement of windows and decks and the development of the internal layout.

3.4.1 Sunshine and breezes

Thermal considerations were overlaid on the original ideas and were dictated largely by the lightweight construction. The clients’ thermal concerns related to comfort and cost.

HELEN: They were interested in siting and . . .?

PETER: Yes . . . They wanted the view but they were concerned about the western aspect . . . They didn’t actually say they wanted an energy efficient house but they were concerned about heat loads and they wanted it to be cheap to maintain because they don’t have a huge income.
The walls and ceiling are insulated and care is taken to restrict or shade western openings. A major concern during design was the placement of windows for cross ventilation but this was considered in conjunction with other aspects of window design such as the provision of daylight, framing of views and the need for privacy. Peter said that he and the clients “talked about the glazing in great detail”.

PETER: [indicating the master bedroom on the plan] - either side of the bed you have long louvre windows - Breezeway louvres - and then glazed above so that the room’s quite bright and when you’re in the bedroom you get really good light coming in and with the door and screen door [on the opposite side of the room opening on to the deck] you get good cross ventilation which is . . . something I was concerned about with these materials.

. . .

HELEN: And this looks nice. [Looking at a little ‘bay’ window that projects into the deck area]

PETER: . . . [It] has the blank wall facing west and louvres on each side so you can get ventilation and light but not the heat. You can put the bed into the recess or in this case the desk. They were really quite taken with that idea . . .

[For] these windows we put the louvres in the middle and the fixed glazing at the ends so that if they had window treatment like curtains . . . they can still get breezes in without messing up the curtains. And they really liked that . . .

In the bathroom, there’s a huge gumtree [outside] and there’s a high level louvre above the shower and then it drops down a bit above the bath and when they’re in the shower in the morning and the louvres are open they can see kookaburras just out there.

HELEN: There must be a really nice quality of light in this place.

PETER: That was something that I was working for but they hadn’t actually said they wanted a light, bright house. Living in [my own] house, it’s not a very light house – I really like light.

In this case the architect had an image of the way he wanted the finished building to ‘feel’ for the occupants. His description of the design of the windows indicates that this image incorporated ideas about how the spaces would be used in the future as well a sense of the qualities of natural light, ventilation and thermal comfort and the views that he wanted for the design. Each window was carefully thought about in relation to its immediate surrounds, orientation, and the use of the internal spaces. The considered placement and design of the windows was reflected in the visual appearance of the finished building.

PETER: Every elevation looks totally different.

3.4.2 Environmental delight

Peter maintained that throughout the project the clients’ main concern was the budget however the initial framing of the problem in terms of budget and ‘appropriateness for the site’ developed during the design process to accommodate other environmental concerns. The architect had a sense of the importance, for the design, of views, daylight, ventilation and solar access based on his previous professional and personal experience. However, it appears
that the clients' appreciation of these aspects of the design were fully realised only when the building was complete and they were able to experience them directly.

PETER: And just after they moved in and they were still living in packing cases and they had their mattress on the [floor], one Sunday morning they were reading in bed which was a luxury because they had 3 little kids – they said it was great and the sun was coming through the window and shining on to them on the bed. They said, “Gee thanks Peter you’ve done a great job”. And when they told me, it made me feel really good.

HELEN: Do you think that when they went to you, to an architect, they thought they were going to get . . . something like that, some sort of delight as well as just something for the price?

PETER: No, I think they were really just going for something for the price.

3.4.3 Environmental issues: resources and pleasantness

HELEN: Can you pin down why [these issues] are important to you?

PETER: I guess one of the things is the earth's resources – and the other is just to make the house more pleasant to be in and obviously it's going to be more pleasant to be in if it responds to the climate and the things that are around it. That's how I see it . . .

3.5 “Distinctively modern”

The design that Jane described is an extension to the back of a ‘Californian-style’ bungalow in an inner Adelaide suburb that involved removing a former unsatisfactory lean-to addition, relocating the kitchen, upgrading the existing wet areas and creating an informal living space for the family. The clients are artist/arts administrators and they were interested in doing something ‘very modern’. The architects were interested in the thermal aspects of the design.

JANE: And from our perspective, one of the main starting points was dealing with the fact that the house didn’t have a good orientation and it faced due south. So the back area, which was really the main living area, was very cold and dark and not good from a thermal performance point of view. A lot of the design grew out of trying to compensate for the fact that it did have a south elevation, as pretty much half the houses in Adelaide do with our wonderful grid.

HELEN: Was that something that they came to you with?

JANE: No. They were more interested in ending up with something that was comfortable but also, from their perspective, stylish. They had a strong visual idea of what they wanted. They didn’t have a design but they had an intent or an objective that it was going to end up looking . . .

HELEN: distinctively modern?

JANE: . . . yes distinctively modern.

HELEN: And architect designed?

JANE: Yes. So from that point of view they were ideal clients as opposed to people who want to build reproduction . . . The issue of thermal performance or solar access wasn't something that they identified. That was really as professionals, looking at the building and what the constraints were, that was something that we were able to contribute to the project.
Once again the architect indicates that the clients had a strong initial image of what they wanted from the future design. Rather than being connected to a physical form (for example, that it look like another particular building) this image involved concepts such as ‘modern’. The clients’ image of a modern, architect-designed house would be used to evaluate whether the evolving design satisfied them.

3.5.1 Consideration of thermal issues

As mentioned above one of the driving forces in this design, from the architect’s point of view, was the desire to address thermal issues with a site that faced south.

JANE: There were a number of strategies we could have used I guess. Because of the existing shed in the back yard and the size of the yard we didn’t want to, for instance, build it as a pavilion further down the yard because that would have involved demolition of the shed. We wanted to get northern access and one technique would have been to do the extension as a separate pavilion. But we also wanted to have strong links back to the house so that they used that rather then totally migrating out to the back extension.

What we ended up doing in terms of the roof form, [was] designing a roof that provided minimal overshadowing to the back yard so that we weren’t creating more overshadowing problems by building the extension. The [outside] area that we’re keen to use is probably the area closest to the house and, particularly in winter, if the building ends up overshadowing the whole back yard you’ve really diminished the use of that space on a nice day.

The other main thing we did was develop a roof profile that gave us a skylight to the north which has a substantial overhang on it to cut out summer sun but to let winter sun in. By having that northern skylight we both achieved solar access and it also has the advantage of giving us opportunities for cross ventilation. We had high level windows so that we can promulgate drawing in of cooler air from the south side and exhausting to the north in warm weather. So it gave us a double benefit.

The ceiling-roof profile is one that their firm has used on a number of projects and that Jane described as ‘their’ detail.

JANE: [It] is an upside down roof truss. It is a traditional gang-nailed roof truss that we use upside down so that the ceiling profile has a section that’s flat and then a sloping section and it’s an economical way to achieve the roof profile and you get the interest of the sloping ceiling which gave us the good northern skylight.

This explanation of the reasoning behind the final design shows the interplay of the various issues considered. The guiding image was of how the house would work – in relation to sunshine and breezes, summer and winter, the connection between inside and outside and between the existing house and the extension. The resulting ‘feel’ of the extension is a marked contrast to the old lean-to it replaces and to the existing house.

JANE: From being a really dark, drab back area in the original lean-to our new semi lean-to – it still has the qualities in a way in terms of having the mono-pitched roof – with the extensive glazing, the cafe doors and this continuous skylight which runs basically from one end of the house to the other is very light and bright and very different from the way the old back lean-to used to feel. From our clients’ perspective they’re really delighted with how it works.
Based on their previous experience of the conditions in the old lean-to, the clients insisted on having air-conditioning.

JANE: They wanted to have reverse cycle air conditioning. We just got a console unit. But they found that they really hardly ever needed to use it. We've got ceiling fans to promote circulation so it is there in a worse case scenario but the extension has performed probably better than they expected. They've found that they haven't needed to use the air conditioning as much as they might have anticipated.

HELEN: Did they have air conditioning before?

JANE: No. They didn't. They just knew what the [space] was like and so it was a response to the way [it] performed in the past.

HELEN: Mainly winter?

JANE: Both. It was a lean-to without any insulation . . . So they were used to being out there and, although it faced south, because it had minimal thermal mass and insulation it was just hot and not very pleasant in summer. I think it was the memory of that compared with the older part of the house which has a lot of thermal mass and so had long thermal lag before heating up. So they were concerned about that. And certainly unless you're using active systems of heating you need some kind of winter heating which that provides.

The clients' expectation that they would need air conditioning was based on their previous thermal experiences. Their knowledge did not extend to an intellectual understanding of the interaction between building form, orientation, materials, and heating and cooling plant; they simply equated the desire to feeling thermally comfortable with the need for improved climate control.

The importance of the actual experience of the thermal properties of the space is illustrated by the clients' responses to the new extension. They found they had not needed to use the air conditioning nearly as often as they had anticipated and Jane said this had given them a new understanding of the thermal aspects of design.

JANE: [T]he fact that they don't need to use the air conditioner in the way they thought they would affects the way they use the space. It probably also affects the way they think of their work environment and potentially has some carry-over to people who visit the house. I think it all helps. I think there needs to be lots and lots of work at a whole range of different levels and this is the grass roots kind of level . . .

JANE: This house, you can't describe it as a piece of low energy architecture, but I think its got some strategies in it that improve its thermal performance.

3.5.2 “Cafe culture”

The existing Californian bungalow style house was built in the 1920s and reflects the attitudes to housing and lifestyle of that time. Houses still had formal rooms and visitors were generally excluded from areas such as kitchens. Servants were becoming less common and ‘labour-saving’ devices and innovations such as motor cars, gas stoves, electric lights, telephones and a public sewerage system were becoming more widespread. Architectural historian, Robin Boyd maintains that during the 1920s “[t]he sun was still deliberately avoided” (Boyd 1987, p. 60) and the favoured orientations were south and east.
While appreciating the character of the existing house, the clients obviously felt the need to adapt it to their 1990s lifestyle. One aspect of this concerned the way that the existing house related to its immediate environment.

HELEN: You were saying they wanted something comfortable... JANE: Well I think they wanted something informal as opposed to the more formal areas of the house. The existing house has a strong arts and crafts feel. There’s some very nice fireplaces and timber detailing. They were using what was probably the original formal room as a study and small sitting area and that’s a very nice room and they had a larger room that’s being used as a lounge area. What they wanted was a place for all the family to be in and to be able to have a connection with the back garden, an indoor-outdoor connection. Most houses from that era were orientated only to the street; the backyard was where the toilet was and the wash-house. It wasn’t seen as a valuable living space. This house was wanting to end up with some living space that had that connection to the outside... The creation of informal family-living-kitchen areas has been an important impetus for renovations of older housing in Australia in recent years. These spaces are seen to reflect and support modern family lifestyles that tend to involve less separation between children and adults and between formal and informal living areas than there was in the past. Another contemporary trend in housing in Australia is that of using outdoor space as an extension of the living area. This, too, was less common even two decades ago. In this design an important aspect of realising the connection between indoors and outdoors was the decision to use cafe-style folding, glazed doors. These enable a large area of the room to be completely open to the outdoors thereby enhancing an impression of ‘connection with the environment’. The doors themselves also suggest references to the sort of urban public lifestyle the owners enjoy – a marked contrast to the internal life of the bungalow.

JANE: And one thing that we developed in the design they were really keen about was having what I call cafe doors so that we could open the living room out to the terrace... which is a large slate paved area at floor level. When they open it up they’ve got an extended living area. They can move between those two areas. That was something that they were really keen on. I guess they like the cafe culture of the east end of [the city] and they were quite keen to have that kind of indoor-outdoor feel so that in summer when they’ve got it completely open it has something of that quality – you can almost imagine it set up with lots of chairs and tables.

One of the goal images in this example was that of creating a ‘modern’ or contemporary design. This image has many aspects to it including the importance placed on informal living spaces, the light and airy feel of the design, the indoor-outdoor connection, and the external form and appearance of the building. It is also connected to contemporary cultural ideas about family, living patterns and house styles. Many of these qualities contrast with the existing building and with the lifestyle this form of housing represents. The cafe-style folding, glazed doors and the ability to open the room to the outside are an important aspect of the contemporary image of this design.
3.5.3 Material considerations

Decisions about the external cladding were influenced by the response to, and a desire to contrast with, the existing house that has red brick external walls. Most of the new section is clad with western red cedar weatherboards.

HELEN: Did you talk about a range of materials with the clients?

JANE: Yes. We have used a variety of materials. There is brick matching the original brick on the corner at the rear but wrapping around. That was because we were building on the boundary and we had to achieve a fire rating and it was also a material that was acceptable to the neighbours because they've ended up with that as a boundary wall. So that's brick which is a pressed red brick which was as close as possible to the original pressed red brick on the side of the house.

I guess the main reason for using the western red cedar was the original garage had been re-clad at a certain point in time with western red cedar but not with first grade western red cedar, with unseasoned, rough-sawn which hadn't weathered particularly well. So the starting point for looking at the materials was looking at matching that because we were going to continue using that material. At the end of the day they decided that they didn't like it because it had weathered badly and there were cup boards and split boards and they weren't happy with that and they decided to just re-clad the lot. But they liked the look of the natural timber, they were happy with the appearance with that so that's what we ended up using.

I'm trying to remember what other options we considered. I'm pretty sure we talked about lightweight construction. We've done a lot of buildings that have been clad in corrugated iron so we talked about that. We talked about the brickwork. We were keen though, predominantly, to give this extension a life of its own rather than feeling like it was part of the original house. Now that's not an entirely consistent approach given what we did on the side but that was really more to appease the neighbours than anything else . . .

It was essentially looking at a lightweight construction and the main reason for [that] was initially cost although when you clad it in western red cedar you're not really [saving anything].

This example illustrates the way a decision about an aspect of the design, such as the external wall material, may emerge from a range of considerations with basic principles being applied and then adapted for expediency or to accommodate other factors. In this case there was a desire to contrast the old with the new but also to appease the neighbours, and there was a need to consider costs but provide an acceptable product. The clients liked the look of timber and the architects liked the idea of working with it, in principle, although Jane maintained that their choices were constrained by the lack of information about, and difficulty of accessing, sustainable sources of timber.

The preceding example illustrates the interrelatedness of the issues considered during design. Thermal considerations, siting, the way the house will be used in the future, constructional, formal and aesthetic considerations intertwine. It also illustrates the importance of the relationship between the clients’ and the architect’s images of design that is modern and stylish.
3.5.4 Environmental issues and place

HELEN: Can you explain why environmental issues are important to you . . .

JANE: Our [practice] has a specific interest in regional architecture or architecture that's appropriate to place. That's something that's really interested us in all our buildings. Our buildings tend to all be quite different one project to another rather than stylistically looking like you can look at them and know that that's a building that we did. And one of the key things about place is the environment, the natural climate. So in designing things that are appropriate to a particular place you've got the site and you've got the climate and making a building that works in that place, responding to the climate, is a key part of the design.

And I think that directly links into issues of the environment, so that designing something that is appropriate for that space should be as environmentally responsible as possible and the net benefit of that is I think you end up producing architecture that has a much greater chance of feeling like it belongs . . . So in the same kind of way I guess we're interested in those issues from a design perspective in our architecture and that deals with issues like passive design. I think it also deals with issues like selection of materials, things like collecting rainwater, as soon as you've got lots of rainwater tanks they have an impact on your design and they become a design element. That's the reason.

3.6 Environmental stewardship

Frank choose to talk about the house that he designed and built for himself in dry, mallee country about 60 kilometres from Adelaide. The discussion was held in the main room of the house; a serviceably furnished space that functions as living and working room. Frank was unique among the architects interviewed in that the sort of concerns that dominated the conversation were those previously identified in this thesis as being connected with a ‘global’ view of environmental problems (for example, energy use). Frank has considerable experience with renewable energy systems in his design practice and this was evident in his familiarity with figures related to energy use. This sort of knowledge is relatively uncommon in South Australia where most architects design exclusively for grid-connected dwellings and therefore may never have to calculate energy requirements. Frank identified himself as one of only a few architects working in South Australia who has a “sincere environmental bias”.

FRANK: My focus tends to be very application-orientated. Different architects have different focuses. A lot of them will say, "I want to turn out an immaculate set of drawings". To me the drawings are just a means to an end. If they're on the back of an envelope I don't care. When the job is done the drawings are never looked at again. What I'm interested in is the finished product – working. I'm not particularly perturbed about whether all the detailing is totally neat and tidy or whether the builder got it exactly the way I had it in my head. I don't care as long as they go into the place, the place is comfortable to live in, the services work, the energy demand is down at a level where I want it to be which is usually below 1.5 kWh/day, which is way below conventionality would assure us is practical. So that’s my focus.

3.6.1 Minimal intervention

Frank’s house is small (80m²) with one bedroom, a living/work room, kitchen and bathroom. Constructed of a steel portal frame clad externally with sheet steel it is unprepossessing in appearance and looks more like a utilitarian shed than a house. The
architect’s promotional material states that the design is driven by “functional criteria” rather than public expectations of what residential buildings should look like. One of the design aims was that the house be self-sufficient and “notionally capable of location anywhere”. The house is not connected to the electricity grid and is powered by solar photovoltaics. Rainwater is collected from the roofs.

HELEN: Do you want to talk about this place . . .

FRANK: When I first came here the land had been share farmed and was in very pitiful condition. I knew, therefore, that I had a problem on the site and I needed to live on the land to do the right things in terms of re-vegetation, weed control, bushfire control, all those things. I couldn’t do them remote. So I had to impose myself on the land. I wanted to do that with the absolute minimum of impact even at the stage of building the building. So the strategy was developed to prefabricate off the site, stand the building up from within its own footprint and therefore have no disturbance to the building from the outside walls. I’ve done that now on 3 or 4 projects on some sites which are very sensitive and it’s a very successful approach because what it allows us to do is use hand tools, get the portals and roof up first, get the solar system going and then we have power on-site and we build in underneath the shell we have created.

That has other benefits in that I believe in lightweight structures. I’m not a fan of mass in the climate we are living in. There is a need for some mass and in this building I didn’t have to worry about it because I’ve got a sea-breeze which comes in off the lake in the afternoons . . . All I have to do is keep this place comfortable until 1.30 - 2 o’clock in the afternoon. All I’m trying to do is insulate the heat out.

What I’ve been developing over the years through my other interests was the fact that passive solar deals with the shell of the building but doesn’t deal with the occupants, doesn’t even deal with the heat generated internally and irrespective of how effective your insulated shell is you still need to cross-ventilate even in a cold climate to get rid of the accumulated humidity and the tendency for things to get stuffy. So I was looking for climatic forces that were going to help the cross ventilation effects, to the point where I was happy for the form to be driven by those requirements rather than by an aesthetic . . .

This place, I just said, I want to minimise my footprint, to minimise the damage on site and I want to use the external infrastructure, the fact that we’ve got cooler than ambient here, warmer than ambient on the north side, use those sort of forces just as they are without really emphasising them.

The site and Frank’ response to it reflect the custodian-style relationship he has adopted to both his immediate environment and the larger conception of ‘the environment’. The driving force for the design of his house is that it should have minimal environmental impact both during construction and after occupation. The land in this area is very dry with sandy soils. It has suffered from previous human intervention when attempts at farming it resulted in the loss of groundcovers and lower storey plants through over-gazing. Small areas of remnant mallee scrub remain. More recently the area has been sub-divided into large ‘hobby farm’ acreages (40 hectares). Frank feels the site is in need of restorative care and attention and believes that while this necessitates habitation the impact of this further intervention should be minimised. The house was designed to have a small footprint and to sit in the landscape without any major attempt to ‘soften’ the immediate surrounds. Structural methods and materials were chosen with lightness in mind. The lightweight structure was designed to be largely prefabricated off-site and manipulated relatively easily on-site thereby creating
minimal on-site disturbance. A power system was chosen that would impose a light load on fossil-fuel resources and not contribute to atmospheric pollution.

3.6.2 Material properties

Material issues were influenced by the site, environmental, structural and constructional issues.

FRANK: Anecdotally steel is not considered to be an environmentally friendly material. I use a lot of steel. I try to use it in a way where it is salvageable in terms of being demountable. But I use it because I find it is a very effective way of doing very little damage to the land. Whereas most construction processes you're burrowing or digging or putting mullock-heaps of sand or brick – you're doing damage to the site just in terms of the moving round and whatever . . .

Trying to say that I can grow building-quality timber in this environment is futile. Woodlotting timber is fine so my heating fuel, my cooking fuel, are wood because I can keep that balance. But in this terrain I had to import building materials and I had to say, okay, I know that I am robbing someone else of that resource but I'm doing it for what I believe to be an adequate, justifiable reason. That gets into very hairy territory and all we can do is do the best that we can.

Frank has been extending his ventilation ideas and incorporating subsidence cooling towers in some recent designs.

FRANK: See this is eight inch rainfall country and you get very interested in water conservation and that's one of the reasons I haven't got a subsidence tower on this house. I quite simply haven't got the water supply.

HELEN: Do you feel like you need [a subsidence tower]?

FRANK: No.

HELEN: What happens in a heat wave?

FRANK: Because the building's got very little mass it doesn't stay hot overnight, it cools down.

HELEN: What sort of floor is it?

FRANK: Concrete floor, so that's the only thermal mass. And as you've noticed, contrary to passive solar I've got almost nil north-facing windows, I've got one north-facing window which is what I use in winter time for getting a little bit of direct solar gain and that's all it really needs. Most of my ventilation stuff is all south facing.

HELEN: You don't feel the lack of the movement of sunlight . . .

FRANK: A lot of my life is directed outside. I'm out in the land. I did my hour and a half out there this morning. The kangaroos were sitting behind the bushes saying, "Do we really have to move?" I've got that relationship with the land as a whole and really the building is there because I as a human being like to have a cave to crawl back into occasionally.

3.6.3 Air flows

Frank' approach to thermal comfort issues is based around achieving good ventilation in his buildings that in turn is connected to his passion for gliding. This has given him an intimate understanding of forces that, to many people, are 'invisible' and largely understood only in theory.
Frank’s gliding experience and environmental interests have contributed to a sense of the landscape not to be looked at and admired visually so much as appreciated as a living, breathing force.

FRANK: The reason the landscape is the way it is with patches of mallee and then a clearing and then another patch of mallee is the surface of the earth needs to clean itself. It needs to get rid of the pollen and the dust off the ground and the only way it can do that is by venting it out and using solar energy to do that. Now, if Mother Nature can do that then why can’t we as architects use exactly the same mechanisms in the built form and the vegetation attached to it? In other words, the landscape suddenly is no longer a visual thing it becomes part of the air conditioning system of the building. So that is what was running through my head; I wonder how much of that I can really make work effectively.

FRANK: And so the buildings have really been a succession of explorations of that, using different techniques and getting better and better at making buildings really perform. What that does is drive the energy demand down. I’m running a 0.48 kWh/day solar system — [that] runs my home and office. That’s impossible I’m told; it can’t be done — 4.3 is about the least you can go down to . . . you can’t do any better than that! No building of mine is running at more than 1.7. That’s the biggest one I’ve got, which is a combined wind turbine and solar system.

3.6.4 Environmental issues and empowerment

HELEN: Can you say why these issues are important to you personally?

FRANK: I am the child of emigrant refugees, so I grew up in a household that said that the system sucks, and that society is going to jump on you the individual and you are going to carry all the garbage because the system is playing much bigger games and you don’t count. So if you want to survive kiddo, you better get yourself into shape. So self-sufficiency and empowerment are very strong forces in my up-bringing and that is one of the things I offer my clients. And it’s interesting watching clients reaching retirement or people making major shifts in their life and want some measure of certainty and then come to me for a physical product that will give those sort of things.

3.7 Discussion

The preceding section offers four distinctive design examples. Each project provides a unique example of problem framing (see 2.4.1) that reflects the particular circumstances of site, clients’ expectations, budget, the architect’s skills and interests and the clients’ and architects’ values that combine in any design project. The architects describe the designs in a story-like way: setting the scene, introducing the main characters, outlining the aims and motivations (both the clients’ and their own), strategies, and outcomes. These ‘stories’ incorporate a range of images. There are the clients’ images of their future house (a ‘dream
There are four clients (see 2.4.2). They refer to experiences of other places such as 'traditional cottages', 'project homes' and dark villas. There are images of goals such as creating a house that is 'low energy', 'appropriate to place' or 'light and bright'.

The architects refer to the use of images in communication between the architect and their clients (see 2.4.2). They also used images frequently as they described their designs during the interviews. Images are used to connect design concepts to specific experiences, emotions or examples such as the 'feeling' of heavyweight construction, the need for air conditioning in particular climates and building types, how specific rooms may be used, and what external appearance is desirable. Images are also used to link goal to strategies.

The 'voices' of the architects are strong. Their values permeate the descriptions through the tone of each extract but also through the issues they select as important to talk about. It is apparent that the environmental aspects of design hold an important place in the work of all four architects — although for each of them this is manifested in different ways. Frank's design is driven by concerns about energy use and land degradation. Jane also is concerned about energy use but, along with the Peter and Michael, indicates goals related to comfort, delight, connection and appropriate economy. The role of the values of the architect and his or her clients is also apparent as the emerging design is evaluated in terms of how it corresponds to their many aims — architectural, financial, affective, temporal etc. (see 2.4.3).

The interviews highlighted the particularities of design. The designs discussed reflected the combination of a specific site, with particular clients and their wants and needs. The environmental design ideas that were brought out in the interviews are rich and complex, highlighting the way issues to do with people, site and building inter-relate and influence each other. The extracts above illustrate this inter-relatedness and the implausibility of talking about such issues in isolation. Constructional issues are discussed in relation to such things as site, budget and the clients' expectations; thermal issues are discussed in relation to views, materials, siting and the clients' expectations; windows are discussed in terms of visual connection, lighting, heat gain and loss, ventilation and visual appearance. Decisions about any one of these aspects will have implications for the others. The interviews revealed that the architects' images encompassed a range of issues.

3.8 Summary

This chapter presents extended extracts of four interviews in which the architects describe one of their designs. These extracts demonstrate the range of issues considered and illustrate the use of images for communicating ideas, connecting design concepts to specific experiences, emotions or examples, and evaluating whether the emerging design is 'right'. It
suggests that one of the important qualities of images is that they allow the consideration of a range of inter-related design and environmental issues.
4. The architects' images of 'what should be'

4.1 Introduction

The previous Chapter illustrates the way issues to do with the environment, built-form and human habitation were intertwined in the architects' consideration of the environmental aspects of the buildings they described. The images referred to by the architects are vivid and descriptive, often encompassing many issues. The next four chapters look in more detail at some aspects of images, considering them both from the points of view of the architects interviewed and from a more theoretical viewpoint represented by examples taken from various branches of research, government policy and regulations, and professional guidelines. An important distinction already outlined, one that is reinforced by the analysis of the transcripts of the interviews, is that between images of what is known or believed to be true ('what is') and those images that are more closely related to ideas about what could, or should be, in the future. This distinction is used as an organising device in this thesis: Chapters 4 and 5 outline images of 'what should be', Chapters 6 and 7 discuss images of 'what is'. Images of 'what should be' are vital considerations in design decision-making (see 2.4.3). Identifying the images that architects have of how environmental issues should be addressed in house design will provide insights into how these issues are currently considered.

The first section of this chapter reviews images of 'what should be' raised by the ten architects. These are presented in the form of a 'snapshot' of each architect. Extracts from the ten interviews are included and therefore there is some repetition in the cases of the four architects who were quoted in the previous chapter. The following section presents the results of an analysis of the interviews in terms of the three images identified by Beach as important considerations in decision-making; the value, goal and strategic images.

The issues discussed below, while fairly extensive, by no means represent an exhaustive list of the environmental values, goals and strategies of these architects: they merely reflect the issues that arose from the interviews. They are presented to illustrate the range and nature of issues raised and there is no attempt to indicate the frequency or relative importance of particular images.
4.2 The architects

Adam

Adam’s designs are strongly influenced by his ‘holistic’ beliefs. These incorporate what another interviewee, Frank, defined as a very broad interpretation of energy encompassing an interest in Feng Shui, design principles to reduce the use of energy for heating, cooling and lighting, renewable energy systems and aspects of ‘personal’ energy. Adam said he values his “intuitive sense” and finds it particularly important when he is designing houses for clients. Natural landscapes are an important source of inspiration.

ADAM: [T]hey didn’t know anyone who was sensitive to the outback . . . And this firm . . . said, well we know Adam pretty well and we know his direction is environmental. Bit of Feng Shui thrown in and stuff like that. So they commissioned me . . . and I did a little booklet with a few ideas. And they were pretty happy with . . . the thinking which was more about landscape than about architecture.

Adam said that the buildings he designs are not orientated towards fashion: rather he strives for architecture that is “appropriate” for the occupants, the setting, and the wider environment. This appropriateness encompasses understanding and working with the local climate, responding to adjacent land forms, minimising the use of fossil-fuel based energy, and considering issues related to health and well-being. He regularly incorporates recycled materials into his designs.

ADAM: We used recycled timbers which we got out of a woolstore so it looks as if we just ripped the mini-orb ceiling off, which we did do. We replaced that same mini-orb ceiling in the ceiling of the upper function room. But in the courtyard, if you knew it before and you knew it today, it feels like it’s always been there. Even the old staircase is a new one built out of recycled timber.

Frank

Frank, who considers himself one of a handful of architects working in South Australia with a “sincere environmental bias”, most clearly articulated ecocentric environmental values. He referred to the Gaia hypothesis, originally proposed by James Lovelock and popularised by Kit Pedler (1979). This maintains that the earth is a living, self-regulating system “which seeks an optimal physical and chemical environment for life on this planet” (Lovelock 1979, p. 11) and is an important aspect of ecocentric ideologies.

Frank’s lifestyle, his work and the ideas he expressed in the interview reflect aspects of the key ideas of deep ecology that include:

... those of a just and sustainable society, carrying capacity, frugality (or ‘voluntary simplicity’), dwelling in place, cultural and biological diversity, local autonomy and decentralisation, soft energy paths, appropriate technology, reinhabitation, and bioregionalism (quoted in Harding 1998, p. 70).
The goals that guide Frank’s work are those of minimising impact on the site, minimising energy use and empowering occupants. The strategies he referred to in relation to the goal of minimal impact included using renewable energy, restricting the size of buildings, using materials economically and minimising impact due to construction procedures.

FRANK: Then we have very long debates that say, ‘Your impact on the planet is in large part due to your excessive floor space aspirations. Look at the fact that we can actually constrict the building size and still get you the lifestyle you’re looking for’.

Frank regularly incorporates renewable energy systems (using solar and wind power) and grey water reed bed treatment systems into his work. He often works in arid country and a particular goal is conserving water.

FRANK: The question I’m usually asked is, if I were building this place now, would I make it any different and the answer is probably not. I’d probably have a reed bed rather than a septic tank. When I built this, that technology just simply wasn’t available.

Frank expressed the view that dwelling involves environmental responsibility and that this responsibility has implications for the architect and the client that extend beyond the design period.

FRANK: The vast majority [of my clients] are people who understand that it’s a partnership and they are taking on some responsibilities. And yes there is ongoing contact.

Frank has a positive attitude to the future role of technology in housing.

FRANK: The building as an organism ultimately should be self-determining, that’s taking a very broad philosophical stance. [My internet service provider] is in the middle of supplying me with some little 386 smart cards which we can attach to individual bits of infrastructure of the building and pre-program them and just let the building open and close the windows, open and close the blinds on stimuli and then the building ultimately becomes the organism.

Gary

Gary spent many years travelling and working at a variety of jobs between graduating as an architect and finally setting up private practice. He identified himself as non-materialistic saying that he only ever owns two pairs of shoes at any time whereas clients of his have as many as 50 pairs.

GARY: I’m still that sort of hippy of the ’70s that I was when I came back and decided that I couldn’t be an architect.

He is a sole practitioner who specialises in housing and values the ability to design housing to ‘suit’ his clients.

GARY: I like to think that all of my clients finish up with something a lot nicer that they were expecting.
He keeps in touch with most of his clients and is proud of the strong attachments that many of them have developed with houses he has designed.

GARY: Most just can't contemplate leaving. These ones . . . he was offered a job overseas. . . but he doesn't want to leave his house. I don't know how much it's the house, just the whole package seems to be working. The first house I did the client got married after it was done for him then they wanted to do something together but he just decided in the end he couldn't leave the house.

Gary has a strong belief in the importance of good design. In the interview he talked frequently of the qualities he finds important in housing such as taking advantage of views, and getting winter sun into living areas, and the efficient and appropriate use of space and energy.

GARY: I'd say, If I were building for myself on this site these would be my priorities . . . I'd say, "That's a lovely view, you've just got to have that; you'll have some beautiful sunrises over there, you want to see them for breakfast; you want to sit here at night and see the sun on the hills. That would be an extreme priority for me." Or there might be a sunset that's available so you don't turn your back on that.

GARY: The first house I did 10 or 12 years ago was 3 pavilions around a central courtyard. The starting point of that one . . . was to be able to get the sun into the south side of the building because it was a tight suburban site where the courtyard worked nicely . . .

Gary believes that being able to ‘sell’ his designs is an important aspect of his practice, both in the sense of promoting himself to potential clients and in terms of presenting his ideas to existing ones.

GARY: I think I'm getting better, not at designing, but at getting good designs built rather than letting them get lost through not being able to sell it well enough.

Jack

Jack works as a sole practitioner and has considerable experience designing housing. His main interest in the environmental aspects of house design are related to siting, solar access and views.

JACK: Everything I do is about getting the sun and getting the views if it's got views.

Jack discussed windows and solar access in terms of thermal comfort and the particular goal of having a house that is cool in summer and warm in winter. He referred to the strategies of orientating the building to get maximum winter sun, and of designing shading to protect from unwanted sun in hot weather, and to using concrete slab floors as heat sinks and insulation to protect against unwanted heat gains and loss. Jack said that he thought many people have only vague ideas about environmental issues related to housing and about energy efficient housing.
JACK: My feeling is that it is to do with a house that’s comfortable to live with and not expensive to run. It will extend to hot water heaters and things like that.

Jack also referred to the importance of control and flexibility in the thermal environment specifically in relation to “controllable heat” and the ability to control ventilation.

JACK: You want to be able to control the breeze. You may want protection but you might also want a breeze. So a lot of it I think is flexibility. Often its just like having a window you can open... it doesn’t have to be complicated.

Jack sees himself as providing a service that is appropriate to the client.

JACK: Some people just want the job done and they have a pretty clear idea of what they want and there is not much design input from me. I can confirm their ideas, that they are on the right track, and that they're not doing something silly. I can give them a budget and get their approvals and get a builder to do it. But others just have... vague ideas of what they want.

Jane

Jane is a partner in a small practice that has two main strands: residential projects such as renovations, extensions and house designs and small public buildings such as visitor centres in tourist areas. She is a strong believer in the benefits that good design can bring to the occupants and the wider community. Jane’s interest in environmental issues is connected to the goal of design that is “appropriate to place” as well as to reducing the use of energy, and creating comfortable interiors.

JANE:... One of the key things about place is the environment, the natural climate. So in designing things that are appropriate to a particular place you’ve got the site and you’ve got the climate and making a building that works in that place, responding to the climate, is a key part of the design. And I think that directly links into issues of the environment, so that designing something that is appropriate for that space should be as environmentally responsible as possible and the net benefit of that is I think you end up producing architecture that has a much greater chance of feeling like it belongs.

Jane believes that material choice should involve consideration of the sustainability of the product and processes. She likes to use natural materials and recycled timber wherever possible.

JANE: It was looking at a whole range of strategies to make the building have as minimal negative impact on the environment as possible and one of the things that we did was to use an enormous amount of recycled timber...

JANE: The idea of timber appeals to us because it is a renewable resource and we have used a variety of timbers on different jobs but never south-east Asian rainforest or south American rainforest timbers...

JANE: Our architecture has a lot of natural materials, we like using natural materials and we feel like that from an environmental perspective...
Jane referred to the benefits for occupants of design that incorporates natural light, sun and an “indoor-outdoor connection”. These include delight, comfort and an increased awareness of the possibilities of the interaction between built-form and the climate.

JANE: [Y]ou can be inside in winter and have sunlight. I think if it’s a nice day it’s lovely. It might be freezing cold outside but if you’ve got some sun coming in it’s just a much more cheerful place to be.

Jane believes that her firm’s approach to environmental issues is “intuitive rather than analytical”.

Mark

Mark graduated in 1975. He has worked as a sole practitioner most of his professional career, specialising in residential work and many of his projects are located in the inner city and inner suburbs. For many years Mark was deeply involved in heritage issues. He is committed to architecture that has a ‘human’ quality. He discussed this in terms of scale, meaning and control.

MARK: I think architecture should have some sort of empathy with human beings. And I don’t care if architecture is seen to be a bit conservative so long as there is some empathy with the people who have to use it.

Mark sees environmental issues as a fundamental aspect of his concern that architecture should have empathy with humans. He drew a distinction between natural and ‘false’ environments where natural involves a sensory connection with the climate and the immediate setting. He feels that this connection is important on a personal level but also has implications about how we think about other environmental issues such as energy use.

MARK: All these technological wonders that are less and less expensive to run but you run them for longer so you’re still chomping up the energy. It really isn’t solving the problem. In fact in some ways its making it worse because you’re getting people used to the idea of living in an environment that is totally false.

...That’s one of the reasons for doing our house the way we did it. I’ve separated the two buildings. You actually have to go outside to get from the living areas to the bedrooms. Which means YOU HAVE TO GO OUTSIDE! And a lot of people come along and say, ‘Ooh, you have to go outside, are you going to put a canopy over here, what are you going to do in winter, when it’s raining?’ It’s only 9 metres. You walk across. It’s not a problem. We’re terrified about being outside.

Mark aims to use sustainable products where possible, minimise the use of energy and water, and to create designs that are comfortable and work with the local climate. He feels that it is important for design to accommodate a connection between the occupants and aspects of the natural environment such as the sun and sky or a beloved tree.
MARK: I think the sun is a really critical factor in South Australia in particular. Many don’t take it into consideration in planning – what rooms do you want sun to come into, that sort of thing – rooms that are really cold and dull and unfriendly because you don’t have that little bit of sparkle that sunlight can give, particularly in winter.

MARK: One of the negative things of verandahs is that it cuts down the view of the sky and the view of the sky is something almost spiritual – to see that broad sky.

MARK: I just turned it all around in the sense that I got rid of the toilet block from here and put it away and got them a side entrance and a focus on the tree because she really loves the tree.

Mark referred to strategies such as considering the orientation of the building in relation to solar access, natural ventilation and daylighting, and incorporating indoor-outdoor spaces (for example, courtyards and decks), rainwater collection and greywater treatment.

MARK: What I am hoping to do sometime is to separate the greywater and put a sump in the garden so that it just goes into the ground rather than having to be taken wherever.

MARK: I try and use pine as much possible because it’s a local, renewable resource and they’re getting better at it.

MARK: If every household with a garden had a rainwater tank, a substantial sized rainwater tank, that’s a lot of savings of water. Even if they’re just used to water the garden.

Maureen

Maureen was the youngest of the architects interviewed. She graduated in 1997 and her final year project was an award-winning scheme for an ecotourist development. Maureen has worked for firms in Adelaide and the tropics and has also been involved with research projects involving the use of thermal simulation programs. Maureen feels that architects have an ethical responsibility to address environmental issues in their work.

MAUREEN: If you can make better choices, more appropriate choices, inform the clients and the people around you so that they can make more informed decisions, then I think that’s going to benefit everybody in the long run. . . I mean you’re building something so inevitably you’re going to have to destroy some part of the environment somehow, a long way away and near at hand. It’s all about making better choices rather than being bloody minded.

Some of the goals that Maureen referred to were that design should not “infringe too much on the natural landscape”, should enable social interaction, recognise local customs and traditions, be thermally comfortable, and create “a nice space to be in”. She mentioned the importance of the experiences of spaces and of thermal conditions and wondered if “because [places] feel pleasant, you tend to think of them using less energy”.

An important goal for Maureen is that design for the tropics should attempt to avoid the use of air conditioning.
MAUREEN: I don't live in air conditioning, I don't work in air conditioning, I don't like air conditioning and I ride my bike everywhere and catch buses. And because I don't go in and out of air conditioning it doesn't affect me. So I can design buildings without air conditioning and fully believe and know that they are livable buildings.

HELEN: [F]rom your personal experience .

MAUREEN: Yeah. It's not like I'm living in an air conditioned apartment, working in an air conditioned office and saying, 'Hey, you mob you can sit out there and not have air conditioning'. It's not like that. I know that it can be comfortable. Not for everybody but for people who have a little bit more tolerance, more strength than people who are used to living in air conditioning when they don't need to. So it's about that sort of decision, working with the climate.

Design strategies mentioned by Maureen included using materials in a "sensitive and thoughtful" way that takes account of local availability, conditions and requirements. She indicated that she regards natural ventilation as an important consideration in the tropics and that "indoor outdoor experiences" (for example, decks, verandahs) enhance a connection with the site.

Michael

Michael has had his own practice since 1992. He undertakes a range of projects including heritage advisory work, residential and community projects. Michael has a strong sense of the importance of architectural design and sees this as encompassing an understanding of the properties and qualities of materials, the qualities of places and of spaces and the importance of the visual and aesthetic aspects of design. He often referred to the inter-related nature of issues considered during architectural design.

Michael sees environmental issues as a fundamental consideration for design.

MICHAEL: To me as an architect, these issues are important generators of design and important ways of locating a building in relation to a site. They are fairly fundamental organising principles for the design concept. But also they provide integral qualities to the space; qualities of light and qualities of the 'feel' of a space.

Michael referred to the goals of creating a house that responds to the local climate and setting, and creating a comfortable thermal environment for the occupants. He also discussed the importance of reflecting the values of the occupants of the house through the design. This involves a sensitivity to the symbolic importance of certain elements and materials.

MICHAEL: A couple of items like the rammed earth walls and the corner posts were really important elements for the client although in a sense they're only a fraction of the whole package.

The strategies Michael referred to included designing for daylight, solar access and natural ventilation, rainwater collection, consideration of the landscaping and siting of the building, and the incorporation of references to local traditions and practices.
Peter

Peter graduated in 1972 and worked for a government architecture office for many years before setting up in private practice. He singled out concerns about resource use and the desire to create pleasant living environments as the reasons he is interested in the environmental aspects of house design.

PETER: I guess one of the things is the earth's resources – and the other is just to make the house more pleasant to be in and obviously it's going to be more pleasant to be in if it responds to the climate and the things that are around it. That's how I see it...

The strategies he referred to include respecting and reflecting the site, enabling a connection for the occupants with the immediate setting of the house through views, access to breezes and sunshine, and creating a light and thermally comfortable internal environment.

PETER: That was something that I was working for but they hadn't actually said they wanted a light, bright house. Living in [my own] house, it's not a very light house; I really like light.

Peter sees these issues as fundamental aspects of design but notes that many people seem to think that they can be considered separately from other design issues. He said this attitude was common amongst people who sought his advice when he worked at an architectural advisory service.

PETER: [They say], we don't need any drawings, we've got the drawings but we want to make it cool, what should we do? Spare me!

Peter sees himself as “practical”. He indicated that giving his clients a service and a finished product that they equate with value for money is important to him. His comments suggest an affection and respect for his clients and he maintains contact with many of them.

Sarah

Sarah graduated in 1990 and has worked in a variety of positions since then including undertaking heritage work, design and project management for small firms. She now works as a sole practitioner and hopes to specialise in the design of healthy buildings.

SARAH: I'd already become really interested not only in the energy efficiency and the solar parts of things... but looking at the healthy side of buildings as well. I'd read a couple of books on it then I realised this was what I really want to do. This makes sense taking energy efficiency and taking it a few steps further. It makes it more holistic and it's more what I believe in... it's more of a total concept.

Sarah’s interest in creating healthy buildings leads to the desire to use natural products and natural finishes wherever possible. She also referred to using recycled materials, materials with low embodied energy and reducing energy use.
Sarah expressed concern about the environmental impact of buildings both in terms of the impact of building on the wider environment and the impact that the building may have on the occupants. This concern is a driving force in her design.

SARAH: [H]alf of what's been done to the planet comes from the built environment. Don't we have a huge responsibility that everything we build, whether it be houses or roads or whatever else, to really think about what we're doing? That's where I'm coming from I think. You can't divorce yourself from that any more.

SARAH: So what I'm trying to do when I design is to have toxicity in the back of my head [as well as] sustainability in terms of the energy efficiency of the building and the embodied energy of the materials and then think about the overall health of systems whether it be the health of the environment around or the health of the people inside.

She contrasted the natural environment that she refers to as “more real” with the artificiality of the built environment. One of her goals is to create “a connection with place”. The strategies she referred to in connection with this goal include using natural ventilation, natural light, and solar access, and capitalising on views.

SARAH: And that's the mentality that we've got into, sitting watching television, watching computer screens and divorcing ourselves from what is more real which is the natural environment.

SARAH: I think if you are going to this sort of very unspoilt place that they go to, and it really is beautiful, one of the nicest places I've been in South Australia, it really has a nice ambience to it, that I want to keep them in contact and not have an artificial environment as much as possible. I want them to perceive that it is hot or whatever . . .

Sarah also referred to creating designs that incorporate aspects of the clients’ lives that have meaning and importance.

SARAH: [W]hen we've got down to things like this pepper tree they've been able to realise, “Ah, that's where we park our cars at present. We like that tree. We know that tree.” In a way they've got a history or a personal relationship with that tree and they go, “Good we can keep that tree”.

4.3 The images

The ‘snapshots’ presented in the preceding section briefly illustrate the architects’ ideas about how environmental issues should be addressed in house design. The architects were not asked specifically to reflect on this question but during the course of the interviews each architect made references to such things as what they thought should happen, how design could address these environmental issues, or what makes design ‘good’ or worthwhile. Each architect represents a unique view of these issues and the goals and strategies they refer to are irrevocably connected to their values.

It is difficult to separate value, goal and strategic images as they are interconnected and particular to the individual and their contexts. Nonetheless it was believed to be worthwhile to consider each of these categories separately. The following sections outline the major value,
goal and strategic images identified in the transcripts of the interviews. There is some inevitable overlap and cross-referencing between the categories.

4.3.1 Value images

As pointed out in 2.4.3 value images reflect the principles and beliefs of the designer and the client and are used as a guide to the ‘rightness’ or ‘wrongness’ of design decisions. Not surprisingly, a range of value images emerged from the interviews. Images mentioned include that a building should ‘feel like it belongs’, ‘be appropriate for place’, ‘have empathy with humans’, ‘have minimal impact’ and ‘be expressive of the clients’. These images are used to frame the design problem, evaluate alternatives and to evaluate outcomes. For example, the image of ‘minimal impact’ might encompass attitudes to the extraction, production and transportation of building materials that guide material choices. It may guide siting decisions on particular sites. It will imply certain goals and strategies thereby limiting the range of those that need to be considered. And it will provide a means to evaluate how ‘good’ the design is.

In terms of environmental attitudes two dominant images emerge that correspond to the two views of the environment outlined in 2.3.3 and 2.3.4: the environment considered in ‘global’ terms and as ‘fields of significance’. The view of the environment, as a field of significance for an individual, features extensively in the interviews. This image is connected to concrete concerns about particular sites and their settings and is framed in terms of those issues of significance to the clients (and, to a lesser extent, the architect). It is bound up with a belief in the affective, emotional and symbolic importance of the connection between the occupants of the house and their immediate, and wider, surroundings. This view is largely positive and involves a sense of the environmental opportunities associated with house design. Decisions are evaluated by the clients and the architects by drawing on their knowledge and experience of what is appropriate and desirable.

The global view is connected to ideas about resource use (particularly related to fossil-fuel based energy) and pollution. It is largely framed in terms of large-scale problems. Design decisions are evaluated in terms of their environmental impact in relation to such things as greenhouse gas production, depletion of the ozone layer or land degradation connected to resource production. These matters are technically complex, involve many uncertainties and the extent of the problems are hard to determine. The impact of a particular design, or design decision, on any one of them would be virtually impossible to determine objectively. Rather, the architects evaluate these impacts using abstract theoretical notions of ‘good practice’ and by images of appropriate solutions. It appears that ‘global’ environmental problems are also important for symbolic reasons. For some architects a problem such as greenhouse gas production represents or symbolises the threats to aspects of the world that they consider important (such as the ‘natural environment’). Therefore, acknowledging and addressing these ‘global’ problems in design is considered symbolically important.
One value image, identified by many of the architects, and related to both these views of the environment, is the contrast between 'natural' environments and the built-environment. 'Natural' environments are generally referred to with affection. They are regarded as having intrinsic worth, while often the 'built-environment' is seen as 'false' and problematic. There is an implication that 'natural' environments do not contribute to pollution or resource depletion (the global view) and are a source of meaning, and visual and sensual delight (fields of significance). At the other end of the continuum, highly-developed urban environments are considered to be resource-hungry and responsible for considerable pollution, to alienate the occupants from the natural world and to be deleterious to individuals' health. This contrast provides a means of evaluating the 'goodness' of a design: the closer to 'natural' the better. Therefore designs that incorporate daylighting, solar access, and natural ventilation are perceived to be better than those that are sealed, and rely on 'artificial' climate control and lighting. A similar evaluation relates to materials. Earth and timber generally are considered 'better' than steel and aluminium.

A belief reflected in all the interviews is that the consideration of environmental issues is an inherently valuable aspect of design: guiding material selection, and the siting, form, and layout of buildings; providing meaning, and a sense of connection to the wider world for the occupants; and embodying the values of the architect and his or her clients. This principle is evident whether the environment is being considered in 'global' terms or in the sense of the local 'field of significance'.

Another important value image that emerges from the interviews is that design is vital for creating better environments – both at the particular level of the design of a house to suit the site and the clients, and in terms of addressing wider environmental issues. This is connected to the belief that the role of the architect carries ethical responsibilities arising from the fact that development has implications for those other than the immediate participants. Architects are also considered to have the expertise and sensitivity needed to view issues in a broad context.

**4.3.2 Goal images**

The desired outcomes or goals of a design are an important aspect of images of 'what should be' (see 2.4.3). A number of images related to environmental goals were mentioned by the architects in the interviews; some of these arose from the discussion of a particular house design, while others were mentioned in a more general way. Similarly, some of these goal images related to a 'global' view of the environment while others related to the 'fields of significance' view. Many images reflected both views and many of the goal images were interconnected. The following section describes the major goal images identified from the interviews.
Design that is suitable for the occupants

Creating designs that are appropriate for the particular occupants was a prime concern for all the architects. This image involves the idea that the design of a house should accommodate such things as the occupants’ lifestyles, personalities, budget, and values. During the interviews there were several direct references to the desire to give the occupants ‘more than they expected’, to actively enhance their lives.

Design that is comfortable

The goal that the house design should result in an environment that was comfortable for the occupants was sometimes mentioned in terms that suggested thermal qualities but often in a way that suggested a broader conception of comfort. Other terms such as ‘nice’, ‘pleasant’, ‘warm’ were used to suggest the same concept: something that ‘feels’ good.

Design that is healthy

The goal of creating healthy buildings was mentioned by three architects; two referred to this goal arising in response to specific health issues of particular clients and the other architect has a particular personal interest in healthy buildings. In this case although the architect has other environmental goals she said that she feels that the concept of healthy buildings – considering a range of issues including the toxicity involved in producing buildings products and the affect of the house on the occupants – provides a ‘holistic’ design approach.

Design that enhances the occupants’ contact with ‘the environment’

Another common goal mentioned in the interviews was that design should enhance the inhabitants’ contact with the immediate environment through visual and/or sensory connection. This was referred to in terms that suggested that it is a fundamental human need on the one hand and also a way of connecting to wider social and environmental concerns. Thus being able to see, smell and hear what is happening in the immediate surrounds not only helps people know that they are alive but alerts people to changes in the wider environment such as pollution or damage to the landscape.

Lisa Heschong in her book, Thermal delight in architecture (1979), maintains that thermal sensations provide information about the world around us and that;

... [t]here is something very affirming of one’s own life in being aware of these little pieces of information ... When the sun is warm on my face and the breeze is cool, I know it is good to be alive (Heschong 1979, p. 18).

The sun, sky and wind are constantly changing, and incorporating them in design can contribute to an internal environment that is dynamic and stimulating.
Design that is ‘meaningful’

A number of architects referred to the importance of aspects of the design that have special meaning for the clients, for example a specially chosen column or second-hand doors that the clients want incorporated in the design, or the retention of a beloved tree on the site.

One architect referred to his design working in terms of ‘aesthetic and emotional responses’ of the occupants. In this instance the comment related specifically to thermal mass and a sense of enclosure but a similar attitude was evident in some of the other interviews when the architects talked about the relationship between the internal and external environments they were trying to achieve. The aim was obviously not just to create a physical response (for example, the sensation of coolness possible with ventilation on a hot day) but to enable an emotional and affective one. This was clearly evident when the architects discussed designing in relation to the sun. The consideration of sun penetration in the house and, in particular, designing to get sun into the house in cold weather and exclude it in hot weather was referred to as an important aspect of many of the designs discussed. It was obvious that this was not related just to solar gain for heating. The sun was referred to as an essential element, one that brings positive emotional benefits. Cooper notes that:

... after the gods, it has perhaps been the sun which has attracted the greatest reverence. This is not, however, the sun considered as a large ball of gas millions of miles away, but the sun as the grower of crops, whose appearance or retreat cheers or depresses the day, and whose various colours and sizes people must learn to read if they are to organise their work and pleasures (1992, p. 175).

One architect used the term “spiritual” when referring to the importance of a view of the sky and the architects interviewed appeared to attach a fundamental and symbolic importance to both the sky and the sun.

Design that is suitable for the site

The goal image of a building that suits the site has many aspects. The attributes of a particular site are important for determining the siting, orientation and form of the building. This in turn has implications for such things as energy use and comfort. All the architects described the topography, vegetation and surrounds of the sites when they discussed a design. The goal of ‘suiting the site’ sometimes extended to the design reflecting attributes of the site. Two examples mentioned in the interviews were roof-forms that mimic the geometry of surrounding landforms and that echo the slope of the land. Several of the architects referred to the goal of minimising impact on the site because they perceived the site as fragile or because they wanted to restrict site-works. Another aspect of this image is ‘making the most of the site’: siting to take advantage of views and outlook, and to maximise solar access and access to natural ventilation.
Design that is suitable for the climate

The goal image of design that is appropriate for the particular climate was referred to frequently by the architects. This image has several aspects. Firstly, it relates to acknowledging and designing for features of the local climate. This might encompass, for example, the desire to capture the cooling breezes or to exclude the hot winds that are a feature of a particular location in summer. Another aspect of this image is connected to the idea that the form and materials of the building should be suitable for the diurnal and seasonal changes in temperature of the particular location. Both these aspects are connected to other goals such as creating thermally comfortable interiors, reducing heating and cooling energy use through the use of appropriate design techniques or enhancing the occupants' contact with the environment.

The goal of creating a design that is suitable for the climate is also connected to the desire to accommodate the way the occupants want to 'live' in a particular climate. For example, people may wish to be cocooned from the external environment or to be able to spend considerable periods of time outdoors. This goal image encompasses the idea that design should reflect and enhance the lifestyles of the occupants (for example, through creating protected indoor/outdoor spaces).

Design that is resource efficient

Resource efficiency was a common goal for the use of materials and energy. Several architects mentioned the goal of energy efficiency either explicitly or through their discussion of the strategies they used for heating, cooling and lighting systems. One architect referred to the specific aim that his buildings should have an energy demand of less than 1.5 kWh/day. Several architects referred to the goal of limiting the size of the house by eliminating unnecessary circulation space and combining room functions where possible. This has direct benefits in terms of reducing the materials used (and costs). Another aspect of this image is the efficient use of building materials through appropriate selection and design. Other resources, such as time and money, were also discussed in terms that implied the goal of efficiency.

Design that supports sustainable practices

The goal of making decisions based on the sustainability of materials was referred to, particularly in relation to the use of timber products. In relation to the use of timber products this involved images of the social and environmental implications of where and how the timber was produced. It also involved the comparison of timber with other products, such as aluminium in the case of window frames, or steel in house framing. Several architects mentioned that they supported producers, suppliers and manufacturers who attempt to address environmental issues because of the values of the firms as well as for the material or
product they produced. This image is bound up with the understanding that the production of the built environment is a system with many participants.

4.3.3 Strategic images

Strategic images represent ideas about how goals can be realised or accomplished (see 2.4.3). The strategic images identified in the interviews are presented below. As with the value and the goal images, the situation with strategic images is complex. There are strategies that relate to either one of, or both, ‘global’ environments and ‘fields of significance’. There are examples where the same strategy may relate to more than one goal or where several strategies may address the same goal.

Develop understanding, rapport with the clients

A vital aspect of the design of a house for clients who will be the occupants is the development of an understanding of their wants, needs, lifestyles, and values. Some of the necessary information is objective but much of it is value-laden and involves affective and emotional issues that are difficult to quantify and often difficult to put into words. The strategies for developing an understanding of their clients described by the architects involved verbal and graphical communication (see 2.4.2). Sarah asked the clients to describe what they do on a typical day. This strategy can be useful for establishing the clients’ expectations regarding such things as heating and cooling, lighting, and spatial requirements. Michael discussed with the clients the “qualities” they might want from their house and how the house might ‘work’. Gary explained to the clients the features that he would value in a design for their site.

Most of the architects consider drawings to be an important tool for developing understanding. During the interviews the architects referred to using drawing to establish what was ‘meant’ by certain terms (such as ‘modern’), to assess the direction the client wanted to go in (by offering them choices), to communicate the ‘feel’ of a proposed design and to determine how well the clients ‘read’ drawings. Clients, too often used cuttings from magazines, mud maps or sketches to help them communicate their ideas to the architects.

Design for views

Most of the architects referred to designing windows to capitalise on views. Providing views and outlooks is an important strategy for enhancing the occupants’ connection with the wider environment, and to provide comfort and delight.

Incorporate inside/outside spaces

All the architects give examples that show that their design thinking extends beyond the actual building’s walls to encompass inside/outside spaces such as decks, verandahs, courtyards and beyond to garden areas or the land surrounding the site. The inside/outside spaces are
not only valuable for the occupants and the performance of the house but also help determine the way the building is integrated into its surrounds.

**Incorporate design techniques that reduce energy use for heating, cooling and lighting**

Extensive references were made to design techniques that integrate the climate, site and built-form to maximise ‘natural’ lighting, heating and cooling. Design for natural ventilation was an important consideration in many of the designs as was the siting, form and materials of the building in relation to solar gain for warmth in cold weather. Design for daylight also was referred to frequently.

In some cases the connection was made between these strategies and the environmental goal of reducing energy use. In others they were discussed in terms of comfort or delight but often the aim of adopting these techniques was unstated. Rather, they were discussed in terms that suggest that they were considered an inevitable and unquestioned component of good design.

For many of the architects the strategy of designing with the climate was bound up with the desire to avoid the use of air conditioners for cooling. Whereas the use of heaters in cold weather is an unstated expectation, cooling by air conditioners was considered avoidable – even in the tropics.

**Consider embodied energy, transportation of materials**

A number of the architects said that they considered the embodied energy of materials when making material choices during design – often with the rider that it was difficult to get useful information.

One concept that was mentioned a number of times, and appeared to be useful for decision-making, was that of thinking about the distance materials had to be transported. This was referred to in terms of energy (transport energy): the further the materials had to be brought to the building site the more (transport) energy they embodied.

**Use natural materials, recycled materials**

The use of recycled materials was mentioned by several people during the interviews. This was a strategy adopted to address environmental issues including conservation of resources and energy. The use of such materials was also discussed in relation to aesthetic qualities, and because they provided a sense of continuity and embodied meaning.

**Use renewable energy systems**

Several architects referred to using renewable energy systems. The most common reference was to solar hot water systems. Frank mentioned both solar power and wind turbine systems. Adam described a solar powered heat exchange radiator system he had used for heating.
bedrooms. Jack said that he sometimes has clients who specify that they want a solar hot water system.

**Collect rainwater on site, use greywater on garden**

There were several references to strategies to conserve water such as rainwater collection and re-use of treated greywater on the garden.

Strategies to treat grey water and sewerage waste on site were mentioned including the use of composting toilets and reed-bed grey water treatment systems.

### 4.4 Discussion

The overall image of ‘what should be’ presented in these interviews is that the design of the house should result in a healthy, nurturing, dynamic, ‘meaningful’ setting for the occupants and that the process of building and operating the house should use resources wisely and avoid environmental degradation. Environmental issues are considered both in terms of problems to be managed and opportunities to be realised and reflect the two views of ‘the environment’: the ‘global’ view and that of ‘fields of significance’ for the individual. The value, goal and strategic images that comprise images of ‘what should be’ sometimes relate to one or other of these views, but often encompass both. While the global view is represented in concerns about operational and embodied energy use, it is the view of the environment as fields of significance that dominates images of ‘what should be’. Many of the images reflect the particularities of the practice of design: that each house design involves specific contexts, a particular site with a particular climate, and particular clients who have idiosyncratic wants and needs. Environmental issues are largely considered within this framework rather than within the framework of global environmental problems.

The house can be viewed as mediating the relationship between the occupants and the wider environment both in terms of the end product and conceptually during the design. Decisions made during the design of the house reflect the environmental values of those involved. The built form not only embodies these values but also acts as a filter between the internal and external environment. In this view of ‘what should be’, human issues are central for determining what is valued, what aims are identified and the approach taken to achieve them.

The images that the architects refer to encompass many issues and their interrelationships. The setting of the design project, and the various contexts that comprise it, are an inseparable part of the images.
4.5 Summary

The preceding chapter outlines the architects’ images of ‘what should be’ regarding environmental issues and house design. These are presented firstly in relation to individual architects and then in terms of the value, goal and strategic images identified from an analysis of the transcripts of the interviews.

This chapter highlights the importance of understanding that environmental issues can be considered both in terms of ‘global’ problems and in terms of their significance to individuals. It emphasises the importance for design of symbolic, affective and emotional aspects of the relationship between the individual (both architect and client) and ‘the environment’. This chapter reveals that the architects regard the consideration of environmental issues as an inherently valuable aspect of design. The values of the architects and the clients are revealed to be a vital factor in the way such issues are framed and for how decisions about them are evaluated. This chapter indicates the importance of images for understanding environmental issues associated with house design in a way that encompasses the occupants, the house in its surroundings, the larger region and global issues.
5. Design advice images of ‘what should be’

5.1 Introduction

This chapter considers images of ‘what should be’ regarding the environmental aspects of house design from another perspective: that of the images embodied in current design advice about these issues. Theoretical ideas about how environmental issues should be addressed in house design in Australia are expressed in a number of formats such as design guidelines, government policy and regulations, and professional environment policies. This chapter reviews three key sources of design advice:

- the Nationwide Home Energy Rating Scheme (NatHERS) (see Appendix A 1-16),
- The National Resource Document for Residential Development (known as AMCORD) (Department of Housing & Regional Development 1995 – see Appendix B 1-37 for extracts), and

Taken together these sources of design advice form an important representation of current thinking about housing-related environmental issues in Australian society. NatHERS is a response to the Australian federal government’s view of the issues, AMCORD is a result of collaboration between the government and the planning profession and the RAIA Environment Policy and Environment Design Guide is the ‘official’ view from the architectural profession. These documents portray current ideas, from the wider society, about how environmental aspects of house design in Australia should be addressed.

The following section considers the representation of ‘what should be’ embodied in these sources of design advice. It begins by briefly outlining the major residential environmental problem identified by these examples: the production of greenhouse gases. It then describes and critically reviews each of the three sources of design advice. The value, goal and strategic images presented by these sources of design advice are outlined. Finally, these images are compared to the images that emerged from the interviews with the architects.
5.2 Housing and greenhouse gas emissions

The potential for the so-called greenhouse effect to cause global climate change is an issue that has been the subject of ongoing international debate and concern since the late 1980s and currently dominates the rhetoric about buildings and the environment of Australian governments at all levels, and the portrayal of these issues in the media and much of the published information about the environmental aspects of house design.

The term ‘greenhouse effect’ is given to the phenomenon whereby some solar energy is absorbed and re-emitted by certain gases (for example, carbon dioxide, nitrous oxide, methane) in the atmosphere rather than being lost back to space. The consequent warming of the atmosphere is responsible for maintaining the temperatures that sustain life on earth. The concentrations of these gases in the atmosphere appears to be increasing and this has been linked to the increases in the burning of fossil fuels, deforestation and agricultural activities of post-industrial society. Many scientists predict that the increased concentrations of so-called greenhouse gases could lead to global climate change (see for example, Warrick, Jäger et al. 1986; Houghton, Filho et al. 1995; Bouma, Pearman et al. 1996).

The environmental problem of greenhouse gas emissions and its potential to cause climate change is an example of a ‘global’ view of environmental issues (see 2.3.3). The suggested causes, and the predicted impact of this problem, involve the whole planet. The extent and nature of the causes of the problem are identified largely by scientists and the potential impact is predicted using scientific techniques (mainly computer simulations). There is an expectation that large institutions will be involved in defining and implementing solutions and that the problem can be addressed through international, national and local political action to implement appropriate environmental management.

At the international level the United Nations Framework Convention on Climate Change (UNFCCC) was opened for signature at the “Earth Summit” in Rio de Janeiro in 1992. This Convention set out principles and general commitments for ‘stabilising’ greenhouse gas emissions. The Convention differentiated between developed countries (and those in transition to a market economy), called Annex 1 countries, and developing countries (Annex 2 countries). The aim for Annex 1 countries (including Australia) was that they reduce greenhouse gas emissions to the 1990 levels by the year 2000.

This agreement was eventually ratified in December 1993 although shortly afterwards it became obvious that these voluntary targets would not be met. In December 1997 Conference of Parties (COP3) of the UNFCCC met in Kyoto, Japan to attempt to draw up legally binding limits for greenhouse gas emissions. The new target for greenhouse gas reduction in Australia was set at 108% of the 1990 levels to be achieved within the compliance period of 2008-12. These limits will become enforceable once the Kyoto Protocol is ratified by at least
55 countries provided that this includes Annex 1 countries that account for at least 55% of total CO₂ in 1990. By early February 2000, only 22 of the 84 signatory countries had ratified the Protocol². The United States, an Annex 1 country that accounts for over 21% of emissions, had not ratified the Protocol and without US support the future of the agreement is unclear.

At the national level, Australian government policy regarding measures to reduce greenhouse emissions was first outlined in the National Greenhouse Response Strategy (NGRS), released in 1992. The NGRS was revised immediately before COP3 at the same time as a number of new measures were announced by the Prime Minister, Hon. John Howard including the establishment of the Australian Greenhouse Office (AGO). In November 1998 the revised and renamed National Greenhouse Strategy (NGS) was released. The stated goals of the NGS are:

1. To limit greenhouse gas emissions, in particular, to meet our international commitments.
2. To foster knowledge and understanding of greenhouse issues.
3. To lay the foundation for adaptation to climate change (AGO 1998, p. 2).

On a per capita basis, it is predicted that Australia is the third highest source of greenhouse gas emissions in the world (AGO 1998, p.97). The production of CO₂ constitutes almost 75% of total greenhouse gas emissions in Australia and just over two thirds of the CO₂ results from energy production and use. This is largely related to coal fired production of electricity (DEST 1994). The residential sector, as a large user of electricity, is a significant producer of CO₂ (see Table 5.1), hence measures to address the reduction of greenhouse gas emissions include strategies to reduce electricity use in housing.

Table 5.1: Contributions to carbon dioxide emissions in Australia

<table>
<thead>
<tr>
<th>Economic Sector</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>38.7%</td>
</tr>
<tr>
<td>Transport</td>
<td>26.1%</td>
</tr>
<tr>
<td>Commercial</td>
<td>9.8%</td>
</tr>
<tr>
<td>Residential</td>
<td>18.7%</td>
</tr>
<tr>
<td>Other (including Agriculture)</td>
<td>6.7%</td>
</tr>
</tbody>
</table>


The reduction of greenhouse gases is a concern that is reflected in much of the current design advice about the environmental aspects of house design.

² Figures obtained from: http://www.unfccc.org/resources/kpstats.pdf
The RAIA Environment Policy states:

Buildings contribute substantially to the depletion of our planet's finite resources and the reduction of environmental quality. For example, about one third of the total greenhouse gas emissions arising from fossil fuel combustion in Australia are attributable to energy use in the residential, commercial, construction and building materials sectors (RAIA 1995, p. 1 (see Appendix A 17)).

AMCORD refers to greenhouse gas emissions in the first sentence of the section outlining ecologically sustainable residential development:

Australian cities are characterised by relatively low population densities, the dominance of the motor car and high emissions of greenhouse gases (Department of Housing & Regional Development 1995, PNP 3 p. 1 (see Appendix B 12)).

NatHERS is specifically designed to address energy efficiency in housing; one benefit of this is claimed to be that:

...by implementing mandatory energy performance, the housing sector is able to play its part in reducing greenhouse gas emissions (Ballinger 1998a, p. 1 (see Appendix A 1)).

5.3 NatHERS

The Nationwide House Energy Rating Scheme (NatHERS) was first referred to officially in the NGRS amongst a number of objectives and strategies that relate to the residential sector such as improving access to information about residential energy use, requiring public energy utilities to pay greater attention to demand-side management and the consideration of incentives to encourage householders to adopt practices and appliances that would reduce greenhouse gas emissions. The major initiative related to the residential sector was the establishment of a nationwide house energy rating scheme.

Governments, through ANZMEC and other Ministerial Councils as appropriate, will expedite the development of a consistent nationwide House Energy Rating Scheme for trial in early 1994. This project will also examine the adoption of complementary energy performance standards for new houses by the end of 1994, taking account of the costs and benefits of proposed standards (NGSC 1992).

NatHERS has continued to be the focus of strategies to address greenhouse gas reductions in the residential sector. In November 1997 the Prime Minister announced:

We will expand the Nationwide House Energy Rating Scheme by including a minimum energy performance requirement for new houses and major extensions and we will work with the States, Territories and industry to develop voluntary minimum energy performance standards for new and substantially refurbished commercial buildings.

These initiatives will take us to best practice standards in these important areas. If this voluntary approach does not achieve acceptable progress within 12 months, we will work to implement mandatory standards (Howard 1997).
The NGS refers to residential building design in the section, *Improving end-use energy efficiency*.

*Improvements to the design of commercial and residential buildings have the potential to make an important contribution to limiting Australia’s greenhouse gas emissions. Building design has to be considered in its broadest sense – relating both to the architectural design of the building itself and to the wider building envelope and aspects of subdivision design which impact on energy efficiency* (AGO 1998, p. 47).

The major strategy related to residential buildings outlined in the NGS is to:

... *develop a minimum energy performance requirement for new houses and major extensions taking into account, as appropriate, opportunities offered by existing performance measures, or ratings, such as the Nationwide House Energy Rating Scheme (NatHERS)* (AGO 1998, p. 48).

NatHERS is a system to rate houses on the basis of their potential heating and cooling load. It is intended to influence the design of new houses, increasing their energy-efficiency thereby contributing to a reduction in greenhouse gas emissions from the residential sector. NatHERS is based on computer simulations that use hourly weather data to calculate heat flows to and from a house. Assumptions include standard occupant behaviour patterns for each climate (where the principal variation is in thermostat settings) and that the house will be heated or cooled from 7 a.m. to midnight. The heating and cooling load of the house under review is simulated and these simulations are used to establish its star rating: Five Stars represents the most energy-efficient and One Star the least. NatHERS is designed to encourage the “appropriate use of solar energy and natural climatic influences through what is best described as *solar efficient architecture*” (Ballinger 1998a, p.1 (see Appendix A 1)). NatHERS favours designs that incorporate elements of the solar-efficient model of addressing energy-efficiency in housing (see 7.4.1) such as concrete slab-on-ground floors and north-facing windows.

The development of NatHERS has been protracted partly due to the difficulty involved with determining a methodology that accommodates the different climate zones around Australia and regional differences in construction, energy sources and energy use. However, it is an example of the increasing move to promote environmentally responsible and/or energy efficient housing in Australia through regulations and rating schemes. There is a home energy rating scheme operating in Victoria (now called FirstRate, formerly VicHERS) that is specified as one method of compliance with the energy requirements of the building code (Isaacs 1999). A mandatory scheme operates in the ACT (ACTHERS) where building applications for new houses must include a report showing that the house will obtain a minimum four star rating (ACT Planning Authority 1996). Many local government councils in New South Wales also have mandatory minimum energy performance standards and building applications must be accompanied by a HERS report (see for example, Glendinning 1996; Sutherland Shire Council 1997).
The claims made for the ‘scientific’ basis of the house energy rating schemes reflects the privilege afforded to technological and scientific solutions of a technocentric approach to environmental issues.

*House Energy Rating Schemes (HERS) provide important opportunities for stakeholders in the housing market—the building industry, the consumer and the community—to make informed decisions on the energy-efficiency of houses based on scientific data rather than on myths and speculation* (Ballinger 1998a, p. 1 (see Appendix A 1)).

Indeed, the development of the various house energy rating schemes in Australia (VicHERS, ACTHERS and NatHERS) has involved extensive computer simulations. Simulations were used to determine the range of heating and cooling loads for each star rating and they are used when allocating a star rating for a particular house design. However, the connection between the situations modelled and what happens in practice in terms of actual energy use in real houses is dubious. Energy use is largely determined by the occupants and is the result of a complex web of characteristics including the number of occupants and their age, occupations, lifestyles, thermal preferences and income, the number, type and usage of appliances, and the size and location of the dwelling as well as the materials that it is built from. Each household will have a unique combination of factors and these will change over time with changes of occupancy, changes to the fabric of the building and the changing use of appliances. Many of the cultural, social and economic issues that are likely to have a direct impact on energy use are not accounted for in computer simulations. Other issues such as the affective and emotional aspects of environmental considerations play no part at all.

Rating schemes are based on limited quantitative assessments of the potential for the house design to result in reduced operational energy use. This point is often lost when claims such as the following are made:

*A house rated in the range of 31/2 to 4 stars in the Nationwide House Energy Rating software, will consume approximately 70% less energy for heating and cooling than the same house rated as a 1 star design!* (Ballinger 1998a, p. 1 (see Appendix A 1)).

Implicit in NatHERS is the image that reducing domestic energy use is largely a matter of manipulating elements of the building fabric. The role of the future occupants of the house in determining actual energy use is widely acknowledged and yet in NatHERS the occupants are represented by internal heat gains from a “standard family” based on a daily routine that does not vary. Heating and cooling is modelled as thermostatically controlled despite recent research highlighting the idiosyncratic ways people actually operate heaters and coolers (Lutzenhiser 1992b; Williamson and Riordan 1997). It is also presumed that the occupants will operate blinds and curtains ‘thermostatically’. These assumptions within the computer program are not accessible for testing by designers. In its present configuration NatHERS is entirely unsuited to testing houses in tropical climates that may use no heating or cooling.

NatHERS embodies not only a narrow interpretation of environmental issues—reduced to issues of energy-efficiency—but also a narrow definition of energy-efficiency. It is confined
to addressing the building fabric of housing and then only in relation to heating and cooling load rather than the actual energy used as this depends on the fuel source, the type of heating and cooling plant, and the portion of the house heated or cooled. It is estimated, however, that space heating and cooling accounts for only about 14% of household greenhouse gas emissions, half that of water heating (28%) and 4% less than emissions from refrigeration (Wilkenfeld 1995). This is largely due to the high proportion of gas heating used in Victoria and the fact that wood is still widely used as a fuel for space heating. The type of heating and cooling plant is not accounted for in NatHERS and neither are fuel sources. Similarly, the embodied energy, or energy used to produce the materials that the house is built of (see 7.3.2), are not taken into account. Williamson (1997) has shown that under the current scheme:

... houses may achieve the same rating, based on the sum of heating and cooling load, but in practice could have very different annual household delivered energy and CO₂ emission results depending on the plant installed (Williamson 1997, p. 156).

Although essentially a policy tool, one of the stated aims of NatHERS is that of assisting building designers and architects and their clients to make better choices in terms of “comfort and energy efficiency” (Ballinger 1998a, p. 1 (see Appendix A 1)). This is linked to the program’s ability to ‘simulate’ the impact of different material, orientation and window options. In fact, NatHERS has limited use for architects seeking advice about particular design decisions. It is difficult to access the assumptions built into NatHERS and this limits the architect’s ability to determine how much a particular design project differs from these assumptions. Also NatHERS does not deal with many of the real-world problems that architects are likely to encounter during the design of a house. For example, it does not consider issues that are likely to arise in the choice of appropriate heating and cooling plant (for example, cost, availability, fuel source). NatHERS reduces the complex and variable issues to do with human occupation to standardised patterns of occupancy and temperature control therefore it is of limited use for providing advice to architects and building designers dealing with actual clients. For example, it provides little guidance for dealing with conflicts between aims to do with reducing heating and cooling load and other aims that the occupants may have such as those to do with privacy, the external appearance of the house or the degree of control that they wish to have over their thermal environment. The in-built assumptions of NatHERS about heating and cooling favours the solar-efficient model and disadvantages other design approaches to reducing energy use in housing. For example, design that concentrates on the use of natural ventilation to eliminate the need for air conditioning may have little internal mass and a large area of operable windows to catch prevailing breezes. These features may disadvantage the design if judged against a solar-efficient model that is based on high internal mass and windows designed primarily for solar access.

These examples illustrate the limitations of NatHERS as a source of design advice. And yet, the public image generated by the promotion of NatHERS has ensured that it has become an important source of images of how environmental issues should be addressed in house
design, even for the many architects who do not use the program. Not only are building designers increasingly being required to address rating schemes to obtain building approval but design information of various types refers to NatHERS as a tool for judging the environmental ‘appropriateness’ of housing (see for example, Energy Victoria 1994; Department of Housing & Regional Development, 1995; Hollo 1995; BDP 1995 ongoing).

The adoption by local and state building regulators of NatHERS and other rating schemes as the key components of their environmental policies serves to reinforce the idea that this is an appropriate way to address environmental issues related to housing. Therefore operational energy use becomes accepted (or taken for granted) as the major environmental issue associated with housing and solar-efficient design becomes the ‘societally-privileged’ way of addressing these issues. Gaining building approval for designs that differ greatly from the solar-efficient model or designs that have other environmental goals becomes more difficult as the onus is placed on the applicant to ‘prove’ compliance. Thus not only does NatHERS promote particular issues and ways of addressing them, it also disadvantages other design options.

NatHERS has arisen from Australian governments’ identification of the need to address the environmental problem of greenhouse gas production. The appeal for governments of using a rating scheme such as NatHERS as a way of addressing residential greenhouse gas production lies partly in the fact that it is product-based and therefore easier to regulate for than other approaches such as changes in occupants’ behaviour. It addresses these issues in a generalised way rather than having to ‘measure’ the impact of particular designs on particular sites. It provides a visible message that governments are willing to ‘do something’ about environmental issues associated with housing. It also conveys the underlying idea that this is an issue to be addressed at the level of the individual household and that it does not have to affect the status quo in a fundamental way.

5.4 AMCORD

AMCORD (Department of Housing & Regional Development 1995 – see Appendix B 1-37 for extracts) is introduced in the Foreword as:

... a national resource document for residential development containing up to date technical information and the latest urban research material. It is a manual of best practice covering both infill and greenfield situations. AMCORD emphasises the importance of adopting an integrated, performance based approach to urban development and provides a practical alternative to outdated prescriptive methods.

It is further stated that the audience for AMCORD is primarily:

... designers, builders, developers and State and local planning and servicing authorities. ... Its purpose is to provide State, Territory and local Governments with source material for the development of State and local residential codes (Department of Housing & Regional Development 1995, p. 51).
AMCORD is used as a reference document by local planning authorities and professionals involved with housing development and influences the content and intent of many local development guidelines. Hence it is an important source of design advice for architects and building designers, either directly or through local development guidelines that reflect its principles.

AMCORD has two volumes; Volume 1 consists of Part 1: Setting the Context and Part 2: Design Elements (Neighbourhood Planning, Physical Infrastructure, Stormwater, Streetscape and, Site Planning and Building Design) and Volume 2 contains a series of practice notes and case studies. The term, sustainable urban environment, is used extensively throughout AMCORD and is defined in the section Sustainability and residential development (see Appendix B1) as:

... one in which there is a balance between what the community needs, and what it can afford and sustain, and the long-term preservation of the environment (Department of Housing & Regional Development 1995, p. 26).

Three environmental considerations listed in this section are:

*Minimise the use of resources*
There should be recognition of the relationships between urban form, housing density and type, transport systems and street design, the use of non-renewable resources and energy, and subsequent greenhouse impacts.

*Minimise the negative impacts of development*
The location type and scale of development should be considered in terms of its appropriateness to the environment. Pollution should be minimised through the design and technology of sewage, wastewater, drainage, noise reduction, traffic and other systems.

*Protect sensitive natural systems and habitats from urban expansion*
This includes the need to recognise bioregions based on natural systems (water, soil, air, flora and fauna), to protect these systems from encroachment where some environmental values still remain, and to seek longer-term strategies to withdraw from sensitive regions (Department of Housing & Regional Development 1995, p. 26).

The main design advice aimed at architects and building designers in AMCORD is contained in Site Planning and Building Design of Volume 1 and the Practice Notes Design (PND) of Volume 2. Site Planning and Building Design consists of notes on various design elements (for example, Site Planning, Building Envelope, Private Open Space, Design for the Climate). These notes include a short statement outlining the intent of the element and a set of performance criteria and acceptable solutions for realising this intention.

The section, Design for the Climate (see Appendix B 2-11) relates most closely to this thesis and the intention of this environmental consideration is defined as follows:

*To facilitate energy and water conservation measures in and around housing that will assist in establishing ecologically sustainable residential environments, through the reduction in household use of fossil fuels and greenhouse gas emissions and the use of renewable energy sources* (Department of Housing & Regional Development 1995, p. 189).
It is stated that this may be achieved where solar access is available and when the following Performance Criteria are met.

P1 Building envelopes and internal layouts are designed to minimise energy consumed for heating and cooling

P2 Windows are located, sized and shaded to facilitate good thermal performance

P3 Buildings have an area of roof, with appropriate orientation and pitch, that is suitable for the installation of solar collectors and photovoltaic cells.

P4 Building materials and insulation assist in providing acceptable thermal conditions

P5 Air movement within dwellings is designed to provide acceptable thermal conditions

P6 Building materials, appliances and fuel sources are selected to minimise energy requirements and greenhouse gas emissions.

P7 Landscape design assists microclimate management to conserve energy and water

P8 Building and landscape design incorporate techniques for conserving mains water (Department of Housing & Regional Development 1995, pp. 189-190).

Two examples of Acceptable Solutions are outlined. The first is to attain a minimum rating of four stars from a nationally accredited home energy rating scheme (such as the proposed NatHERS). The second lists a number of factors such as weather sealing, insulating to recommended levels, orientating the building between 30° east and 20° west of north and providing a north-facing living room. In temperate climates this is further refined to specify the number of hours the north-facing windows should receive winter sunlight (3 hours between 9 a.m. and 5 p.m. on June 21st), and that materials of high thermal mass are used for living areas.

A number of case studies are presented in Volume 2 of AMCORD (see Appendix B 16-17 & B 18-25). These are intended to elaborate some of the strategies outlined above. Of the six case studies in Design for Temperate Climate five come from an Energy Victoria publication, *Energy efficient housing manual: design guidelines and case studies* (Energy Victoria 1994).

The goals implied in the case studies are energy and water conservation and the strategies described relate to:

- solar access: living areas are north-facing wherever possible and north-facing windows are sized according to internal thermal mass
- minimising or completely shading east and west windows
- using concrete slabs for ground floors
- shading all windows appropriately
- ensuring walls (where possible) and roofs are well insulated
- allowing for cross ventilation
- draughtproofing
- and, in some cases, installing energy efficient appliances.

83
It is stated that although the guidelines were designed for Victorian conditions “they are equally applicable to other temperate climate areas throughout southern Australia” (Department of Housing & Regional Development 1995, PND 18 p. 1). In line with this, the sites of these case studies are not depicted and apart from one reference to a client wanting to retain views to the west, no mention of the occupants is made. The case studies illustrate a number of the features outlined in the Performance Criteria and they are rated using a house energy rating system.

Apart from the Victorian examples there is one other case study that discusses “a medium density housing project in Sydney that adopted energy efficient and water efficient design techniques” (Department of Housing & Regional Development 1995, PND 18 p. 1). The main features mentioned are:

- living areas and windows face north
- eaves are designed to prevent summer sun’s rays entering
- windows to east and west are either eliminated or shaded to prevent low angle sun entering in mornings and afternoons
- floors are concrete slabs
- ceiling fans are installed in living and bedrooms for air movement
- low embodied energy materials are used in some locations; timber for window frames and framing to upper levels
- dual-flush toilets, low-flow aerated taps and showerheads are installed, and
- rainwater collection is provided.

All the case studies have little specific detail and their main contribution seems to be to reinforce the idea, in a graphical format, that the solar efficient model is the appropriate way of achieving energy conservation rather than explaining how this was achieved in specific cases.

It is stressed in AMCORD that the Acceptable Solutions illustrate ONE WAY of achieving the Performance Criteria, however the image promoted throughout the notes, the Performance Criteria, Acceptable Solutions and the case studies is that reducing space heating and cooling energy use is the prime environmental consideration in house design. Furthermore, certainly for the temperate regions of Australia, there is a concentration on one method of achieving this; the solar-efficient model of house design. AMCORD presents information about this model in terms of prescriptive rules despite the stated intention to provide a performance-based alternative to prescriptive methods. However, as AMCORD is concerned with evaluating house designs rather than occupied dwellings such ‘performance’ assessment can only be theoretical. The only performance-based method suggested for evaluating designs is the use of a house energy rating scheme and this method is promoted as a ‘simple’ way of illustrating compliance.
A national scheme for rating the energy efficiency of all types of dwellings has been developed (NatHERS). When this scheme is adopted at the State and Territory level it will be possible to simplify the detail provided (Department of Housing & Regional Development 1995, p. 188).

The environmental goals identified by AMCORD are extensive and yet the breadth of these aims is not reflected in the subsequent design advice. The aim of facilitating the use of renewable energy sources is not explored beyond the presentation of design principles related to the use of solar energy for heating and natural ventilation for cooling. The Performance Criteria related to the provision of an appropriate roof area for solar collector and photovoltaic cells is not explained further. There is no information about how to select plant or fuel sources to minimise energy requirements. The environmental goal of ‘protecting sensitive natural systems and habitats’ is not substantiated with design advice, presumably because it is accepted that this is an issue that has to be addressed in relation to the particular contexts that it occurs in. However, this suggests that design issues to do with energy and water conservation can be considered in isolation from the many other contextual issues that affect an actual design. There is no attempt to provide guidance on how to address the inevitable conflicts that are likely to arise between the strategies outlined to reduce heating and cooling energy use and other aims outlined in AMCORD such as privacy or maintenance of the streetscape. ‘Inappropriate’ sites (those with poor solar access) are largely ignored. It is simply stated that when solar access is not available “a range of design techniques will be necessary to achieve reasonable levels of energy savings” (Department of Housing & Regional Development 1995, p. 188 (see Appendix B 2)). These techniques are not described.

The goal of ‘minimising the use of resources’ is reduced to design advice related to the energy used for heating and cooling a dwelling again reinforcing the image that this is the major aspect of sustainable development of concern to building designers. Other strategies that could be adopted to address the stated goal, such as minimising the embodied energy of the building, minimising the building’s size, or incorporating renewable energy systems, are either ignored or referred to in a superficial way. Although one of the stated Performance Criteria is that building materials, appliances and fuel sources should be selected to minimise greenhouse gas emissions there is no further information about how to do this.

AMCORD presents the image that it provides a comprehensive approach to the issues of sustainable residential development. However on closer inspection it concentrates on the goal of reducing residential heating and cooling loads through the promotion of the solar efficient model of house design.

5.5 BDP Environment Design Guide

The Royal Australian Institute of Architects (RAIA) released its Environment Policy (see Appendix A 17-22) in 1993. This Policy “reaffirms the responsibility of the architectural
professions to contribute to the quality and sustainability of the natural and built environments” (BDP 1995 ongoing, Gen 1 p. 1).

The architectural profession is committed to environmental and social sustainability. Such a commitment will contribute to preserving and restoring the ecological processes on which life depends, thereby providing the opportunity to maintain or improve the quality of life for current and future generations, and maintain the intrinsic values of the natural environment (BDP 1995 ongoing, Gen 1 p. 3).

The issues that are identified as necessary for the architect to consider are immense in scope and reflect the ‘global’ emphasis of the Policy.

Ecosystems will be affected by decisions the architect makes regarding the use of resources, which must be defined to include materials, energy, amenity and waste. In making design decisions, the architect must consider the effects, both long term and short term, on ecosystems over the entire product life cycle - from materials extraction, processing and transport through to possible fire, demolition and disposal. These effects may range from the local to the global (BDP 1995 ongoing, Gen 1 p. 3).

The RAIA Environmental Policy contains 5 principles (see Appendix A 19):

1. Maintain and, where it has been disturbed, restore biodiversity
2. Minimise the consumption of resources, especially non renewable resources.
3. Minimise pollution of air, soil and water.
4. Maximise the health, safety and comfort of building users.
5. Increase awareness of environmental issues (BDP 1995 ongoing, Gen 1 p. 3)

Each of these principles is elaborated with a list of recommended design actions. For example, there are fourteen design actions listed for the second principle, minimising consumption, each one involving complex considerations that are context-dependent (for example, practising land and soil conservation, recommending building on and rehabilitating already disturbed and degraded land).

The approach identified in the Principles is generally in line with the environmental management version of technocentrism with emphasis on resource conservation, education, the role of the expert and an acknowledgment of inter-generational responsibilities. However, the natural environment is mentioned in terms of its intrinsic rather than instrumental value.

The Environment Design Guide (BDP 1995 ongoing – see Appendix A 1-46 for extracts) was launched shortly after the RAIA released its Environment Policy. The Environment Design Guide “provides technical and other information which specifically addresses the Environment Policy” (RAIA 1993, p. 90). Originally published by the RAIA, in June 1999 publication of the Environment Design Guide was taken over by The Australian Council of Building Design Professions an umbrella organisation that represents professional architects, engineers, quantity surveyors, landscape architects and planners. The Environment Design Guide is available by subscription to members and non-members of the professional organisations and has a loose-leaf ring-bound folder format with additional material being sent to subscribers several times a year. Articles are generally written by “an authority in the
field" or by RAIA staff and cover General Issues, Design Strategies, Technology, Products/Materials, Case Studies, Newsletter and Notes.

One of the main features of the Environment Design Guide is its attempt to ‘cover the field’. There is an acknowledgment of the many environmental issues related to the built environment and it addresses this by producing many discrete articles on a wide variety of topics. For example, General Issues outlines many issues including biodiversity, ecologically sustainable office practice, embodied energy of living, design strategies for energy efficiency, recycling and the health aspects of building materials. In June 1999 there were 24 articles in the Design Strategies section. More than half relate to energy efficiency or to some aspect of it such as thermal mass, lighting, ventilation or thermal simulation computer programs. A further four are related to water conservation, four to practice issues such as client briefing and site management and one, entitled Perceived Comfort, is related to the occupants of buildings. One consequence of this broad approach is the sheer bulk of the material presented; by mid 1999 there were more than 600 pages.

Strategies for addressing environmental issues are outlined in the Design Strategies section and are evident in the Case Studies. In the period from 1995-1998 the fifteen case studies range from a toilet block to a multi-storey building and include four residential examples although one of these essentially describes a geothermal heating system for a medium high-rise apartment development in Adelaide, South Australia.

The Armstrong-Mobbs Sustainable House case study (Prasad & Veale 1998a – see Appendix A 25-28) describes an extension to the north-facing rear of a terrace house in inner-Sydney, New South Wales that incorporates many energy and water conservation and waste treatment features. The project is “an exercise in self-sufficiency” driven by the concerns and beliefs of the owner-clients.

The goals for the project are listed as:
- no storm water to leave the site
- no sewerage to leave the site
- collect sufficient potable water on-site to meet resident requirements
- be a net exporter of electricity over twelve months, and
- use recyclable or sustainable materials wherever possible.

Case Study 13 (see Appendix A 29-34) describes a display house for the Capricorn range of project homes designed for the Sunshine Coast region of Queensland (Prasad & Veale 1998b). This design is intended to offer “energy efficiency and comfort in an affordable package” and “the opportunity to enjoy the natural environment”.

87
The strategies outlined to achieve this include:
- planning for natural ventilation and solar access
- prefabrication
- use of lightweight construction
- optional water collection, and the
- incorporation of covered external deck.

The first completed stage of the Homebush Newington Village at the Olympics site forms the basis of another case study (Prasad & Veale 1998c – see Appendix A 35-46). This development is intended to provide a ‘model’ of urban and ecologically sustainable development residential development. The goals of the project are to realise a substantial reduction in:
- CO₂ emissions compared to similar developments
- household energy demand
- the use of PVC, and
- potable water use.

The strategies outlined to achieve these goals are:
- installation of rooftop photovoltaic cells to all single lot dwellings
- planning for solar access and natural ventilation
- use of gas appliances
- use of low toxicity, low embodied energy materials, and
- use of reclaimed water for non-potable purposes.

The goals outlined in the case studies concentrate on water conservation and energy efficiency. They are most specific in the case of the Armstrong-Mobbs house. This may reflect the fact that this was a case where the occupants were active participants in the design process and were able to define their goals in a fairly specific manner.

The *Environment Design Guide* is an attempt to bring many environmental issues before the building design professions. It does so by presenting many simple and discrete views rather than describing the interaction between issues and in this sense adopts a non-design stance. The integrative nature of design, and the importance of the contexts that it occurs in, are overlooked in much of the design advice in the *Environment Design Guide* to the extent that environmental issues are treated as if they occur with minimal relationship to other concerns (for example, cost and time constraints). Much of the information is presented in a general way ignoring the fact that design involves the need to respond to a particular brief, a specific site and particular clients. The emphasis in the *Design Strategies* and *Case Studies* is on a ‘global’ view of the environment. There is an implication, through the scope and the sheer bulk of the material presented in the *Environment Design Guide*, that the architect needs to be an expert in a vast range of areas to adequately address environmental issues. And yet once
again the range of images of the environmental issues to do with house design and how to address them are relatively narrow. There is an emphasis on issues to do with energy-use that leads to the image that environmental issues in house design largely involve designing to reduce energy for heating and cooling. There is also a predominance of the image of the solar-efficient model as an appropriate approach for doing so. The alternate view of the environment as ‘fields of significance’ for the inhabitants (encompassing affective, emotional and symbolic concerns) is largely absent from the Environment Design Guide.

5.6 The images

The preceding sections outline the formats and critically reviews the content of the three selected sources of design advice explored in this thesis. These examples are influential constituents of the wider body of design advice about the environmental aspects of house design currently available to architects in Australia. Many other sources of design advice present similar information and/or refer to these examples in a way that presents the image of a consensus view of ‘what should be’ regarding the environmental issues in house design in Australia.

The following section discusses, in more detail, the images presented by the selected sources of design advice. In particular it focuses on those images identified as important for design decision-making: the value, goal and strategic images (see 2.4.3).

5.6.1 Value images

The predominant environmental values expressed in the documents reviewed are technocentric reflecting the rhetoric of Australian governments’ that economic priorities can be meshed with environmental objectives. For example, in his speech outlining the National Greenhouse Strategy (NGS), The Prime Minister says:

Since its election the Government has addressed the critical issue of global warming in a way that effectively promotes Australia’s national interests.

Those interests lie both in protecting Australian jobs and Australian industry whilst ensuring that Australia plays her part in the world wide effort needed to reduce greenhouse gas emissions.

... 

Today I announce the largest and most far-reaching package of measures to address climate change ever undertaken by any government in Australia.

The package carefully preserves a unique environment and lifestyle for our children’s sake, defends wealth creating efficient industries and promotes lasting employment into the future. It provides a durable framework to promote Australia’s national interest towards the year 2010 and beyond (Howard 1997).

The message of this speech is that environmental issues are important and that environmental problems should be addressed but that this should be accomplished in a way that does not compromise existing development, jobs or current lifestyles. The issues referred to in the speech above and in the three sources of design advice reflect the ‘global view’ of the
environment (see 2.3.3). This environment is described by experts and common to everyone. The global view is evident in the design advice through the concentration on environmental problems, and specifically those with global implications such as greenhouse gas production, resource use and biodiversity loss. There is an image in the design advice that these issues may affect everyone therefore they are of concern to everyone and will be influential considerations in design decision-making.

The three sources of design advice reflect the values of scientific objectivity. It is implied that environmental problems, and their potential solutions, can be defined in an objective way through the use of appropriate scientific methods. Computer modelling including thermal simulation programs are an important source of knowledge both about the causes and consequences of environmental problems, and about proposals for addressing them. The major environmental concerns relate to issues that can be quantified such as energy use (particularly in relation to production of greenhouse gases) and, to a lesser extent, water use. Other issues such as biodiversity are mentioned but are not treated as comprehensively.

The image of the design process that emerges from the design advice is that it is systematic and ‘rational’. The consideration of environmental issues during the design of a house is seen to involve gathering the information necessary to understand the environmental implications of design features, being aware of appropriate solutions, and then making appropriate, informed decisions. The well-informed architect will be able to recognise those design features that are energy and water-efficient and incorporate them into the design of the house. The architect is presented as the major (if not sole) decision-maker. The lack of mention of the future occupants of the house (and/or the clients) presents the image that, in terms of addressing environmental issues, their influence is either negligible or their aims are congruent with those of the design advice. Similarly, the absence of mention of other design aims creates the image that decisions that affect environmental issues will override or will not conflict with other design aims. The design advice projects the image that ‘good’ design can be achieved through following prescribed courses of action.

The proposed solutions for addressing environmental problems presented in the design advice reflect an ‘environmental management’ attitude towards dealing with environmental issues. In this view development is seen as inevitable, beneficial and a measure of an advanced society. It is, however, acknowledged that there may be undesirable environmental consequences of development and therefore a better understanding of the problems themselves is required. Solutions are sought that maintain the benefits of development while minimising environmental degradation. These solutions are identified using scientific techniques; houses that receive a Five Star rating through NatHERS or that closely reflect the solar-efficient model (in temperate Australia) are promoted as the ideal. The solutions that are promoted also reflect the existing status quo. For example, the house designs that are illustrated in the case studies tend to have ‘typical’ construction (usually brick veneer and
concrete slab on ground floors for temperate regions) and they are generally large (often with 3 or more bedrooms, 2 bathrooms and separate living and family rooms) and, externally, they reflect contemporary housing styles. There is virtually no mention in the design advice of the strategies of either not developing or minimising development, strategies that, measured in terms of resource use and pollution, have obvious environmental benefits.

The three sources of design advice focus on solutions that involve the manipulation of elements of the built form and the incorporation of energy and water savings features. Strategies for reducing energy and water usage, and reducing greenhouse gas emissions, are discussed primarily in terms of incorporating appropriate features into the design of the house. This leads to the image that the building itself is responsible for energy use. The role that the future occupants will play in determining the energy used in the house is not reflected in the design advice creating the image that either their influence is not considered important or that it falls outside the domain of the architect and the design process.

In these sources of design advice the evaluation of outcomes is discussed in terms of quantification. This is certainly true of NatHERS where houses are evaluated by ‘measuring’ the potential impact of certain design features. It is also evident in the language used in AMCORD and EDG. They refer to the benefits of appropriate design in terms of ‘conserving resources’, ‘reducing greenhouse gas emissions’ and ‘reducing household use of fossil fuels’. This suggests that there are ‘measurable’ differences between design alternatives and quantifiable improvements possible through the incorporation of appropriate design principles. The design advice presents the image that the benefits of ‘good’ design will be realised both at the level of the wider (or global) society through such things as reduced energy use and reduced greenhouse gas emissions, and for the individual household through monetary savings and comfort.

5.6.2 Goal images

The major goals of these sources of design advice are to identify and promote the awareness of environmental issues related to housing that are of concern to Australian society and to provide appropriate models of addressing them. A more specific goal is to provide information about reducing the use of fossil-fuel based heating and cooling energy in housing in order to address greenhouse gas production in the residential sector. Although the goal of creating healthy and comfortable buildings is mentioned in both the RAIA Environment Policy and in AMCORD, it is not treated in as comprehensive manner as design to reduce energy use. There are also implicit goals to do with ‘advertising’ the governments’ and architectural profession’s understanding of, and commitment to, environmental issues.
Two major goal images are evident in these sources of design advice.

**Design that is energy-efficient**

The goal image of a house that is energy-efficient predominates in all three sources of design advice. This image carries connotations of moral responsibility – that this approach has to be adopted for the good of the planet. There is also a suggestion of deprivation through the frequent use of terms such as ‘reduction’ and ‘conservation’. The term ‘efficiency’ suggests a workmanlike or machine-like approach to design.

More specific versions of this goal image are evident in the promotion of particular models of energy-efficient design in these sources of design advice. The main goal image promoted for the temperate regions of Australia is that of the solar-efficient model (see 7.4.1). This solar-efficient image encompasses materials choices, siting, and layout as well as images of the way the house will ‘work’ thermally, and in terms of operational energy use. Design is directed towards reflecting this image as closely as possible. There is less emphasis on other climatic regions although another goal image referred to in AMCORD (see Appendix B 26-31), and in a very minor way in EDG, is that of the tropical model (see 7.4.2).

**Design that conserves water**

Another strong goal image of the design advice is that appropriate design should result in water conservation. In this case the image is not just related to the built-form but encompasses both house and site.

**5.6.3 Strategic images**

There are two main strategic images evident in these sources of design advice for addressing the goals outlined above.

**The use of policy**

Policy can be defined as “a course of action adopted and pursued by a government, party, ruler, statesman, etc.; any course of action adopted as advantageous or expedient” (SOED 1984). The RAIA Environment Design Policy is an example of policy from a professional body that is intended to direct the conduct of its members. It specifies issues of concern and suggests appropriate approaches for addressing them. While voluntary, such a Policy sets the framework for defining environmental ‘appropriateness’ for its members.

NatHERS and AMCORD are examples of government policy that is intended to realise an identified objective - in this case the reduction of greenhouse gas production associated with residential development. They are both components of a strategy to incorporate such issues into legislative requirements for new residential development. In these cases the policy is intended to promote certain aspects of house design that it has been deemed are able to meet
this objective. Policy is largely based on promoting strategies that have been identified as acceptable or successful and thus they look to what has been done before.

The use of design guidelines and case studies

The design guidelines and case studies are intended to supplement and describe the policy in a design-orientated way. They illustrate the strategies. For example, the case studies in AMCORD and the EDG describe the solar-efficient model as a way of addressing greenhouse gas reduction in housing in temperate climates.

5.7 Discussion

The image of ‘what should be’ arising from these sources of design advice is that the design of the house should result in a building that provides a thermally comfortable environment while reducing the use of fossil-fuel based energy and hence reducing greenhouse gas emissions. Environmental issues are largely considered in ‘global’ terms as evidenced by the identification of potential global climate change as the major issue of concern. The intention to address this issue, promoted to architects, building designers, developers and home buyers through design advice (policy and guidelines), is considered to reflect the values of the wider Australian society. The design advice promulgates strategies that have been identified as appropriate for addressing environmental issues in house design. These strategies are usually presented as design principles related to physical aspects of the house such as the choice of wall and floor materials, its form, layout and siting. Other contextual issues including cultural, financial, locational and lifestyle concerns are largely absent.

One of the overwhelming impressions arising from these sources of design advice is that, compared with the architects’ images, they portray a narrow and relatively uniform range of images of how environmental issues should be addressed in house design. The interviews with the architects highlighted the complex, inter-related, context-dependent nature of the issues considered during the design of a house. Many of these factors are disregarded in these sources of design advice in order to concentrate on one aspect of the design process – design to address ‘global’ environmental problems and specifically energy use. These issues are considered as if they can be isolated from other design concerns. The images of how these problems should be addressed are dominated by the solar-efficient model of house design. By contrast, the images arising from the interviews were as various as the number of design projects discussed. The interviews highlighted the significance for design of the particularities of place, time and participants. The importance of specific issues arising from particular design projects for determining how environmental issues should be addressed is not reflected in design advice that adopts a global view of the environment. Information is generalised and presented as applicable (or adaptable) to all design situations. No doubt this is connected in part to the format of the information and for reasons of brevity and focus. Nonetheless this gives the impression that these design issues are straightforward.
The images of people embodied in these sources of design advice are noticeably different from those identified with the architects' images of 'what should be'. Both the EDG and AMCORD identify a link between current environmental problems and the type of urban development that has evolved in advanced industrial societies. Although the causes of the problems are strongly identified with human habitation, people are assigned a very minor role in the design advice view of how such environmental problems should be addressed in the future. The roles of the clients or future occupants of the house in determining these factors are virtually ignored. The occupants are represented mainly through assumptions about comfort. The emphasis on the connections between built-form and energy use is presented in ways that suggest that energy use can be (and, perhaps, should be) considered separately from those issues to do with humans such as social, cultural and economic concerns. By contrast, the architects' view of energy use in housing (as with other housing issues) is intimately connected with images of people. There are images of how the future occupant's will live in, and operate the house, and of what sort of appliances they are likely to have, what their budget is, what thermal conditions they prefer, etc.

The interviews highlighted the fact that the design process involves many participants who may have conflicting goals and values. Most of these participants (for example, builders, clients, suppliers, local authorities) are absent from the image of the design process presented in these sources of design advice. Also absent is a sense of the co-operative nature of design where clients and architect negotiate joint understanding of issues. The design advice view of the role of the architect centres on his or her making appropriate, informed decisions during the development of a design. A number of other aspects of the architect's role in the design process were raised during the interviews. Most importantly, many of the architects commented on the educative role they played with their clients: drawing their attention to environmental issues, explaining the connection between aspects of the built-environment and energy use, and outlining design opportunities.

These sources of design advice present the image that environmental issues essentially involve problems to be solved or managed. This contrasts with the image emerging from the interviews. While recognising a link between the built-environment and environmental degradation, many of the architects considered the environmental aspects of house design largely in terms of opportunities to be realised in design.

The evaluation of outcomes suggested by the design advice is discussed in terms of quantification. In many ways this is not a useful image for design decision-making. Current understanding of the quantitative aspects of individual household energy use and greenhouse gas production is limited and the future impact of design features is unknown. It is not possible to actually measure the environmental impact of different design alternatives. Although the design advice does not suggest that this is what designers should do it is implied that the difference between alternatives is measurable. This can be confusing or
misleading if designers attempt to evaluate alternatives quantitatively. There is little way of evaluating designs in these terms apart from assessing how they comply with prescriptive rules or with an existing model (for example, the solar-efficient model), or by comparing them with ‘normal practice’ (for example, do they have more insulation, or more efficient appliances and plant than ‘normal’). The architects, on the other hand, indicated that they evaluated the finished house against their own, and the clients’, images of what they were trying to achieve.

Many of the benefits of ‘good’ design referred to in the design guides (such as reducing greenhouse gas emissions) accrue to the wider society at some time in the future rather than to the individual household. The contribution from an individual household is likely to appear negligible if considered only in quantifiable terms. The impression emerges from the architects that an important benefit of addressing environmental issues is that it reflects the values and concerns of the participants and is considered ‘the right thing to do’. The design advice projects a more analytical and scientific approach and therefore philosophical, affective and symbolic issues are either ignored (NatHERS and AMCORD) or are given minor coverage (EDG). Other benefits to the individual household referred to in the design guides include monetary savings and comfort. However, the future monetary savings possible through energy-efficient design are likely to appear remote and small compared to the capital costs involved with building a house. Therefore they may not be an important consideration in decision-making. The design advice presents little guidance for evaluating designs in terms of their impact on comfort.

The differences between the architects’ images of ‘what should be’ and those embodied in the sources of design advice discussed in this chapter, indicate why design advice may be misleading, inappropriate or simply irrelevant in practice. For example, these sources of design advice present the image that the reduction of greenhouse gas emissions is of significant importance during the design of a house. Architects and building designers who do not recognise this as an important goal may consider the design advice irrelevant. The image presented by the design advice that reducing greenhouse gas emissions essentially involves designing to reduce the energy used for heating and cooling may be misleading if other important issues, such as the energy embodied in the materials, or the size of the building, are overlooked. The particularities of site and/or clients may preclude the solar-efficient (or other) models of energy-efficient design. There is little information in these sources of design advice about other strategies or design approaches that could be taken. The lack of images in the design advice of the future occupants may be confusing when, in practice, they are a vital consideration in the design process.
5.8 Summary

This chapter considers three key sources of design advice that architects in Australia are likely to refer to, or be influenced by, in the consideration of the environmental aspects of house design. It outlines the format and content of each and describes the goals and strategies for achieving these goals that they promote. The value, goal and strategic images embodied in these examples are considered in more detail.

The value, goal and strategic images arising from the interviews with the architects described in Chapter 4 and those embodied in the design advice are compared. Many differences are found and these are traced to different images of 'the environment', and of the design process, including the role of the future occupants.
6. The architects' images of 'what is'

6.1 Introduction

The previous two chapters outline images of 'what should be' from the point of view of the architects interviewed and as expressed in three important sources of design advice about the environmental aspects of house design. This chapter and the one following consider images of 'what is' from these two points of view.

As indicated in Chapter 2 a portion of the architects' knowledge about how the world works ('what is') involves images of environmental issues, housing, the role of the architect and the nature of design in Australia. The architect will draw on these images when faced with a new design project to understand and frame this project. Images of 'what is' also form the basis for images of 'what should be'.

This chapter outlines the key features of images of 'what is' that emerged from an analysis of the transcripts of the interviews. It begins by reviewing the sources of these images and then outlines images related to 'the environment', and to housing and to the practice of design. Due to the comprehensive nature of images there is some overlap and some repetition between the sections. The chapter concludes with a discussion of the role of these images in the consideration of the environmental aspects of house design.

6.2 Sources of images of 'what is'

During the interviews the architects were asked where their ideas about 'what works and what doesn't' regarding environmental issues came from and whether they used any specific 'aids' during the design process. Their responses provide an insight to their sources of images of 'what is'. Further insight was provided by an analysis of the transcripts of the interviews. This revealed that the architects often made references to the sources of their ideas in response to other questions, or when they were clarifying an issue or illustrating a point. The architects referred to a wide variety of sources of information about environmental issues and house design ranging from general life experience to publications about specific topics.
MARK: I do pick up stuff from trade magazines, advertisements about different materials or products. But in general it’s just over the years looking at things, talking to people. Looking at traditional architecture, actually that’s a major influence, and thinking about what these people were doing and why they were doing it. You don’t have to absolutely mimic it but if the reasons for doing what they were doing are still valid well then perhaps we should be doing something similar...

Several architects mentioned ‘theoretical’ sources such as their education, design guides, trade literature, journals and books about housing and environmental issues. Two of the documents referred to in Chapter 5 were mentioned by name; NatHERS (Ballinger 1998a) and the RAIA Environment Design Guide (BDP 1995 ongoing). AMCORD (Department of Housing & Regional Development 1995) was not mentioned.

HELEN: Where do your ideas, about what works and what doesn’t, come from?

JANE: Well I guess in a low-key way looking at things like the Environmental Notes from the Institute of Architects. Our education dealt with issues of good passive design principles, issues of orientation, sun shading and so on; just being interested in environmental projects, going to conferences where those sort of things are talked about, buying books and I guess just low-key background reading and research.

The references to theoretical information often indicated that this was used to get a general understanding of particular issues rather than studied in detail to acquire technical expertise.

When Adam mentioned the Environment Design Guide he referred to how he used it.

ADAM: Well, I’ve used it for substantiating arguments about embodied energy, for example. By flipping through it and looking at some of the examples there are issues around how we use thermal mass and natural ventilation to cool major buildings. I’m looking at a community centre at the moment which will operate in that way if they can get the funding together for it, so there’ll be a lot of information that I’ll go back to the Guide to get. It just provides me with a broader understanding. I haven’t really sat down to read it. And I’ve been getting it since day one. But this bundle of stuff arrives and I’m flat out and I say, put it in the file, let’s stick it in the catalogue and I’ll read it later. It just grows. There’s just so much to do.

Adam also indicated that he was aware of NatHERS.

ADAM: The technical side of things I have some difficulty with, because there are so many variables in any of those things. I mean even NatHERS gives me a bit of a chill down the spine because it cannot possibly cope with the whole issue.

Two other sources of design advice identified by name were, Windows and Energy (Williamson et al. 1993) and Sunshine and Shade in Australasia (Phillips 1983). Windows and Energy consists of a series of charts that enable the designer to determine the amount of solar energy entering a window of various orientations and external horizontal shading. Figures derived from the charts can then be compared with tables of recommended solar gains. Sunshine and Shade in Australasia contains charts that plot the angle of the sun at different times of the year and can be used to determine sun penetration through a window. Others design aids referred to generically ("the sun charts that map the angle of the sun"),
“that chart thing” and “the little chart”) either refer to *Sunshine and Shade in Australasia* or a simple version that illustrates the sun angle at noon on the summer and winter solstices. These examples provide information about specific issues that a designer may be interested in when considering the environmental aspects of house design. They can also be a source of images of the paths of the sun and solar penetration through windows in different orientations.

Apart from these examples there were some mentions of un-named sources of theoretical information. In her interview Sarah referred to statistics about the environmental problems associated with the built-environment:

SARAH: And . . . one of the figures from California is that the built environment has 15-45% of the harmful effects on the environment.

Another source of theoretical information was the designs of other architects. Three architects were referred to by name; Gabriel Poole (see Figure 7.1), Troppo Architects (see Figure 7.2) and Glen Murcutt (see Figure 7.3). Two of these references were to houses that the interviewee had not actually visited suggesting that they were known through public representations such as in journal articles, books or exhibitions. The work of these architects has been widely publicised not only in professional journals but also in the popular press. Murcutt has had a number of books written about him (Drew 1985, 1999; Fromont 1995) and books on the work of Poole (Walker 1999) and Troppo Architects (Goad 1999) have recently been released.

MAUREEN: Gabriel Poole’s roofs sort of inspired me. Do you know the latest house he’s done? That was sort of an inspiration. And also a design that Troppos were doing when I was up there . . .

GARY: The underneath had to be sealed because it is a bushfire-prone area . . . I would have preferred the light Murcutty look of 'touching the ground lightly' but in this case we had to seal the under floor space.

The term ‘touch-the-earth-lightly’ has become intimately connected with Murcutt’s work. Drew quotes a reference to a similar saying amongst aborigines in Western Australia:

...which admonishes man to avoid disturbing nature any more than is absolutely necessary. But in addition, it conveys a sense in which the landscape is seen to possess a sacred character. It says, walk on tip-toe, be gentle with Mother Earth. The houses of Glenn Murcutt convey a similar reverence (Drew 1985, p. 54).

The term touch-the-earth-lightly has become associated with aspects of the visual form of some of Murcutt’s buildings in an almost literal way: the lightweight elevated construction (clad with timber or corrugated iron) that touches the ground only at the footings, and the large areas of glass, that is often louvred and shaded with internal or external venetians.

References were made to a number of images of place types that reflect theoretical information about constructional or other design principles. Specific examples were: “low
energy house”, “passive solar”, “Five Star design”, “energy-efficient houses”, “rammed earth buildings”, “southern European terrace house”, “tropical or Asian building”, “low-cost houses” and “pole-frame houses”. These terms refer to design concepts rather than built examples and, therefore, are particular (although not exclusive) to the built-environment professions. To those involved in building design these terms convey images that connect structural and constructional considerations with visual appearance and with thermal performance. Terms such as “low energy house”, “passive solar”, “Five Star design”, and “energy-efficient houses” are often used to refer to the solar-efficient model (see 7.4.1).

Several architects responded to the question about whether they used design aids by saying that they did not and that they relied instead on their “intuition”, a ‘gut feeling’ or a “wing and a prayer”. After stating that he worried about NatHERS dealing with “the whole issue” Adam went on to say:

ADAM: ... and neither can my brain and I rely heavily on an intuitive sense about all sorts of things, particularly in domestic architecture where I’m relating directly one-to-one with my clients. Something else starts relating as well as those surface connections we have; there’s an intuitive understanding that’s going on. And I give it as much opportunity to express as I can.

Indeed, theoretical information formed a relatively minor part of the range of sources of images referred to by the architects. Most references were to less ‘formal’ sources and involved places and events that the architect had experienced personally. Several architects referred to the importance of travelling and experiencing different house forms in different cultures and climates.

GARY: I guess that travelling . . . different houses, different styles of buildings in different climates. We looked at all these lovely tropical examples, and desert examples . . . to see them work in reality and live in them was quite an interesting experience.

One of the most frequently mentioned sources of images was that of the houses the architects had lived in or visited. These provide a source of images that connect the sensual or thermal aspects of design with other design issues such as form, siting, layout and materials. They also provide a source of images of the affective and emotional aspects of dwelling. They were mentioned as sources of ideas about successful design features and those that should be avoided (for example, problems with western sun or houses that were dark).

JANE: [M]y mother is an architect. I’ve lived in probably 5 or 6 houses that she’s designed and they’ve always had good orientation. We never had air conditioning and our houses were always much cooler in summer than my friends’ houses. So I grew up knowing that houses didn’t have to be baking hot in summer and freezing cold in winter. I should say that when we first came to South Australia we lived . . . in an old villa which was freezing cold in winter and after 3 days of a heat wave was unbearably hot inside, so I did have an experience of living in what was a more traditional way of building as opposed to long thin houses that faced due north and had good solar access and good sun shading.
MARK: I don't think a lot of consideration is given to the fact that you get a lot of shade in winter, an incredible amount of shade. And that's probably come because of my own personal experience with building where I live. I'm sure that's where it's from. Over the years you realise that most of the winter when you really want the sun, the garden is actually in shade. And it really annoys you, so you try and do something about it. . . .

The architects indicated that the experiential knowledge of houses and other buildings provided a source of images related to specific design concerns and also of the 'feeling' of certain spaces.

MICHAEL: Whenever I think of the seaside situation and I know that people are going to put a balustrade up and then get frustrated from looking through it . . . I recall a beach house on the south coast where we sat down in the chair and all you could see were these permapine barriers. So that obviously stuck pretty well; so there's an awareness of that.

MAUREEN: My great-uncle's house . . . where I've been staying since I was very young, was an old garage and he turned it into a house. And it has a big double garage swing-up door and one metre behind that has glass sliding doors . . . Really interesting. So you can have that open and of course it provides great shelter as well, because it's this little patio area. It's fantastic, really, really fantastic. And it also creates an interesting space just as you come in the sliding door because that part of the ceiling has to be lower to accommodate the swing up roof. So that's 600 or 700 mm lower than the rest of the ceiling so that as you walk in from the outside you also have that sort of verandah feeling because the ceiling is lower . . . You know all these sort of things, they're really interesting and I know they feel pleasant . . .

GARY: I remember at home that we had one north facing window and that was a nice room.

The architects referred to their clients' use of their experience of existing or previous homes as a source of images about such things as whether or not they would need air-conditioning and what sort of materials they wanted for the house being designed. In some cases, such as the clients referred to in 3.5.1, this can lead to the problem of misleading images due to the limited experience of the clients or where the images are based on 'bad' designs.

Knowledge of the experience of dwelling is invaluable for understanding what is 'normal' for a particular climate and place, what may be needed in terms of comfort and what a house is likely to 'feel' like. One architect identifies this as a qualitatively different way of knowing about houses from the normal presentation of architectural information.

MICHAEL: If you think about a house that you live in you don't particularly think about the plan or even the elevations. Most of it you never even look at. There are other qualities which add up to make a house attractive or memorable or whatever.

The previous houses designed by the architects provided another important source of images. These constitute a repertoire of design ideas and information about such things as sources of materials, construction techniques, and the time and cost implications of design decisions. In some instances the on-going relationship between the architect and former clients meant that the architect had visited the houses after design completion. This provided invaluable information about how previous designs worked as lived-in houses.
Other houses and house types were also important source of images. Some of these may have been experienced directly while others would be known in a more 'theoretical' way. There were many references to existing, familiar house types in South Australia for example, "Californian Bungalow", "suburban project-type homes", "traditional stone cottages", "Cornish miners cottage", "traditional villa" and "Australian homestead". During the interviews the place types were referred to in a way that presumed that the architect and interviewer had a shared image of the type. Indeed these terms immediately conjure images to do with external appearance but also, depending on the context of their mention, such things as construction, their likely location, how they are likely to be used, their 'feel' and a sense of their appropriateness to the time or place. It seems that many of these place types are familiar to a wide range of South Australian residents, not merely architects.

The preceding section outlines references to sources of information that emerged in the interviews. No attempt was made at the time to carry out a more exhaustive survey of the architects' sources of information. Nonetheless the references above indicate that the architects draw from a wide range, including personal experiences, and those of other people, and public images related to design and environmental issues.

6.3 The architects' images

The images that the architects have of 'what is' regarding 'the environment', housing and design will be important for their understanding of the contexts in which decisions are made about the environmental aspects of house design. The analysis of the transcripts of the interviews revealed many images related to these three issues: in some cases these were explained or elaborated, and in some cases their meanings were evident due to the context in which they were raised. These images encompass broad and interlocking concerns that are often difficult to disentangle and would be impossible to elaborate fully. The following sections highlight the major images of 'what is' related to environmental issues, and to housing issues and design issues that emerged from the interviews. Once again, no attempt was made at the time to carry out a more exhaustive survey of the images that the architects' used during design. The images that are discussed below are simply those arose during the interviews.

6.3.1 Images of environmental issues

As pointed out in 3.2.2 there was no attempt to define for the architects the nature or scope of the 'environmental' issues to be discussed during the interviews. The issues that the architects chose to talk about reflect, in some ways, their understanding of what 'environment issues' are. Some of the architects were explicit about their environmental concerns and in some cases these concerns were identifiable mainly through the value, goal and strategic images that emerged from the interviews.
'The environment' was referred to in the interviews both in terms of the ‘global’ view and that of fields of significance highlighted in Chapter 2 (see 2.3.4). The global view was evident in the references to large-scale or ‘global’ environmental problems such as the production of greenhouse gases and the depletion of resources and threats to natural habitats. It was also apparent, by implication, in concerns about energy use (both operational and, to a lesser extent, embodied energy). Energy use was often discussed without reference to why it was of concern although it appeared that it was to address 'larger' environmental concerns rather than to reduce costs for the future occupants.

The view of ‘the environment’ as a field of significance for the individual was reflected through the discussion of particular sites and settings and their meaning and significance for particular clients. Important aspects of this view included the natural features of the landscape, and of the climate (particularly the sun and the wind), and the way they interacted with the building and the occupants. This view of ‘the environment’ was also obvious through the range of environments identified. Specific references included: the “internal environment”, the “built-environment”, the “work environment”, “the economic environment” and the “natural environment”. Each of these environments would be defined by, and specific to, the subject. All the architects referred to environmental issues in these terms. Most of them also referred to the global view. Often the term ‘environment’ was referred to without a qualifier although usually the meaning of the term was evident through its context.

One architect reflected that the nature of environmental concerns associated with the built-environment is not static. In the 1940s these concerns were related to Modernist ideas about comfort; in the 1970s the ‘oil crisis’ turned attention to the finite nature of certain resources and lead to an interest in energy conservation and in the 1990s the issue of greenhouse gases has become the focus of concern.

The architects referred to environmental issues in ways that suggested that their images of them were inextricably linked with issues to do with people. This was to be expected when environmental issues are considered in terms of their significance for the individual, but it was also evident in the ‘global’ view. For example, several architects connected environmental degradation to people’s lifestyles and attitudes. Frank referred to problems stemming from the “consumer-orientated society” and Maureen referred to “throw away notions”.

Similarly, the consequences of environmental problems were mentioned in terms of the implications for individuals and groups. Peter mentioned “the earth’s resources” as an issue of concern and Jane referred to the need to reduce greenhouse gases. One of the aspects of the ‘global’ view of the environment highlighted in 2.3.3 is that this environment is considered common to everyone. During the interviews, these issues were referred to in collective terms as ‘our’ problems that ‘we’ need to do something about.
MAUREEN: Basically I don’t believe that the throw-away notions that a lot of people exist upon are going to benefit anyone in the long run. I think if we are going to survive over the next couple of hundred years then the difference in attitude that we can employ now will make a difference in five hundred years.

Sarah noted that, compared to Europe, Australia’s size and wealth of resources contributed to a particular attitude towards environmental issues.

SARAH: And I think that we’re not as aware in Australia about how much we have been polluting our environment and we’ve just accepted it and thought we’ve got so much space and so many resources that we can . . . just do whatever we like.

‘Global’ environmental concerns are associated with addressing large-scale environmental problems. It was clear that those architects who expressed ‘global’ concerns believed that addressing these problems is difficult and that the contribution of design decisions related to one house (or even many houses) would be minuscule in relation to the overall problem. Despite this understanding, these architects referred to ‘global’ environmental problems in ways that suggested that, for them, these were fundamental design concerns. The architects did not give explicit reasons during the interviews for why this was so, however it was clear that they did not see these problems purely in ‘scientific’ or quantifiable terms. They saw them in symbolic terms (for example, the potential threat of greenhouse gas emissions to the world that they valued) and also in terms of the causes of the problems (people’s lifestyles, consumption patterns and attitudes). Addressing these problems involved symbolic issues to do with expressing the values of the architect and of their clients. It also involved an acknowledgment that change has to happen in many ways and on many levels including that of raising people’s awareness (their clients’ and their own) through the continual exploration of ideas.

There were several references to the importance of ‘natural environments’, and to the ‘threats’ to natural environments from the built or ‘man-made’ environment. There were allusions to a sense of alienation or separation from the ‘natural’ world caused by technology and development associated with modern society.

SARAH: And that’s the mentality that we’ve got into, sitting watching television, watching computer screens and divorcing ourselves from what is more real which is the natural environment.

MARK: All these technological wonders that are less and less expensive to run but you run them for longer so you’re still chewing up the energy. It really isn’t solving the problem. In fact in some ways it’s making it worse because you’re getting people used to the idea of living in an environment that is totally false.

JANE: I think as a profession we were seduced by the controlled environment. Its a thread throughout man’s evolution that we’ll subdue nature, that we’ve won, we can create these wonderful spaces with our clever technology that provides perfect comfort. It isn’t perfect comfort – [there’s] sick building syndrome – but [there was] the idea that you could do that until the first energy crisis back in the ’70s when America suddenly found they couldn’t get quite as much fuel as they needed. That’s when we started
beginning to assess energy because prior to that it was just perceived as an infinite resource.

The ‘natural’ world, exemplified through discussions about landscape, sky, wind, sun and rain, was identified as an important aspect of the architects’ images of environmental issues. In the field of significance view this was related to particular landscapes (or sites). The natural world was considered important for affective and symbolic reasons and as an important generator of designs. In design terms the consideration of these issues represented opportunities to locate the building on the site, and to enhance the occupant’s lifestyle, and improve their comfort, as well as to create a sense of connection to the wider world. These considerations also linked into ‘global’ concerns through their relationship to design strategies aimed at reducing energy used for lighting, heating and cooling.

Many of the architects indicated that they believed that design that addresses environmental issues does not reflect the current status quo for housing in Australia. There were a number of references to the difficulty of incorporating environmental features into house designs for reasons ranging from cultural ideas about the size of houses to government regulations restricting the use of composting toilets.

JANE: We particularly found that problematic on jobs like [the government building] that had a very good environmental brief but when it came to the crunch federal government union conditions about what temperature range had to exist really precluded a whole lot of things we were hoping to do with that building because we just couldn’t meet their requirements. If you’ve got building occupiers these days [saying] it’s an unacceptable working environment because the temperature isn’t being maintained between 24 - 26° you’ve got significant problems.

Another architect referred to the ‘opportunistic’ attitude of some housing developers and designers who have seized on the marketability of environmental issues.

FRANK: There are a very few architects who look at [environmental issues] very cynically and say “That is a potential market niche, I will market myself to that niche”.

In turn, he was quite cynical about the difficulty of addressing core issues.

FRANK: It is not ‘cool’ to put environmental concern as your number one priority. It is very cool to be able to point to it and say, “By the way it also achieves all these wonderful environmental things and aren’t I better than you”. But it is still important to meet all the traditional consumerist expectations first and then claim environmental credentials afterwards and that’s in fact how the market forces tend to be out there. Big businesses buy environmental credibility and people will develop a product and then search for the environmental benefits after the act. That’s just how society is and I’m not going to change that.

These architects perceived themselves as having valuable skills related to the consideration of environmental issues in house design whether related to knowledge of specific issues such as renewable energy systems or in general terms of understanding the design implications of the clients’ wants and needs, and the site, and its climate.
FRANK: And they're the ones who'll say, 'Oh yeah I've heard about this solar power, that's all wonderful but what do you about the power at night?'. And that one floors me, it really does, simply because I've become so familiar with it. Then I have to remind myself that to a lot of people it's only ever been words, that they've never actually come hands on.

JANE: The issue of thermal performance or solar access wasn't something that [the clients] identified. That was really as professionals looking at the building and what the constraints were, that was something that we were able to contribute to the project.

There were several references to the difficulty of convincing some clients of the importance of issues such as thermal performance. Two architects with explicit environmental agendas referred to the difficulty of finding clients who enable them to explore these interests.

SARAH: My difficulty is getting experience and getting built examples for people to be able to show them, this is what I can do.

FRANK: It's the age-old dilemma; if you're working as an architect, you can do the work and explore the things when you get some clients. If you haven't got the established position then the clients won't necessarily come to you.

These images of environmental issues reveal that the architects consider them in terms of complex and intertwining concerns. There are concerns related to particular individuals and particular settings and to the particularities of the practice of design as well as 'global' concerns related to conceptual issues presumed to have implications for the whole planet and humankind. Concerns related to individuals form part of a larger narrative that involves images of the kind of world we wish to live in and to bequeath to future generations.

An important aspect of these images is that the architects did not consider design that addresses environmental issues to be straightforward; because of the complex nature of the issues involved but also because of the different values of the many participants (notably the clients and the wider society represented through regulations and procedural issues). One architect highlighted the difficulties of evaluating the environmental implications of certain decisions, particularly those to do with materials.

JANE: One of the areas that we need to do a lot more work in or we'd like more work done in is the environmental soundness of using [different] materials. Western red cedar comes from north America where I guess my feeling is they have the potential to manage their forests as opposed to South America and South East Asia . . . but the cost of bringing it here, the energy of just getting it here, doesn't make sense. As a timber though it is a very durable and you've got a fair degree of confidence that it's going to look OK in a few years time.

JANE: The supplier in Echuca gets recycled timber from all around Australia . . . But then you're paying for all the transport to get it here and using fossil fuels to transport it 400 miles. So when you look at it while it's sound environmentally, if you do a total cost on it, it might be dubious. If he got it off some jetty or woolstore in far north Queensland it could have travelled half way around Australia before it ended up in Adelaide.

Environmental issues were presented as inextricably interwoven with other design concerns, and with no perfect or easy answers.
Change was presumed to be incremental and significant transformation was presumed to involve a change in the status quo.

6.3.2 Images of housing issues

An important feature of the architects’ images of the environmental aspects of house design relates to their experience of and knowledge about social and cultural issues related to housing (particularly in relation to South Australia). This includes knowledge about contemporary patterns of development, and of typical housing styles and the implications of these for the lifestyle of the occupants; knowledge about different living patterns and lifestyles; and an understanding of contemporary expectations of amenity and comfort.

South Australia is a large state with a population of approximately 1.5 million most of which is clustered around the capital city, Adelaide. The capital is located on a plain next to a small river with the sea a few kilometres to its west and a low range of hills behind to the east. Adelaide is often portrayed as the most conservative of Australian capitals; an image reinforced by the strict, grid layout of the CBD, and a topographical flatness that gives the impression that everything is seen and watched. The housing is characteristically single-storey, free-standing and owner-occupied. There is a tradition of masonry construction originally using stone or brick with timber flooring, and more recently brick veneer with a concrete slab-on-ground floor. Most new housing sprawls to the north and south of the capital in estate developments. As indicated in 6.2 the architects referred to a number of house types that are familiar in South Australia (e.g. “Californian Bungalow”, “suburban project-type homes”, “traditional villa”. This indicated that they have a repertoire of images of housing styles that they consider typical for the state.

Many of the architects referred to current assumptions about housing needs. There were several references to the fact that the requirements of their clients were ‘typical’ of people seeking a new house. In South Australia at this time houses ‘typically’ have 3 - 4 bedrooms. Often one of these has an ensuite bathroom and one may be used as a study. Both formal and
informal living rooms are common, the latter often in the form of an open space ‘family’ room incorporating the kitchen. It is common to have more than one bathroom. Several architects said that their clients tended to think about housing needs in terms of distinct rooms and floor area rather than in terms of functions.

**PETER:** They wanted a 4 bedrooms or 3 bedrooms and a study, and they wanted a main bathroom and an ensuite, a formal living area and an informal living area – basically what everybody wants – and a double carport.

**GARY:** They’d worked out from their previous houses that they needed a 200 square metre house . . . they needed 4 bedrooms.

Discussing extensions to existing houses Frank said that;

**FRANK:** . . . the traditional requirement is family space, new kitchen.

There are strong cultural preferences for materials. Adelaide in particular, and South Australia in general, has always been identified with masonry construction. For many years it was difficult to get approval to use timber framing or cladding in Adelaide due to concerns about fire and termite damage. Timber was perceived as a cheap and an inferior building material. This perception still persists despite the fact that it is now used extensively for the load-bearing framework in brick veneer construction, the most common form of residential construction in South Australia (and most of Australia). The external cladding of brick veneer is brickwork and therefore it is visually hard to distinguish from cavity brick construction (also called solid or full brick). Jack maintained that, when he first started his own practice, most people engaging an architect in South Australia intended to build in cavity brick. There was an image that this was the ‘best’ form of construction and if you had an architect it suggested you could afford, and would want, the best. According to several of the architects interviewed, this image is still pervasive in South Australia.

**PETER:** [W]hen you talk to people about . . . insulated brick veneer having better insulation qualities than solid brick they can’t believe it and then you talk about the savings on footings and the flexibility and the less severe cracking and they still think that if they were rich enough they really would go for solid brick.

**JACK:** She wanted masonry, she wanted full brick, she didn’t want brick veneer. . . I think she’d grown up with it, and liked the solidness of it. It’s also good for noise. Brick veneer has a pretty flimsy feel to it. She would have paid a fair bit more because the soil was terrible there and the footings were pretty massive to cope with it all. We discussed all that early on. It’s a reasonably good area, and I suppose she feels that’s what’s expected.

**FRANK:** I very seldom use brick as an external material. I had one job where the clients were quite happy to follow the path that I was advocating but the mother-in-law wasn’t. The mother-in-law was obviously there during the week . . . saying, “But you’ll never be able to sell the place if it doesn’t look like a conventional building”. So we ended up putting a brick skin on it and thankfully we also earth bermed it and we did a whole heap of other things and it still worked fine and it was a concession to conventionality driven effectively by an outside party.
However, as one architect pointed out;

**JACK:** There wasn't the timber tradition here, you weren't allowed to build it in many areas. In Victoria and NSW where they had better timber and better timber buildings it was more common for people to ask an architect to design a timber, or lightweight, house.

The architects referred to images of how different groups of people typically 'use' housing: images of how a family lived in their holiday house, and of how a family with two working parents or a retired couple lived. These included images of the occupation patterns, and of the different requirements for climate control, and for security and maintenance. Such images include an understanding of the spatial and functional aspects of modern lifestyles that have environmental implications such as an increasing expectation for 'flick of the switch' comfort control, an increase in appliance usage over the last decade (dishwashers, microwave ovens, video recorders, CD players, computers and often more than one television per household are now common) and the increasing importance of security.

Several architects maintained that a high level of commitment and understanding is required of the occupants of a house with climatically responsive or environmental systems.

**JANE:** [T]hey had an objective which was a low energy house and they tend to be highly committed people and they're prepared to do a lot of things. The difficulty I guess for people who don't have that level of commitment is that you have to do more things with these kind of buildings. You can't just turn on a switch for the air conditioner and it's instantly cool, you've got to manage your environment a lot more and that's something that we've found potentially is problematic . . .

**SARAH:** You have to have clients who are willing to do the maintenance and put up with the aesthetics of a composting toilet and that's something, that unless they're already of that mind, it's quite hard to convince people to do.

The architects indicated that an architect-designed house is not standard in South Australia and that this has implications for the type of client they are likely to have, and the clients’ expectations of the process and the finished product. Many people thinking about buying a new home in South Australia would not consider the possibility of engaging an architect – believing that it would not be affordable, that it would be unnecessary or somehow inappropriate. In some cases this is connected to the impression that architects don't design houses; an impression reinforced in South Australia because only a small percentage of new housing is designed by architects. There is also an impression that architect-designed housing is inevitably expensive and 'large'.

**GARY:** She thought that an architect might be able to help them and he said no way, they only work on big [jobs].

The architects indicated that those people who engage an architect expect something 'special' of their architect-designed house. This involves designing a house that ‘fits’ particular clients
and their wants and needs to particular sites through addressing a range of concerns including the symbolic, affective, financial, social, cultural and material.

FRANK: And it's interesting watching clients reaching retirement or people making major shifts in their life who want some measure of certainty and they come to me for a physical product that will give those sort of things.

MICHAEL: I guess they wanted to build a dream house.

JACK: You'd expect more care and more involvement from an architect because you pay them more and that incorporates all this orientation and ideas like that and the aesthetics of it and how it fits in with the surroundings.

The previous section highlights the interlocking of symbolic, affective, financial, cultural, architectonic and environmental concerns that are accommodated in the architects' images of housing issues.

6.3.3 Images related to the practice of design

The architects revealed comprehensive images of those issues arising from the practice of architecture that have a bearing on the consideration of the environmental aspects of house design. These included images of the way design proceeds from brief to completion, and of the complex, inter-related nature of the issues to be considered during the development of the design. They also incorporated an understanding of the documentation and representations required at various stages of a job including the requirements for planning and building approval. The major issues arising from the interviews were: the way that environmental issues are considered in client-architect interaction, the impact of regulatory bodies, the implications of the resources available, and the importance of images of building performance.

Client-architect interaction

There are likely to be many active participants involved in the design of a house including, for example, clients, builders, consultants, representatives of various authorities and members of the wider community. The relationships and interactions between these people can have a significant impact on the realisation of a design. One of these relationships that was highlighted in the interviews is that between the clients and the architect. It was suggested in 2.4.2 that design can be seen as a collaborative process of making sense of issues that are often complex and involve terms that may be extremely vague but are also often image-laden. Establishing what these terms 'mean' in relation to built-form emerged as an important aspect of the design process. Written, verbal and graphical communication was used to explore and refine these ideas in a two-way process.

A number of architects referred to the fact that clients begin the design process with images of what they want.
JACK: People very rarely come with a blank slate – they’ve all thought about it a bit and they’ve all got a reasonable idea of what they want.

SARAH: And when they first came to me they already had a little mud map . . . [and] they’d torn pictures out of glossy magazines

MARK: This guy came along with a sketch – a lot of people come along with a sketch.

Often the clients’ ideas were expressed initially in terms of number and types of rooms (see 6.3.2) but as one architect said, this information was not necessarily useful for generating designs: for locating particular buildings on particular sites for particular clients. The architects all indicated that an important aspect of the design of a house involved establishing an image of the site and its climate, and of their clients and their lifestyles, attitudes and values. It was apparent that one of the first things that the architects did during a design project was visit the site. This helped during the initial visualisation of the design by providing particular information to do with the topography, the existence of significant natural features, and by providing an image of the immediate surrounds and of the climate, and an indication of the direction of significant views and outlook.

JACK: I don’t think I’ve ever designed anything that I haven’t looked at the site first [to] . . . get a bit of an idea.

The architects revealed comprehensive and apparently well-informed images of the South Australian climate in general and that of Adelaide in particular that they drew on when they considered a particular site. Adelaide’s climate is often called Mediterranean; it has hot, dry summers, and cool winters and the rainfall occurs in the winter. Heating is considered essential in the colder months (often from May to October). Mechanical cooling, a rarity until the 1970s, is now more common, especially amongst more expensive (hence often architect-designed) housing where it is almost considered ‘essential’. Typically, heating and cooling are used very intermittently.

Several architects referred to their knowledge of local and regional climatic patterns.

JACK: But I know that when you get a hot northerly it comes off the water and its not such a problem so long as you’re up on top of the sandhills. Once you’re away from the sea it’s just as hot as somewhere like Victor Harbor gets on a hot day. Overheating is not nearly such a problem when you’re on the coast.

GARY: I would just say that if [this site] were mine this would be a high priority; it’s in the Hills, it’s a relatively cold area so let’s try and get as much sun in for winter heating [as possible].

One architect referred to the importance of conceptual and experiential, rather than statistical, knowledge of the climate.

MICHAEL: I don’t know what the climate actually is. I think it would be pretty moderated because it’s the peninsula. So that in the really hot weather it probably doesn’t get so hot but I could be wrong about that. I mean I didn’t really go out of my way to find factual information.
HELEN: Is it very hard to get it?

MICHAEL: Well it's probably hard to get but also, what does it mean? In a sense it's really the clients' attitudes or expectations that are most important and so it's not really a quantitative process.

The architects indicated that their conception of environmental issues related to house design involved developing a picture of the future operation of the house and the way the occupants would live in it as part of the overall image.

SARAH: What I do is go through, “What do you do on a typical day, how do you live when you're there?” They thought I was quite crazy at the start, asking them questions like that

One architect referred to the importance of seeing the process as an ongoing partnership.

FRANK: I get some people who make claims of environmental responsibility but are actually consumers at heart and really don't want to know after the event . . . But the vast majority are people who understand that it's a partnership and they are taking on some responsibilities. And yes there is ongoing contact.

Another important aspect of this image was that of the qualities that the clients wanted from their future house. When asked if his clients’ brief consisted of numbers of rooms and spatial relationships Michael replied;

MICHAEL: Ah, well I guess it covered those. But I guess I tended to focus more on qualities which are actually useful, rather than quantitative stuff. So I think there was clear desire for thermal qualities or passive solar qualities, obviously the view, landscape integration.

The architects reported that their clients described these qualities in vague terms such as “stylish”, “modern”, “comfortable” and “environmentally sound”.

JACK: People sort of talk in vague ways about energy efficient housing . . . Usually when they come it's a vague, general term. And sometimes they probably don't know exactly what they mean anyway . . .

The development of the design involved the exploration of what these terms ‘meant’ to both architect and clients. In some cases the architects referred to explaining the connection between one of these terms and aspects of house design.

FRANK: Then we have very long debates that say, ‘your impact on the planet is in large part due to your excessive floor space aspirations. Look at the fact that we can actually constrict the building size and still get you the lifestyle you're looking for.’ And we work through open planning and the fact that there are private spaces and there are public spaces but there are ways of mingling those things together.

In some cases the clients were presented with a graphical representation to see if they ‘identified’ the qualities they desired in the design.
HELEN: You were saying she wanted something ‘modern’ – did she have a particular idea of what that meant?

JACK: I did three sketches. Basically the plan was pretty similar... and one of them was a conventional hipped roof, another – I can’t remember – and then there was this one with a curved roof. She liked that.

Many of the architects referred to graphical communication as an important tool for communicating ideas to their clients.

SARAH: I tend to draw little perspectives. I’ve drawn perspectives of what they see when they sit in this bed and what they see when they walk down this corridor. They tend to be a small free hand things but it gives them an [idea].

MICHAEL: In a sense I would tend to not try and put into words the feeling or the overall quality of the building. I mean, I think the drawing has to speak for itself in a sense in explaining that.

However, the architects indicated idiosyncratic approaches to the importance of graphical communication.

FRANK: To me the drawings are just a means to an end. If they’re on the back of an envelope I don’t care. When the job is done the drawings are never looked at again. What I’m interested in is the finished product – working.

MICHAEL: Visually [the two plans] presented a very different image immediately. And I guess I’m always aware of the issues of the kind of visual image of the plan and its importance in creating a good building. So that the plan is a graphic design.

SARAH: I encourage them to take drawings away and get to them with a red pen with their whole family, they sit down with their children and whoever else they think is interested and mark up anything. And they give me typed up lists of points 1 - 10... of what they’d like.

A number of references were made to the way ideas about the design developed during the course of the project.

ADAM: The brief was pretty broad. It really grew as we went along... As the project developed, so did [the client], so did her ideas about what it was she wanted and the nearer we got to the end and the more they saw the spaces... it just developed and developed and they spent twice as much on fit-out as they’d anticipated.

During the development of this project the clients’ image of the building increasingly focussed on the environmental aspects of the design. This overall image then became an important consideration when decisions were made about specific issues (such as the finishes used).

The architects recognised that ‘drawing the drawings’ was only part of the service they provided. Another significant aspect was that of educating the clients about the design process and the procedures and process of construction. Some architects indicated that educating clients about the environmental impact of design decisions and about alternative ways of living were important aspects of their role in the design process.
SARAH: They’re not coming to me for an environmentally sustainable building. My job I see is to slowly educate them . . . so that they can understand the difference and that they’re aware of the decisions that they are making. That’s the best I can do.

MAUREEN: If you can make better choices, more appropriate choices, inform the clients and the people around you so that they can make more informed decisions then I think that’s going to benefit everybody in the long run.

The image of the development of the design apparent from the interviews is that it is a two-way process involving action and response and that out of this process a shared image of the future house evolves. The issues considered during this process are complex and interdependent and include those to do with environmental concerns. These are not thought about in isolation: changes to other aspects of the design resulting from constructional, structural, aesthetic, time and cost concerns will have implications for the way the environmental aspects of the design are framed.

Regulatory bodies

Part of the image of the practice of design involves impressions of the nature of regulatory bodies and their potential impact on the design process. Several architects mentioned that they felt the existing building, planning and health regulations were a hindrance to incorporating non-typical materials, styles, and forms of buildings as well as ‘unusual’ systems into their designs.

FRANK: I have great trouble meeting building codes because they’re written around presumptions of brick veneer and Federation style and all that sort of stuff and if you want to do something else, if you want to use mass-produced garage frames for buildings it makes poor old building surveyors fall over. It’s all right to use it in an industrial building, but you can’t use it in a Class 1 [Housing], it’s just not on!

Frank maintained that he frequently encountered difficulties as his designs often incorporated renewable energy systems such as solar and wind, and reed beds for grey water treatment.

FRANK: The classic is a job . . . where it took us two and a half years to get all the approvals. And of course the owners in the end just gave up, they were worn out.

FRANK: . . . The dilemma we have is that the Health Commission has no standards for . . . potable water or for grey water. We keep getting promises that is coming, but it still hasn’t surfaced. In the mean time, every time I do one of those and I get approval for it means arguing the case from scratch. You then have to spend 6 months on paperwork.

It was recognised that aims to do with environmental issues may conflict with other design aims. For example, Sarah said that design guidelines aimed at conserving the ‘feel’ of the area where she was designing a holiday house proved to be a major constraint when she was considering the environmental aspects of the design.

SARAH: A lot of the constraints are constraints that have been put on by the design guidelines . . . how close to the boundary you can actually build, where you can start building, how far to either side boundary and even the proportion . . . of living, dining, kitchen or whatever which has been traditionally closest to the beach have still got to be in that location. It’s that prescriptive.
Trying to get approval for anything unusual was described as a time-consuming and frustrating process; both clients and architect had to believe that it was worth the effort. Delays could be experienced when gaining building or planning approval, during the procurement process, or when trying to find appropriate tradespeople as well as during construction. Discussing the use of recycled timber one architect said;

JANE: *The problem is you have to know what timber is available and . . . there are problems along the way because you don’t always get what you pay for. You’ve got to pay for it up front and it’s not the way the building industry normally works so there are problems in terms of the normal procurement process of actually incorporating that.*

Mark, referring to an attempt to get approval to separate greywater from sewerage, said:

MARK: *It's just so time-consuming to do anything different!*

**Financial issues**

During the interviews there were many references to the importance of financial issues to the design process. The budget can determine the scale and scope of the work in the first place and influence the amount of involvement the architect has with the client and the project; smaller projects sometimes entail design but no involvement with building supervision and tight budgets often mean limited time for client liaison and for design.

GARY: *On jobs like this I can just say, ‘Look there’s no room for messing around. I’ll pick you a door handle, and a tap and they’ll look all right and there’s no point in looking around town and looking at all these examples because I know the best for your budget. Believe me. I do’. My fees for these cheap jobs are so low anyway that I just couldn’t get bogged down.*

The budget was identified as an important consideration at the various levels of decision-making where evaluations of cost versus benefits were involved. The architects referred to knowledge of typical building costs and the sort of issues that can affect these ‘typical’ costs such as unusual materials or non-typical construction techniques. Many of the architects said that clients equated ‘value for money’ with floor area per dollar. This was true even for Frank whose clients generally seek him out for his environmental expertise.

FRANK: *The niche market that I work in is very much to the already converted who are very emphatic about what they as individuals want to achieve about individual responsibility.*

When asked if his clients’ desires for a relationship between the internal environment and the climate was a strong force in design, Frank replied that, in fact;

FRANK: *The strong force is], ‘I want as much floor area in square metres for as little dollars as I can possibly get’.*

HELEN: *Even the people who seek you out . . .
The budget available for a project frequently limited choices or suggested options in terms of materials and construction techniques. One of the main constraints to incorporating 'environmental' concerns that the architects identified related to cost.

JANE: I guess from our perspective promoting even things like solar hot water heating we've always found to be problematic in clients who don't come with an environmental objective, just because of the initial capital costs. So you can get two hot water services and one you can argue that the payback period means that it is actually an economic choice but it's the capital up-front. I think when it comes to the crunch unfortunately most people are much more influenced by what the initial capital cost is rather than the life-cycle cost.

JANE: But if it's, 'use wool instead of use fibreglass' there's still this... 'Oh I'm prepared to pay for insulation but I'm not prepared to pay a premium to use an environmentally sound form of insulation'.

Several of the architects mentioned cases where a change was made to a design to cut costs that they felt was likely to compromise the performance of the house. It appeared that elements which the client considered 'add-ons' or somehow not inherent to the design, such as sunshades, were particularly vulnerable.

MARK: I had this little balcony which provided shade for the door and a little outside space. Well they didn't build that... Now they get all this heat in there because there's no protection... So now there's all this sheer glass and they're hanging bits of sailcloth. But that was their choice, there was nothing I could do about it.

PETER: That [window hood] got cut out – that saved about $500 – labour and time and finicity.

The concept of minimising 'running costs' was mentioned as a consideration in justifying decisions although it was not mentioned nearly as frequently as issues related to capital costs.

MARK: Price is always THERE!

Building and material performance

The references to "low energy house", "passive solar", "Five Star design", "energy-efficient houses", "rammed earth buildings", "southern European terrace house", "tropical or Asian building", "low-cost houses" and "pole-frame houses" indicated that the architects had a repertoire of images of place types and their constructional and functional implications. These are connected to images of thermal performance, daylighting, ventilation, and the maintenance of buildings. Such images are often based on both theoretical and direct experience. Frank referred to the difference between the theoretical and the practical knowledge of building performance that he had acquired over the years since he designed and built his own house.
FRANK: *What I've got better at being is more accurate with the performance of the end product. When I built this I had very little practical experience to work back on. I knew on paper it would all work.*

(a) Thermal performance

Many images of thermal performance arose during the interviews. These images were sometimes offered as an alternative to ‘scientific’ explanations of performance. Conjecturing about the difference in performance between a house with massive construction and one that was lightweight one architect said;

JACK: *I suspect most of this is orientation, but I don't have scientific reasons.*

Images of thermal performance were mentioned in connection to the comfort of the occupants and to energy use. These images concerned the orientation, window design, materials and form of the house. The architects indicated that they had strong images of the daily and seasonal paths of the sun and showed an understanding of the implications of this for design. Many references were made, for example, to the desirability of northern orientations (good sun penetration in winter and easy to shade in summer), the difficulties of west facing rooms (difficult to shade from late summer sun) and the benefits of the even light of south-facing windows.

There were a number of images of the way massive and lightweight constructions perform. These included images of mass as a “storer of heat”, a “heat sink” and a “temperature dampener”. Mass was discussed in relation to other factors, commonly the sun, orientation and/or insulation. Referring to an old country hotel Adam said;

ADAM: *It's . . . full of high thermal mass, high ceilings, no insulation and incredible exposure to the sun. And therefore it's highly inefficient in a long drawn-out summer and unbelievably cold in winter.*

Mass was also seen to be a more expensive and, in the case of cavity brick walls, a less common form of construction (than brick veneer). One architect pointed out that people’s responses to the thermal performance of materials was at least partially influenced by how these materials are marketed.

MICHAEL: *If you ask people what their feelings about traditional stone cottages are, they'll always say they're cold. Essentially they're much the same asrammed earth buildings from the performance point of view. But you ask them what a rammed earth building is and they'll say it's nice and warm. But the kind of people that would consider a rammed earth building are probably more sensitive or aware of thermal issues because its really part of a package and I wouldn't say that they're necessarily unbiased in terms of selling the ideology. They've probably got a huge pot belly stoves or huge slow combustion heater or something that they stoke up with wood.*

Another architect referred to the importance of the experience of thermal mass.
ADAM: I know how thermal mass works. I’ve lived in it before and I’ve seen thermal mass not work – like on western facing walls fully exposed and – because I’ve done a fair bit of community housing work – I see where mud brick developers have developed these ‘energy efficient, environmentally sound’ mud brick houses using mud bricks which are basically a sandy substance bound together by bitumen, so it doesn’t suggest a healthy material, with these massive two storey walls facing west. And they claim that mud brick has wonderful thermal mass. Well it does.

HELEN: They get mass and insulation mixed up . . .

ADAM: And thermal lag and all of that. So in the end I can say that is going to be bloody hot in summer. I know from feedback from the people that are now living in these things, who said . . . they can’t stand it. It gets outrageously hot.

Images to do with lightweight construction related to its ease of insulation, ability to cool down quickly, its ‘touch-the-earth-lightly’ appearance, cost benefits and the possibility of off-site pre-fabrication with resultant minimal site disturbance. Another aspect raised by several architects was the relative ease of erection of lightweight framed construction that makes it attractive for owner-builders or single tradespersons.

GARY: I said to make this work we’ve got to keep it as simple as possible, lightweight construction, something that a carpenter can do nearly all of it himself. So that is the construction. A little strip footing around the outside built up on piers, timber framed floor with clear finished pine as the flooring right through. So every material is the cheapest way you can do it. You can’t do a cheaper floor than that. So there was minimal soil disturbance doing a footing like that.

b) Lighting

Daylight was referred to as an important design element; one that is intertwined with considerations of solar gain, view and the internal and external elevations of the house. Michael referred to the need to avoid glare. He pointed out the potential conflict that arises with the solar-efficient model prescription for north-facing living areas with large areas of glass and no windows to the east or west.

MICHAEL: I’ve got a concern to avoid the sort of high glare situation that you often get with north facing windows and no balancing lighting.

There were many references to the quality of light of the houses described and that this was a distinguishing feature of the design. Contemporary housing has a larger window area than houses of previous generations and the resulting ‘feel’ is a hallmark of contemporary design.

JANE: [W]ith the extensive glazing, the cafe doors and this continuous skylight which runs basically from one end of the house to the other it is very light and bright and very different from the way the old back leanto used to feel. From our clients’ perspective they’re really delighted with how it works.

c) Ventilation

The architects indicated that ventilation is an important consideration in South Australian houses. While it was usually discussed in terms of its contribution to cooling the building
fabric or its occupants in hot weather, Frank referred to a more general need for ventilation to prevent 'stuffiness'.

FRANK: Passive solar deals with the shell of the building but doesn't deal with the occupants, doesn't even deal with the heat generated internally and irrespective of how effective your insulated shell is you still need to cross-ventilate, even in a cold climate, to get rid of the accumulated humidity and the tendency for things to get stuffy.

The architects showed extensive knowledge of the general wind patterns of Adelaide – both desirable (such as cooling breezes in summer) and undesirable (hot winds in summer) – and wind patterns related to particular locales. Several strong images of the relationship between built-form and air flow were identifiable. These included drawing air from the cooler south side of the building and expelling it to the north, and using openings of different sizes or at different heights to direct air flow.

JANE: By having that northern skylight we both achieved solar access and it also has the advantage of giving us opportunities for cross ventilation so that we had a high level windows that can promulgate drawing in of cooler air from the south side and exhausting to the north in warm weather. So it gave us a double benefit.

FRANK: Almost every building that I have done has a clerestory of some sort and quite a few of them have got curved roofs. The philosophy being that in a desert climate like here, we have predominantly northerlies in summer, and if we can modify the air pressure at the clerestory we can get suction ventilation there, without having to put up with the temperature of the wind and the dryness and the dustiness. Suddenly we have the ability to draw the air from a controlled space, which is why I've got my pergola on the southern side of the building because that effectively becomes my pre-humidifier for incoming air.

MICHAEL: Cross ventilation has been planned in each room with upper level opening windows and south facing conventional [ones]... So the building from the cross-ventilation point of view is very transparent and the high level roofs will help that considerably, creating low pressure zones up next to the clerestory windows.

MAUREEN: I came up with this idea based around the type of tropical buildings you see in Asia which have quite steep pitched roofs with the lifted-up top part for ventilation...

So it's simple. The roof was simple. It's double skinned, mono-pitched. Double-skinned so that the hot air that radiates from the top of the roof gets swept away before it gets through.

d) Maintenance and durability

Images of the durability of material are interconnected with issues to do with regulations, maintenance, materials choice and health. Sarah referred to some of these concerns when discussing the use of timber for external screens.

SARAH: They're... going to be timber and the big problem we've got is obviously it's very hard to get recycled timber or true sustainable timber... And then there's the maintenance problem in the marine environment so we're going to have to look very carefully at what it's going to be and there are major termite problems over there so any timber we choose has to be termite resistant as well.
Termite protection is of particular importance in South Australia and recent standards specifying acceptable methods of addressing this issue have design and performance implications.

MARK: But then you've got things like – what do you do about termites? At our place we used [steel mesh barrier]. That was a giant hassle. We didn’t want to use the poisons because of the timber floor and also I tried to get some ventilation under the floor and through the house and you don’t want the ventilation bringing in the fumes. Now a concrete slab is regarded as a termite barrier so long as the penetrations through the slab are protected in some way. If you use [mesh] the slab is a barrier. . . So long as you can inspect the perimeter, it’s about 80 mm above ground level. If you’ve got timber you have to basically cover the whole floor underneath the timber.

HELEN: Why is that because in theory you could put it . . .

MARK: Like an ant cap. You can do that only if you can get underneath to inspect it . . . And then you’ve got the added problem in the city that if you’re building to the boundary you’ve got the relationship between your building and the next building. You lie there at night worrying; “I bet they can go up there and around there and get in”. Then you think well maybe I should have used steel and then I could sleep at night. Or we should have used treated timber, but that’s another poison.

Several architects referred to the difficulty of specifying natural finishes such as oils for timber due to their clients’ perceptions that these would involve greater cost and time commitment.

SARAH: I want to use products such as oils which are benign rather than using any forms of toxic treatments for the timber which are going to last longer. I have to get a balance between what the client . . . is happy to do [and] where I’m coming from.

ADAM: They liked the sorts of ideas that I had but they were a bit worried about not using polyurethane. We used a narrow jarrah vanity benches with a semi-recessed basin and I said to them, 'if you use a polyurethane and something big drops on it, it cracks. You’ve got to strip it all off again to make it look any good. But if you use oil, you just have to keep the oil up to it. The cleaners can clean the bench and then just wipe it with an oily rag and it will just go on protecting it and enriching it. So it is more labour intensive but in the long run, it’s something that you can market, it is a cheaper maintenance effort at the end of the day.

6.4 Discussion

The preceding section illustrates some of the architects’ images of ‘what is’ that are related to the environmental aspects of house design. It is an amalgam of the subjective knowledge of the ten architects. There is extensive agreement about key features of the images despite the differences between architects and the fact that each of them described designs that were specific in terms of clients, location, time, budget and brief. These key features are: that environmental issues are complex and value-laden whether considered in terms of the ‘global’ view or that of fields of significance; that housing issues are complex and involve socio-cultural and individualistic considerations that have environmental implications; and that many aspects of architectural practice have implications for the consideration of environmental issues in house design.
One of the most striking features of these images is their comprehensiveness. They easily encompass people and their values, and housing and design issues and the myriad contexts within which they occur. They allow connections to be made easily, immediately and not necessarily at a conscious level between seemingly remote concerns such as the ‘scientific’ concept of the production of greenhouse gases and the design implications of an individual’s desire for a west-facing picture window to capture a view. To illustrate this connection verbally or in written format would require lengthy explanations of the so-called greenhouse effect, and of how this is connected to residential energy use in Australia through the use of electricity from coal-fired generators. It would need an explanation of the solar gain through windows of different orientations and the particular problems of western facing windows.

The connections between solar gain, thermal comfort and residential energy use would need to be explained as would the implications of material choices and choices of plant and fuel. Strategies such as designing shading to exclude summer sun while admitting winter sun could be outlined. This could be supplemented by a discussion of the increasing use of mechanical cooling in new housing in Australia and cultural attitudes towards housing and comfort control. Even this discussion would not necessarily encompass affective and symbolic issues related to the client’s desires and wider global concerns.

Another striking feature of the images is their vividness. They are open-ended and often suggest other images, conjuring pictures in the reader’s mind. They are suffused with meaning and importance. Much of this ‘meaning’ stems from their subjective nature. An individual’s images of the world are bound to reflect his or her values. The greatest strength of these images is the way they incorporate information about those aspects of design that are difficult to convey in other ways; the value-laden and whole-experience of dwelling that is a vital consideration for design.

The images are not necessarily objectively ‘correct’. There were some examples in the interviews of dubious connections between environmental and design issues. There were also examples were it seemed apparent that technical information referred to was not well understood. Nonetheless, these images reflect an understanding of the world and are obviously useful for design. Many of the sources of images referred to in 6.2 provide information about the ‘feelings’ of spaces that cannot be explained easily in other ways. Images can link spatial sensations to particular room sizes and forms; and they can link thermal sensations to such things as materials, and window type and orientation. These images reflect the importance of experiential knowledge.

The images discussed in this chapter will be used to frame new projects. They provide a source of information about what issues are likely to be important. They provide a picture of what is normal or typical both in terms of process and product and of the possibilities and implications of deviating from this. They suggest what might be possible, what is desirable and why.
6.5 Summary

This chapter outlines key images of 'what is' identified through an analysis of the transcripts of the interviews with the architects. It reveals that design advice appears to form a relatively minor source of information about the environmental issues related to housing, with less formal, experiential sources dominating. These provide a well-spring of emotive, objective and affective images of the existing situation regarding the environmental aspects of house design in South Australia.

The architects' images of 'what is' are revealed to be comprehensive, vivid and inter-related. The architects' images of environmental issues reveal the complex nature of the relationship between 'global' concerns and those to do with the view of an environment as a field of significance.

Many practical barriers to addressing environmental issues in house design are identified including the policies of existing regulatory bodies, the difficulties associated with accessing certain materials and the current status quo in regard to residential development, house types, and construction practices.
7. Design advice images of ‘what is’

7.1 Introduction

This chapter reviews the images of ‘what is’ that inform the three sources of design advice discussed in Chapter 5. It outlines the major sources of these images and then reviews three key aspects of the images: the environmental impact of housing; ‘appropriate solutions’; and people and the way they relate to housing and environmental issues. This chapter concludes by presenting some examples of alternative images of ‘what is’.

7.2 Sources of images

In Australia, knowledge about the relationship between house design and environmental issues comes largely from research into the connection between built-form and energy use. Most of this research is undertaken by a relatively small community of building scientists and architectural researchers. Referring to the existence of scientific communities Kuhn remarks that the members:

... have undergone similar educations and professional initiations; in the process they have absorbed the same technical literature and drawn many of the same lessons from it. Usually the boundaries of that standard literature mark the limits of a scientific subject matter (Kuhn 1970, p. 177).

Many of the members of the ‘current’ architectural science research community are based in academic institutions and also teach energy-related and environment-related subjects to architecture students. For example, Deo Prasad and, formerly, John Ballinger are based at the National Solar Architecture Research Unit (SOLARCH) at The University of New South Wales; Richard Hyde and Steve Szokolay are at The University of Queensland; Terry Williamson, Veronica Soebato and, formerly, Susan Coldicutt are at The University of Adelaide; Trevor Lee and formerly Peter Lyons are at the Energy Research Centre at the Australian National University in the ACT and Neville D’Cruz is based at Curtin University in Western Australia. Other important research organisations and personnel include the CSIRO DBCE, (Angelo Delsante, Steven Moller), Energy Efficiency Victoria (formerly Energy Victoria – Tony Isaacs), and, more recently, the Australian Greenhouse Office. Private consultants in this area (relatively rare in Australia) include Alan Pears (Sustainable Solutions), George Wilkenfeld (George Wilkenfeld and Associates), Gareth Cole, and Holgar Willrath. Many of these researchers collaborate on projects.
This pool of researchers have contributed extensively to the three examples of design advice examined in this thesis. They are amongst the major contributors to the *BDP Environment Design Guide*. Four of the 19 references for Sustainable development cited in *AMCORD* are works by Ballinger and/or other members of SOLARCH and other references include works by Sustainable Solutions and Energy Victoria. Members of the research community, both individually or through their associated organisations, provide advice to Government on policy issues. Many have undertaken consultancies. The development of house energy rating schemes in Australia was largely undertaken by SOLARCH and Energy Victoria with other researchers including Williamson, Coldicutt, D’Cruz and Szokolay providing input such as discussion papers, and the collection and generation of data. Other rating and point score systems have been devised by Willrath and Cole.

Many of the researchers identified above publish in the journal *Architectural Science Review* (the major journal in this field in Australia). The other major source of publications is conference proceedings from special-interest organisations such as the Australian and New Zealand Solar Energy Society (ANZSES), the Australian and New Zealand Architectural Science Association (ANZAScA), Passive and Low Energy Architecture (PLEA), International Building Performance Simulation Association (IBPSA) and Catalyst. A number of the researchers have been involved with the management of these organisations. Most of the identified researchers have participated in committees of the Standards Association of Australia.

Taken together these researchers and their publications form a loosely coherent group with linkages between organisations, and between the citations in the publications. There is a noticeable bias towards architectural science and thermal/energy research amongst these sources although research into housing and environmental issues can be approached from other perspectives (for example as a cultural or ethical issue).

Not all the sources of images mentioned in the chapter originate in Australia. Research and public images related to the environmental aspects of house design from overseas also are important. However, this importance may be limited due to differences in construction techniques, climate, plant and fuel sources, legislative requirements, and cultural and social concerns.

Many of the images of the occupants of housing that inform the design advice do not directly come from the research community outlined above. Images of the ways that peoples’ beliefs, attitudes and behaviour impact on residential energy use, and on other design issues, arise from a range of sources. These include research found within the traditional disciplines of the humanities (linguistics, psychology, human geography, philosophy), the sciences (building physics, environmental chemistry, ecology), economics (decision-making, environmental economics) and built-environment studies (environment behaviour studies, architectural design).
The following sections outline some of the major design advice images of ‘what is’ by reviewing examples of research that is intended to explain aspects of the environment-house-person relationship. The literature that is potentially relevant is vast and beyond the scope of this thesis to cover in detail. Nonetheless, the examples reviewed below are representative of the major sources of information in the fields and illustrate the dominant images that inform current examples of design advice.

7.3 Images of the environmental impact of housing

Public images of the environmental aspects of housing are dominated by the view that house design involves addressing environmental ‘problems’. In the 1970s it was resource use and pollution; in the 1990s it’s a related but not identical concern: greenhouse gas emissions and the potential for global warming. For example the RAIA Environment Policy states:

_Ecosystems will be affected by decisions the architect makes regarding the use of resources, which must be defined to include materials, energy, amenity and waste. In making design decisions, the architect must consider the effects, both long term and short term, on ecosystems over the entire product life cycle – from materials extraction, processing and transport through to possible fire, demolition and disposal (RAIA 1995, p.3)._ 

AMCORD refers to the need for sustainable residential development as follows:

_Cities consume land, water and energy resources, produce high levels of pollution and waste, and are not ecologically self-sustaining._

_The challenge is to create urban forms that can do better in terms of environmental impact and use of natural resources_

_... In planning for greater sustainability there must be a response to the global issues of energy consumption, air and water quality, and species conservation. The local issues are likely to include avoiding unnecessary urbanisation of rural lands, introducing low impact infrastructure and reducing transport demands (Department of Housing & Regional Development 1995, PNP 3 p. 1)._

The NGS deals with a specific issue – the reduction of greenhouse gas emissions as a way of addressing global climate change.

_The world’s climate scientists have provided a clear message – that the balance of evidence suggests humans are having a discernible influence on global climate. Australian Governments recognise the importance of climate change as a major global issue, and are committed to playing an effective part in international efforts to respond to the environmental threat it poses (AGO 1998, p. 1)._ 

The dominant image of ‘the environment’ evident in the design advice is that of the ‘global’ environment exemplified by the concentration on greenhouse gas emissions (see 5.2). This image is associated with the ideas that ‘global’ problems need to be addressed at many levels including that of the individual household; that the residential sector is a significant contributor to greenhouse gas emissions; and that these emissions can be reduced through the ‘appropriate’ design of houses. Research into the connection between housing and the environment is coloured by this perspective and largely consists of measuring, monitoring and modelling the impact of house design on resource use (particularly energy use) and

125
pollution (particularly the production of the greenhouse gas CO₂). There is comparatively little research into the relationship between house design and other environmental problems such as threats to biodiversity, land degradation, and health and affective issues.

7.3.1 Statistical information

The design advice image of ‘what is’ is reinforced by information that seeks to define the connection between the residential sector and greenhouse gas emissions. Often this information takes the form of measurements of the environmental impact of housing. Statistics are used to describe such variables as household energy use, carbon dioxide emissions, house sizes, appliance ownership, energy use and water consumption. (For example, households are responsible for 9% of net greenhouse gas emissions (Wilkenfeld 1995); Sydney residents produced 0.77 tonnes of solid waste per head in 1990 (State of the Environment Advisory Council 1997); water heating accounts for 29% of residential greenhouse gas emissions (Pears 1997).) A recent survey conducted for the Australian Greenhouse Office of the greenhouse gas emissions attributable to the residential sector (AGO 1999) included the compilation of an extensive amount of data related to household numbers, appliance ownership, housing stock and energy consumption. These were used to develop a model of residential energy use and consequent greenhouse gas emissions in 1990. The emissions are measured in terms of carbon dioxide released with an additional equivalent value for the small amount of methane and nitrous oxide attributable to the residential sector. The estimation given for the 1990 levels of greenhouse gas emissions from the residential sector in Australia is 49.5 MT CO₂-e (AGO 1999, p. 27). This figure is then used to predict the impact of existing and proposed energy policy programs on greenhouse emission levels.

Statistics can evoke a powerful response, provide an easy-to-grasp impression or comparison, or give a broad brush-stroke picture. However, it can be difficult to obtain relevant statistics. For example, in the AGO report (1999) a range of figures are quoted for space heating and cooling use. These include a number of reports from NSW undertaken by three different groups, apparently using different methodologies and undertaken at different times between 1983 and 1993. There are no figures for Victoria, South Australia and Tasmania. It is often difficult to make meaningful comparisons between, or to combine, figures that use different scales, measure different values or were collected at different times.

The use of such statistics helps to create an image that environmental issues are basically scientific in nature, and amenable to identification and quantification. Statistics can convey the impression that issues such as greenhouse gas emissions can be defined precisely. The many qualifications and assumptions necessary to arrive at the figure for 1990 levels of residential greenhouse gas emissions are hidden in the precision of the figure and these qualifications and assumptions are likely to be forgotten as it is the figure itself, and the associated image, that is memorable. Ross calls such figures ‘ecostatistics’ and says they form “the basic ammunition for environmentalists’ arguments made in the public arena” and are often used
to create a “climate of fear” (Ross 1994, p. 184). The use of statistics in environmental debates is often criticised as issues that are not amenable to quantification, such as attitudes or values, are often ignored or some attempt is made to attach a measurable value to them. For example, environmental attitudes may be equated to ‘willingness to pay’.

Statistics about housing and environmental issues hardly ever include environmental variables that are useful for the design of a particular house (for example, statistics about solar exposure for a specific location). This approach ignores environmental particularities – even particularities of climate – creating the impression that they do not matter.

7.3.2 Models of energy use

Modelling, and in particular computer modelling, is considered an important method for gaining understanding of the environmental impact of housing. Modelling is a technique used extensively to explore ‘what would happen if . . .’. Models are conceptual constructs that are used to represent reality. They may be verbal, mathematical, graphical or physical. Models have played an important role in developing theory about the environmental impacts of housing: for example climate modelling has been used to predict the future impacts on the world’s climates of greenhouse gas emissions (Alcamo 1994); urban growth models have been used to explore the environmental impact of development patterns (Young and Gu 1993); and stormwater models have been used to investigate management strategies for urban stormwater (James 1997).

Models have been used extensively to investigate environmental implications of design decisions. Physical models were used as early as 1944, when the then newly established Commonwealth Experimental Building Station (CEBS) constructed test huts and models in a number of locations to research the effect on thermal comfort of different forms of construction (Drysdale 1947, 1959). Physical scale models were also used at the Commonwealth Scientific and Industrial Research Organisation, Division of Building Research (CSIRO) to study the thermal performance of different constructions (Division of Building Research-CSIRO 1957). From the 1950s mathematical models of heat flows into buildings were developed (Muncey 1953, 1955, 1956; Coldicutt 1976); these contributed to the development of computer thermal simulation programs.

More recently building simulation models have become the major tool used to predict the impacts of design decisions.

Simulation models are:

... rule-based constructions to generate new states of systems triggered by the passage of time or the occurrence of some event. They are intended to mimic closely the behaviour of a system (Pickett et al. 1994, p. 72).
Building simulations may be used as a design tool in which case variations of a particular building are modelled to investigate the impact of design options. For housing, this use is rare partly due to the time, and hence expense, involved. Building simulations are also used as a research and policy-generating tool in which case they typically model the impact of design decisions on ‘a base case’ with a view to either optimising for given outcomes (for example, the construction combination that has the lowest heating and cooling load) or predicting the outcomes in a comprehensive manner (for example, establishing the heating and cooling loads for each of a range of construction types). Building simulation programs are used to model variables such as costs, lighting, spread of fire and thermal performance. Of particular interest to this thesis are those that model the energy use (operational and embodied) and the environmental impact of housing.

**Heating-related and cooling-related operational energy use**

Operational energy is the energy used during the ‘running’ of a house (for example, energy used for lighting, water heating, space heating and cooling, cooking and to run appliances). The simulation of operational energy use – and in particular the energy used for heating and cooling – is possibly the major form of computer modelling of housing for design purposes and is a major source of images of ‘what is’. Often, the results of such modelling are incorporated directly into design guidelines and used to establish rating schemes (for example NatHERS).

An early example of the use of a building thermal simulation program to investigate the operational energy use of a house in Australia is described in an influential paper published in 1974 (Williamson & Coldicutt 1974). This paper presented the results of a computer analysis comparing a standard project house and one with ‘thermally integrated’ modifications such as careful orientation with large north-facing windows shaded by a pergola with deciduous vine, internal mass (tiled concrete slab, brick internal walls, cavity brick external walls) and insulation to external walls and roof. The thermal performance and costs of the two cases with various forms of heating and cooling plant were evaluated. The analysis showed that:

... given the various assumptions, and providing the computer model could be relied upon, the suggested modifications resulted in considerable cost and energy savings while maintaining thermal comfort conditions (Williamson 1997, p. 1).

This study was followed by many others that adopted a similar approach and reported similar findings (see for example, Walsh et al. 1982; Baverstock & Paolino 1986; Szokolay 1991). In turn these studies are referred to in various design guides (see for example, NCDC 1977; Hollo 1982; Ballinger et al 1992; Hollo 1995).

Since the early 1980s building energy simulation software has been used to develop house energy rating schemes. Walsh et al. (1982) used a program developed at the CSIRO, called Z-STEP, to model the thermal performance of a house of rectangular plan in seven locations
in Australia. Internal temperatures and energy use were investigated for two types of construction (cavity brick walls with concrete slab-on-ground floor and brick veneer with timber floor). This work influenced the development of the first attempt at a house energy rating scheme in Australia, the Five Star Design Rating Scheme (GMI 1984). More recently NatHERS (Ballinger 1998a, 1998b), has been developed, based on the computer simulation of a proposed dwelling design. This software uses the simulation engine CHENATH developed by the CSIRO, Division of Building and Construction Engineering (DBCE) and whose origins can be traced directly to the Z-Step program. CHENATH was also used to develop ACTHERS and another rating program called BERS (Willrath 1996). VicHERS (now FirstRate) is another recently developed rating scheme operating from software based on the correlation of element behaviour formed from many thousands of NatHERS runs.

Most building simulation programs are used to develop ideas about optimum solutions. Building simulation programs are rarely used to model the impact of occupancy issues on energy use despite the acknowledgment that the occupants of a house play a vital role in residential energy use. One study of households living in identical houses found that energy use varied by as much as 100% between houses due to the characteristics of the occupants and their behaviour (Seliman 1978 quoted in Ballinger, Samuels et al. 1991, p. 25).

**Embodied energy**

Recently the embodied energy of buildings has been recognised as an important component of the life-cycle or total energy use of a building and there has been an increase in research into this consideration. Embodied energy is defined as:

\[
\ldots \text{the energy required to be consumed directly and indirectly in order to produce a good or a service, such as a building.} \text{“Direct energy” is, as the name implies, the energy required directly by the process. “Indirect energy” is the energy embodied in products that are consumed in the main process, such as building materials (EES 1999, p. 97).}
\]

One of the major problems with modelling embodied energy is obtaining appropriate data relevant to the local conditions. There are three major techniques for generating the data used for embodied energy analysis; process analysis (actual measurement of energy used at each stage of manufacture of a material), statistical analysis (use of figures from government or industry on gross energy use and total products produced) and input-output analysis (use of input-output economic data collected by Australian Bureau of Statistics). (See Worth (1993) or Pullen (1995) for a more detailed description.) Often a hybrid of process analysis and input-output analysis is used.

Embodied energy information is often presented in the form of tables (see for example, Lawson 1996) or used in conjunction with an analysis of operational energy over the predicted life of the building to enable the question of energy use to be considered in a “life-cycle perspective” (Fay and Treloar 1998; Watson and Hyde 1999). For example, Fay and Treloar (1998) model the operational and embodied energy required for various activities.
such as house operation and car ownership for a hypothetical couple over a 30 year period. Stephen Pullen reports on the impact of different wall and floor materials on the operational and embodied energy of a standard house and the resultant greenhouse gas production over a 50 year period (Pullen 1995). The recent report establishing the baseline data of greenhouse gas emissions for the residential building sector in Australia (EES 1999) includes a study of the impact on greenhouse gas emissions of different forms of flooring (timber or concrete slab-on-ground) and glazing (single or double) taking into account both embodied and operational energy. This is considered over a 100 year life span. The results of each of these studies are complex as they involve interactions between materials, time and energy and rely on many assumptions in the modelling.

Environmental models

A number of schemes exist that attempt to model a range of environmental issues (for example, the BREEAM scheme in the UK, BEES software tool in the US and the GBC assessment method in Canada (see Curwell & Spencer 1999 for descriptions)). In Australia, Soebarto and Williamson (1999) have proposed a building performance assessment tool (ENER-RATE) to model energy use and loads, indoor thermal comfort, life cycle costs, life cycle of embodied energy of the construction, and life cycle CO₂ gas production. It is proposed that the tool will also incorporate measures of environmental degradation associated with using nuclear fuel, and with creating atmospheric pollution and employing timber from non-sustainable sources. One of the essential drawbacks to any such attempt at a more comprehensive building environmental model is that of assembling the relevant information and keeping it up-to-date.

Summary: Modelling

An important value image associated with much of the research outlined above is that it is possible to predict actual energy use and hence to identify building forms that are efficient in terms of their requirements for heating and cooling energy. Typically, modelling techniques are used to generate information about the physical aspects of the building. These techniques are used to compare different forms of construction and to indicate those that are more 'efficient' in their use of materials or energy. Issues to do with people and dwelling are reduced to equivalent internal heat gains. This reinforces the impression that energy-use is determined by built-form and contributes to the image of the building as a problem for which there is a 'right answer'.

Much of the research outlined above presents the image that it is possible to use modelling to determine actual energy use. However, the cases modelled rarely match the complexity of actual houses with real occupants. Models entail a high degree of selection, simplification and abstraction. Selecting what is to be studied involves the consideration of many issues such as the amount of time and money available, the availability of suitable simulation programs and access to the information needed to input data. The operation of building thermal simulation
programs often necessitates simplifications to be made to enable the input of data, particularly regarding any aspects that in the real world are to some extent unpredictable such as the climate or people and the way they inhabit buildings. Actual energy use in housing is intimately linked to the characteristics of the particular householders such as the number of occupants, and their age, incomes, lifestyles and preferences etc. For ease of operation and to minimise the time spent inputting data for building thermal simulation models, occupancy is often reduced to a 24 hour pattern of heat gains from people and appliances that is then repeated for every 24 hour period of the simulation run. In reality factors that generate heat in a house such as the number of occupants, patterns of sleeping, activity, light use, cooking and appliance use are likely to vary from hour to hour, day to day, week to week and season to season; they may be varied deliberately to respond to climatic extremes. Similarly, patterns of heater and cooler use in Australia are intermittent and subject to a range of factors, not all related to temperature (Riordan & Williamson 1993; Williamson & Riordan 1997) although they are often modelled as thermostatically controlled. The solar access assumed in many building thermal simulation programs is ‘idealised’ and equates to having an open unobstructed site. In reality the majority of sites have restricted solar access because of neighbouring buildings or trees and shrubs or because occupants choose to keep window coverings such as curtains closed as is common on street frontages.

Usually, the simplifications and assumptions necessary to run building simulation programs are obvious only to those familiar with the programs. Hence the image persists that such programs model actual energy use in housing rather than predicting potential energy use given many assumptions (related to house form, occupancy, type of heater and coolers and their use, solar access, comfort conditions, etc.) and many unknowns (such as the future weather conditions and future fuel prices). Simplifications, assumptions and omissions are rarely made explicit and this contributes to the image that energy-use (and hence environmental) issues are easily modelled and that the information can be easily generalised to a range of situations. The apparent certainty and precision of many of the findings suggests these techniques are an appropriate way of evaluating energy and environmental issues given that many other methods of evaluation, such as monitoring what actually happens, prove so difficult.

7.3.3 Monitoring

Monitoring the environmental impacts of actual houses is an approach that aims to identify the connections between environmental and design issues in specific contexts. There is a long history of research projects involving the monitoring of houses in Australia. Many of these aimed to establish connections between housing design, thermal comfort and energy use. (See for example, Coldicutt et al. 1978; AHRC 1981; Coldicutt & Coldicutt 1985; Ballinger 1985). Despite the heritage of many decades of projects involving the monitoring of houses the impact of this work on current sources of design advice remains unclear. The results of
many projects remain largely unpublished and those that have been reported, particularly of occupied housing, often convey the image that the complexity revealed by the monitoring surpasses the understanding possible using the techniques.

For example, an important recent project that incorporated extensive monitoring of buildings, *A National Evaluation of Energy Efficient Houses* (generally called NEEHA) sought to establish “relationships between user evaluations of thermal comfort, lifestyle quality/amenity, and both design characteristics and energy consumption” (Ballinger, Samuels et al. 1991, p. 6). This was a joint project undertaken by Ballinger and Samuels from SOLARCH, Coldicutt and Williamson from The University of Adelaide and D’Cruz from Curtin University. An objective of this study was to provide information for dissemination to building professionals, policy-makers and the general public.

A total of 146 occupied houses (and their occupants) in Melbourne, Sydney, Adelaide and Perth were studied. The houses were divided into two groups: ‘energy efficient’ and ‘standard’ houses. ‘Energy efficiency’ was assumed if some published statement had been made to that effect. Since the statements could not be tested they were taken at face value (Williamson 1999). Amongst the ‘energy efficient’ houses:

... some houses had more solar efficient aspects than others, and a wide variety of strategies and unique combinations of potentially efficient features were evident within these sub-samples in each state (Ballinger, Samuels et al. 1991, p. 23).

The methodology included interviews and questionnaires to establish attitudes and preferences of the occupants about a range of energy, environmental, health, locational and built-form issues. The indoor thermal performance of the houses and thermal preferences of the occupants were monitored by Environmental Response Logger. Utility energy consumption records were collected for the two year period prior to the study. The study generated a vast amount of data much that remains unanalysed and unpublished. The results that have been published are in many ways inconclusive. For example, Table 7.1 shows the average annual energy consumption (electricity and gas only, other fuels such as wood are ignored) of the two groups of houses.

**Table 7.1: Average annual energy consumption (GJ) – NEEHA Survey derived from supply authority records**

<table>
<thead>
<tr>
<th>Location</th>
<th>Melb</th>
<th>Syd.</th>
<th>Ade.</th>
<th>Perth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Houses</td>
<td>54.4</td>
<td>43.6</td>
<td>44.3</td>
<td>17.8</td>
</tr>
<tr>
<td>Energy Efficient Houses</td>
<td>64.7</td>
<td>35.0</td>
<td>29.1</td>
<td>26.5</td>
</tr>
</tbody>
</table>

Source: Williamson et al. 1995

These results are somewhat surprising as the average energy use for the ‘energy efficient’ houses in Perth and Melbourne is higher than that for the ‘standard’ houses. However, the
report notes that an ‘energy rider’ needs to be invoked to clarify the meaning of the figures. This rider has two dimensions. Firstly, the figures are for household energy consumption and they reflect the influence of a wide range of issues such as the number of occupants of the household and their behaviour patterns, disposable income, lifestyles and appliance usage rather than simply the characteristics of the building.

The second dimension of the energy rider is that the figures:

... do not relate to energy efficiency per se which is a relative measure of how much energy is saved in comparison to other houses or households, or an indication of a high output to input ratio, where input is energy and output is anything valued (comfort, amenity, dollar savings...) (Ballinger, Samuels et al. 1991, p. 25).

The ‘energy efficient’ houses are not variations of the ‘standard’ houses with the addition of energy efficient features. They are different houses, in different locations, of different sizes, construction methods and use patterns. In other words, limited conclusions can be drawn from the data gathered about the relationships between particular design characteristics of houses and energy consumption.

[The results of this study illustrate the complexity and unpredictability of the interactions between physical design aspects of a house, its surroundings, and total energy consumption, thermal comfort evaluations and lifestyle preferences. An understanding of the impact of the wide range of the occupant aptitudes, attitudes and behaviours on energy consumption is still evolving (Ballinger, Samuels et al. 1991, p. 9).

The NEEHA project not only highlights the complex range of factors that contribute to residential energy use but also indicates the difficulty of disentangling the influence of particular design decisions. Such results are difficult to reduce to the format of generalised design information common in current sources of design advice.

7.3.4 Summary: Dominant images of the environmental impact of housing

Most of the current research into the environmental impact of housing in Australia concentrates on the relationship between built-form and energy use. This reinforces the image evident in the design advice that environmental issues are considered in global terms – where the environment is common to all and is largely framed in terms of problems – and that the appropriate way of identifying and understanding these issues is through the use of science. In this view housing contributes to environmental degradation and specifically to the production of greenhouse gases. Energy use is considered to be the major environmental concern during the design of a house and the relationship between energy use and built-form is treated as something that can be understood using scientific techniques. The ‘scientific’ nature of the techniques used to research these issues, and their suggestions of objectivity, give them an image of authority.

The overall image bound up with these techniques is that information generated using them will be useful for the consideration of environmental issues in house design. And yet often the design implications of the research findings are not readily apparent. The linear, selective
manner of dealing with environmental issues in research does not reflect the design process where environmental concerns are intertwined with, and affected by, many other concerns. The image associated with the research is that it can provide scientifically-justified images of general purpose (i.e. context-free) solutions. Despite this, most of the results of the research are highly qualified and indicate the complexity of issues affecting energy use (and other environmental issues) and the importance of the particularities of site, occupancy, climate etc. This creates an unresolved conflict between the image that “there must be a solution” on the one hand and that there is no one solution on the other. Design advice tends to draw selectively on this research to support the images it projects.

7.4 Images of ‘environmentally appropriate’ house design

Images of ‘appropriate’ solutions for addressing environmental issues in house design are dominated by representations of specific houses and house models. Information about appropriate house models is derived largely from the techniques outlined in the previous section and then ‘re-packaged’ for the design audience. The following sections consider two models of appropriate houses: the solar-efficient model (an established approach to energy efficiency) and the tropical model (a ‘popularised’ version of design for comfort in hot-humid climates). Following this some examples of specific houses are outlined.

7.4.1 The solar-efficient model

Largely for historical reasons the solar-efficient model of house design has become the dominant approach to energy-conscious and environmental house design in temperate Australia. The paper by Williamson and Coldicutt (1974) (see 7.3.4) identified certain modifications to a house design (northern orientation, pergola with deciduous vine to the north, internal mass and insulation to external walls and ceiling) that could lead to energy and cost savings. Twenty three years after this paper was published one of the authors maintains:

> the conclusions in the paper on suitable features to be incorporated into a Solar House provide an insight into the conceptual shift associated with the general acceptance from the mid to late 1970s of this kind of description of the essential elements of a prototype solar-efficient energy-efficient dwelling for the temperate climate locations of Australia. Around this time the discourse changed in several ways: “energy” became more central to the house design problem and the rhetoric of design information embraced the ideal of focusing on the integrated whole building as the product (Williamson 1997, p. 2).

The main features of the solar-efficient model are:

- good solar input in winter (mainly via north-facing windows in the southern hemisphere) and adequate shading in summer,
- internal mass to modify temperature swings, and
- insulation to reduce unwanted heat loss and gain.

The rationale of the solar-efficient model is essentially that the building structure is designed as a solar collector to reduce winter heating requirements and is massive to reduce internal
summer temperatures. In Australia the solar-efficient house is advocated for temperate regions where the climate is characterised by cold winters and hot summers although some researchers recommend it for sub-tropical and tropical areas (Szokolay 1991).

This prototype of energy-efficiency has dominated the design information in the intervening years for architects and designers (see for example, Hollo 1982; Greenland & Szokolay 1985; Szokolay 1987; Ballinger et al. 1992; Energy Victoria 1994; Department of Housing & Regional Development 1995) as well as for the general public (for example, NCDC 1977; Wellings 1988; Hollo 1995). Information about the solar-efficient model is often presented as a series of prescriptive rules with accompanying visual images either in the form of diagrams and orthogonal drawings or photographs of houses that illustrate the features. Williamson lists the common ‘rules’ appearing in a number of sources of design advice:

- Zoned design with living rooms to north, bedrooms to the south. Main heating in living areas.
- A length-to-width ratio of approximately 1 to 1.5 on the east-west axis.
- Cavity brick, slab-on-ground construction.
- Ceiling and wall insulated (recommended values may vary with climate).
- North facing windows, sometimes with a recommended area given as a function of floor area.
- No or minimum glass facing east and west.
- Shading devices to windows during summer (often expressed as an eaves projection or by using deciduous trees or vines for north facing windows and blinds etc. for east and west facing windows).
- Minimum winter ventilation rate. (Williamson 1997, p. 2-5)

The solar-efficient model has been developed largely using thermal simulation computer programs and as such many of the problems outlined in relation to modelling in general apply. Assumptions are not made clear. Issues are treated selectively. The solar-efficient model is often presented as a way of significantly reducing energy use in housing whereas it is only addressing heating and cooling loads. Simplifications are made regarding occupancy patterns, solar access, and the use of heaters and coolers. Often these simplifications are not apparent.

The image of the solar-efficient model is evocative and powerful, combining performance, materials, climate and images of sunlight and light (at least in the north). The promotion of the solar-efficient model, while perhaps not a success if measured in terms of the houses known to be built following the principles, has certainly brought the image of housing as an environmental issue to the attention of the architectural profession and the general public. In particular it has raised awareness of the possible effects of orientation. ‘Environmentally appropriate’ housing has become strongly associated with the features of the solar-efficient model (particularly the large north-facing windows and internal mass in the form of concrete slab-on-ground floors).
The dominance of the solar-efficient image perpetuates the idea, evident since the 1970s, that the consideration of environmental issues during design essentially revolves around the consideration of energy use. This image also reflects the idea that energy use is dependent on the form of the building fabric. As noted above, other factors that are not part of the image may in reality have a significant impact on energy use. For example the occupants and their lifestyle, the size of the house, and the nature of plant and the type of fuel sources are all important determinants of actual energy use. The dominance of the solar-efficient image, certainly in temperate Australia, has resulted in this model becoming the bench-mark for 'environmentally appropriate' design. It is reflected in the requirements of rating schemes and point score systems that favour elements of the solar-efficient model such as concrete slab-on-ground floors, north facing windows and massive walls.

For many people other than those who grasp the 'theory' of solar-efficient design, this model is recognised by its components rather than in terms of the inter-relationships between these components. Thus it is strongly associated with large windows to the living area, clerestory windows, eaves overhangs, tiled slab-on-ground floors, masonry walls and (less visibly) insulated roofs. Less obvious is the performance of the model and the way this involves the interaction between these features in relation to the solar access and the climate of a particular site, and to the thermal, cultural and lifestyle preferences of the future occupants.

### 7.4.2 The tropical model

Another recognisable design model in Australia is the tropical model of house design. In Australia, the theoretical origins of this model can be traced to the original work of the Commonwealth Experimental Building Station (CEBS) in the period following World War II that divided the country into three "broad classifications" of climate zones (temperate, arid, hot-humid) and presented different design information for each zone (Drysdale 1950). These divisions (and their sub-divisions) are often still used in design information (see for example, Ballinger et al. 1992 and Hollo 1995) although one writer has defined seven climate zones in Queensland alone (Szokolay 1991). The 'tropical model' relates to design information for the hot-humid climate zone.

In the post-war period research at the CEBS was conducted to investigate methods of improving thermal comfort in hot weather "without resort to air conditioning or other cooling equipment" with the "view to improving the thermal behaviour of timber-frame construction for service in the inland districts" (Drysdale 1953). The resulting publication, *Designing houses for Australian climates* (Drysdale 1959) highlights the importance of ventilation for housing in hot-humid climates and recommends shading external walls and installing insulation to ceilings and those walls that cannot be shaded. Recommendations are made regarding wall materials (heavyweight or insulated frame construction for sunlit walls, frame construction for others) and floor materials (concrete slab-on-ground or suspended timber).
Large areas of windows are advocated preferably casement, top-hung sash or louvre windows that have relatively large openable areas.

More recently, architect Phil Harris from Troppo Architects has outlined four principles for house design in hot, humid climates (Harris 1991-92):

- promotion of cooling breezes
- ventilation by convection
- reducing radiation of heat
- sheltering walls and openings

He advocates uninsulated lightweight, elevated, timber-floored structures with extensive openings well-protected from sun and driving rain. This work is reproduced in the AMCORD Practice Note for design for hot humid climates (Department of Housing & Regional Development 1995 – see Appendix B 26-31).

Although the ‘tropical model’ was originally proposed for the hot-humid regions of Australia (far-north Queensland and Northern Territory) it is visually associated with a house style known as ‘the Queenslander’. Common throughout Queensland, this is an elevated, timber housing style with wide verandahs and relatively open internal planning in which shade and ventilation are driving climatic forces. The visual images associated with this house type are evocative: the shutters, screens and wide verandahs creating interesting shade patterns and suggesting a haven from the external heat. The tropical model is strongly associated with a number of contemporary architects and architectural firms such as Troppo Architects from Darwin (see Figure 7.1), and Lindsay Clare and Gabriel Poole (see 7.4.4 below and Figure 7.2) from Queensland and the Sunshine Coast in particular.

As with the solar-efficient model the image of the tropical model is strongly connected to certain elements: in this case lightweight wall and roof materials, large well-shaded openings, and screens and shutters. The importance for the performance of the building of the inter-relationship of the various elements is harder to convey and, partly because of this, not a strong aspect of the image. The image conveys implications for other aspects of the design such as privacy and security and presumes certain strategies for cooling, specifically that cooling is by natural ventilation and ceiling fans rather than air conditioning.

7.4.3 Summary: House models

An important aspect of current design advice is the image that design models are an appropriate method for presenting information to architects. These models are seen to reflect current ideas about how to address the environmental impact of housing in a format that is suitable for architects. It is presumed that architects can adapt the generalised nature of the information embodied in the models to their particular requirements.
The models outlined above are the two dominant images of approaches to ‘environmentally appropriate’ house design that are reflected in design advice in Australia. These are often referred to in terms of heavyweight construction (solar-efficient model) and lightweight construction (tropical model). The image of ‘environmentally appropriate’ house design expressed in these models is based around the idea of providing thermal comfort while minimising the need for artificial heating and cooling. There is an assumption that reducing energy use – or more specifically the energy used for heating and/or cooling – is a major concern during design. Energy use is largely considered in relation to the physical form of the building. The image presented by these models is that they represent ‘scientifically’ proven design strategies for reducing energy use and that this can be achieved in actual houses by following the prescriptive rules associated with the models.

A number of limitations associated with the models have been outlined above. Often the models do not include images of site or occupancy. This creates the impression that issues to do with the occupants are not an important design consideration in relation to energy use and that the models can be adopted irrespective of individual particularities of site and occupancy. The images do not encompass the many other contextual issues that are likely to confront an architect designing a house. In some cases aims to do with energy use may conflict with these other issues such as cost restrictions, aesthetic concerns or issues to do with privacy and security. Despite these short-comings, these models are an important sources of images for design advice and hence for architects. This importance is connected to the fact that they present images of ‘the solution’.

7.4.4 Specific houses

Books, design guides and journal articles that feature visual images of built examples of energy-efficient, ‘green’, or environmentally responsible housing in Australia have been relatively common since the 1970s. They are perhaps the most common method of presenting to architects information about ‘appropriate solutions’, outcomes or products about environmental or energy-efficient housing. (See for example, Szokolay & Sale 1979; Baggs et al. 1985; Greenland & Szokolay 1985; Ballinger et al. 1992; Energy Victoria 1994; Hollo 1995). These images of actual houses also inform design advice images of ‘environmentally appropriate’ house design.

‘Research’ of actual houses often takes the form of case studies that consist of information about the design and the performance of particular houses. Case studies have been suggested as an appropriate method of integrating visual images of built-environment solutions with ‘technical’ information based on the techniques outlined in the previous section (Kealy & Lewis 1988; Energy Victoria 1991a). This approach has been adopted for design advice.
overseas in European Community publications such as *Solar Architecture in Europe* (ECD Partnership 1991) and in Australia (see for example, *Energy efficient housing manual* (Energy Victoria 1994), *BDP Environment Design Guide* (BDP 1995, ongoing) and *AMCORD* (Department of Housing & Regional Development 1995)).

In Australia, there are relatively few published examples of case studies of housing. In the period from 1995-1998 when fifteen case studies were presented in the *BDP Environment Design Guide*, only four relate to residential architecture and one of these essentially describes a ground source heating system used in a medium high-rise apartment development (Pidcock 1997). The Armstrong-Mobbs Sustainable House case study (Prasad & Veale 1998a – see Appendix A 23-28) describes an extension to the north-facing rear of a terrace house in inner-Sydney, New South Wales that incorporates extensive energy and water conservation and waste treatment features. This case study presents the image of an experiment in ‘environmentally appropriate’ living on a tight urban site that is an expression of the strong beliefs of the clients. The clients spent four years researching the systems used in the project and were willing to fund design features such as roof-mounted solar panels that run appliances and feed electricity back into the grid, the collection of rainwater for potable water and the use of composting and reed bed waste-water treatment. A cost-benefit analysis concludes that, given the constraints of the site, current technology and prices, and an assumption of a 20 year life span of capital equipment, the net present value at the time was negative (– $31,000). This case study includes some outcomes achieved. At the time it was written:

- apart from one severe rainfall all stormwater had been retained on site
- no sewage had left the site, and
- the solar panels had supplied more power during the day than was used at night from the grid.

Case Study 13 (Capricorn 151) describes the display house for a range of project houses called Capricorn (Prasad & Veale 1998b – see Appendix A 29-34 and 5.5.1). One important image of ‘what is’ presented in this case study is that the Capricorn 151 design embodies less energy than conventional project house construction. Embodied energy data from Lawson (1996) are used to support this although only certain elements are compared. An embodied energy of 131,000 MJ is estimated for the steel portal frame, fibre cement sheet and corrugated iron clad external walls, timber floor and corrugated iron roof of the Capricorn 151 and of 160,000 MJ for the more conventional project home construction of brick veneer, concrete slab-on-ground and tiled roof.

The other important aspect of this case study is that the design is connected with an image of a particular lifestyle. The Capricorn 151 has elements that are strongly identified with its designer, Gabriel Poole who is widely-known for houses that are long and thin, allow a high degree of openness, and have flexible climate control in the form of screens, blind and
louvres. These houses have become associated with a relaxed Queensland indoor-outdoor lifestyle. The Capricorn project houses are designed to offer some of these features to people who cannot afford an individually designed home.

Poole acknowledges that many of the potential customers [for Capricorn 151] are familiar with his work and come to the display house predisposed to the type of lifestyle intrinsic to his houses (Prasad & Veale 1998b, p. 6).

The Homebush Newington Village case study (Prasad & Veale 1998c – see A 35-46) describes the first stage of a housing development at the Olympic Village site. This development was intended to showcase some of the environmental guidelines developed for the entire Olympics project. The designs incorporate a number of strategies to conserve energy and water (see 5.5.1) in line with these guidelines although no benchmarks or specific requirements were established in the brief (Prasad & Veale 1998c, p. 2). Many features of the solar-efficient model are included in the designs. Claims are made that the strategies that were adopted result in water and energy usage that is 50% that of “average Australian houses”. This estimate is based on computer simulations rather than measured use. At the time the case study was written only one phase of the three phase project was complete (although unoccupied) and some of the water and energy saving features had not been completed. Nonetheless the case study presents the image that the designs demonstrate actual energy and water savings.

Newington is notable for its demonstration that energy and potable water savings of more than 50% below the norm can be achieved within a relatively conventional medium density development. The architects were able to achieve these gains while maintaining reasonable levels of privacy within the spatial constraints of medium density (Prasad & Veale 1998c, p. 12)

AMCORD presents the case study of New Haven Village in Adelaide in its Practice Note regarding planning sustainable residential development (Department of Housing & Regional Development 1995). This outlines the energy and water management strategies for the development, however construction of the development was barely underway when the study was written. Five other case studies are presented in the design Practice Notes of AMCORD (see Appendices B3 and B4) including four that are drawn from a publication produced by Energy Victoria (Energy Victoria 1994). These describe the design for the ‘Green Home’ display home built following the guidelines for the Australian Conservation Foundation Green Home, a house with a view to the west, one with no solar access and an alpine house. The solar-efficient features of these designs are described and the designs’ star rating from a house energy rating scheme is given.

Apart from the Victorian examples there is one other case study that discusses “a medium density housing project in Sydney that adopted energy efficient and water efficient design techniques” (Department of Housing & Regional Development 1995, PND 18 p. 1). This is illustrated with a photograph and two diagrams outlining the “energy conservation principles” (living areas facing north, eaves designed to prevent sun penetration in summer,
concrete slab floors). However the diagrams bear little resemblance to the buildings in the photograph. All the case studies have little specific detail and their main contribution seems to be to reinforce the idea, in a graphical format, that the solar efficient model is the appropriate way of achieving energy conservation rather than explaining how this was achieved in specific cases.

Many of the case studies outlined above appear to have been unbuilt or unoccupied at the time they were written about. The absence of references to the occupants in many of these examples reinforces the impression that environmental issues are non-human and largely to do with manipulating the built-form and technical systems. In most cases environmental goals are not explicit and the studies largely consist of descriptions of energy-efficient and water conservation features incorporated in the designs. Therefore a range of topics of interest to other designers such as how goals and strategies are matched, how these relate to outcomes, the costs of incorporating environmental features, and the problems encountered with obtaining planning and building approvals, and with procurement, construction and the operation of the systems, are not covered.

Some publications attempt to deal with the performance aspect of case studies by monitoring how houses perform in relation to energy use, water or waste treatment (see for example, ECD Partnership 1991). This strategy was adopted to a limited extent in the Armstrong-Mobbs Sustainable House case study (Prasad & Veale 1998a). However, this presents the problems of time, expense, technology and interpretation associated with monitoring outlined above. Another approach is to simulate what should happen however given that the way the occupants use a building has such a significant impact on performance, and the difficulty of predicting future events (changes to appliance ownership or efficiencies, utility prices, household income etc) the best this can do is show what could happen given certain assumptions rather than what will happen.

Despite these limitations case studies provide an important source of images of design solutions. The selection of particular houses as worthy of study clearly identifies them as ‘appropriate solutions’. The strategies outlined in the text and the visual images presented in drawings and photographs become strongly associated with ‘environmentally appropriate’ design.

Public images of ‘environmentally appropriate’ houses are also found in the popular media and in professional journals. Recently the architecture profession has ‘endorsed’ certain buildings through the state and national chapter annual design awards. In 1993 the RAIA introduced citations for environmental issues and in 1998 a common format was adopted nationwide for two awards: the Ecological Sustainable Development (ESD) Award and the Energy Award (see Appendix C 1-3), the latter having a specific residential category. Images of some of the winning designs (see Appendix C 4-6) appear in the architectural design journal Architecture Australia. This journal is published by the RAIA and distributed to
Institute members, and as such is an important source of architectural information for the profession. Award-winning designs are often presented as visual images of the external form accompanied by a written description of the building and a short report of its environmental features.

Public images of ‘environmentally appropriate’ house design are also associated with particular architects and architectural firms such as those mentioned during the interviews: Gabriel Poole (see Figure 7.1), Troppo Architects (see Figure 7.2), and Glen Murcutt (see Figure 7.3).

**Figure 7.1 Architect’s own house, Sunshine Coast Qld: Gabriel Poole**

Source: *Vogue Living* April/May 1997, p. 90-91

One of Poole’s designs featured as a Case Study in the *Environment Design Guide* (see above and 5.5). Phil Harris from Troppo Architects was a consultant for the development of the AMCORD notes on design for hot humid climates (see Appendix B 26-31). Many houses designed by Troppo Architects, Poole and Murcutt have also been widely publicised in popular magazines and books. These publications are designed for a general readership. In these publications, visual images of the external form are an important aspect of the information about the houses. Often the accompanying text emphasises a connection between the houses and ideas about design that is ‘good for the environment’.
Figure 7.2 Housing by Troppo Architects

Source: Artlink, Special Issue: art, architecture and the environment, Summer 1991-92, p.40

This concept may be discussed in relation to such issues as resource or energy use but is often connected to lifestyle concerns – the importance of openness, climate responsiveness and connection to the natural world. These aspects of design are often easier to convey through visual images than, for example, the concept of energy performance, as the ideas are ‘expressed’ in the external forms of the buildings through such things as large openings,
screens, and decks. Visual images of solutions that are evocative and that incorporate features that are easy to illustrate through plans and external elevations (for example, solar systems, window shading, louvre windows for ventilation) may have the greatest chance of reproduction in books, magazines and journals. Many of the features mentioned above can act as signs and symbols for 'environmental' or 'energy efficient' design. In time, certain buildings can act as "code words" for design principles (Watson 1984). Perhaps the best-known Australian example of this is the connection between the buildings of the architect Glen Murcutt (see Figures 7.3) and the term 'touch-the-earth-lightly'.

Figure 7.3 Simpson-Lee House, Blue Mountains NSW: Glen Murcutt
7.4.5 Summary: Dominant images of appropriate house design

The preceding section presents some examples of the images of ‘appropriate solutions’ that are reflected in current design advice. These images also provide an important source of design advice for architects about houses and house types that address environmental issues. This information is dominated by images of a product – specific houses or models of house types. Other solutions such as political or cultural changes, or changes in process are rarely canvassed.

Images of ‘appropriate solutions’ is the area that perhaps best illustrates the inherent interdependence of images of ‘what is’ and images of ‘what should be’. Many sources of design advice about how environmental issues should be addressed in house design draw heavily on images of existing houses and house types. (For example, both AMCORD and the Environment Design Guide include case studies to illustrate the design principles outlined.) In turn the examples illustrated in the design advice often have been identified as ‘appropriate solutions’ because they reflect the image projected in design advice about ‘what should be’ rather than because they have been shown to perform in a particular way.

The connection between environmental issues and the appropriate form of buildings is perhaps most clearly defined in the models of house design and the case studies that attempt to articulate the links between design goals, strategies and the resulting built-form. The dominant value image associated with the models and case studies is that of reducing energy use. Often the links between strategies for addressing this issue and the resulting built-form are ‘scientifically’ justified through assigning the design an energy rating or comparing it with an established model for addressing these issues.

The situation is less clear-cut with other images of ‘environmentally appropriate’ houses such as those often featured in popular magazines and books (see Figures 7.1 -7.3). In these cases the evaluation of the environmental ‘appropriateness’ of a design is less ‘scientific’ and the environmental goals addressed may be more complex. Popular images of the designs of architects such as Poole, Troppo Architects and Murcutt associate ‘appropriateness’ with issues such as a connection to the natural world. This approach to environmental issues (reflecting a ‘field of significance’ view of the environment) is largely unrepresented in the design advice apart from through images of these ‘solutions’. For example, Gabriel Poole’s design for a project house forms the basis for a case study featured in the Environment Design Guide (Appendix A 29-34) and Troppo Architects designs are featured in AMCORD (Appendix B 26-31). In the text of design advice these buildings are largely considered in relation to energy efficiency and comfort although, in the case of Poole’s design, the issue of ‘lifestyle’ is also raised. This can lead to some confusion about the goals that ‘environmentally appropriate’ house designs are addressing. Nonetheless, the wide-spread recognition of images of these buildings, and their strong identification with environmental
issues, indicates the overwhelming importance to both architects and the general public of images of solutions.

7.5 Images of the occupants

Other important images of ‘what is’ that inform current sources of design advice are those to do with the future occupants of the house. These images derives from a wide range of sources including environment-behaviour studies, thermal comfort studies, psychology, sociology and phenomenology.

7.5.1 Built-environment research: comfort studies

Research that investigates the connections between energy use and comfort is one of the major sources of images of the occupants of housing used in design advice. In general usage comfort has a wide meaning: it may refer to visual comfort, acoustic comfort, thermal comfort or a sense of ease and well-being. It can encompass both health and delight. Comfort is multi-faceted and bound up with social conventions, advances in technology and ideas about convenience, efficiency, physical ease, pleasure and privacy. The idea of comfort “has meant different things at different times” (Rybczynski 1986, pp. 230-231). Images of comfort and what it means are important concerns in design.

For example, attitudes to the ventilation of houses have changed considerably since the nineteenth century. At that time ventilation became an important concern partly because of the need to get rid of smoke from the open fires used for heating and cooking but also because of the desire for fresh air in the dwelling. Contemporary theories about comfort identified a connection between ‘stuffiness’ and carbon dioxide levels and it was thought that many illnesses were caused by airborne substances present in ‘foul air’. A consequence of this image was that the recommended ventilation rates in the late 1800s were up to 10 times greater than those considered necessary today and elaborate gravity fed ducting systems for drawing air into houses were explored (Rybczynski 1986, p. 134).

The later part of this century has seen a dramatic lowering of ventilation rates partly due to greater knowledge about disease transmission but also related to changing ideas about comfort and the increased use of mechanical heating and cooling. Lowering ventilation rates is recommended as a way of reducing unwanted heat gain and loss. Paradoxically, Shove (1995) notes that along with these changes, the internal environment, once seen as a protective barrier against the hostile external environment, is now viewed by some as a potential danger to the occupants due to the increasing incidences of ‘sick building syndrome’. It appears that increased rates of allergies and asthma are partially attributable to the lowered ventilation rates and to the properties of modern building materials and to modern construction techniques. These are powerful images of ‘what is’ that influence images of ‘what should be’ and vice versa.

146
Much of the research into comfort associated with building design is very narrow. The terms 'comfort' and 'thermal comfort' are frequently used inter-changeably giving the impression that they are one and the same thing – or can be taken so for the purposes of design. Comfort is often presented as one of a paired set of aims that taken together express the notion of efficiency. For example:

_The main objective of a climate-sensitive, environment conscious approach to building design is to provide a high standard of comfort and environmental quality with the minimum use of conventional energy sources._ (Yannos 1994, p. 9).

The context in which the term ‘comfort’ is used in the quote above suggests that what is actually meant is thermal comfort, a narrower term that can refer to “that condition of mind which expresses satisfaction with the thermal environment” (ASHRAE 1992, p. 3). In scientific literature thermal comfort is usually described in terms of those variables that are seen to influence it: environmental conditions (air temperature, mean radiant temperature, air velocity, relative humidity), and levels of activity and clothing. Rybczynski (1986) maintains that thermal comfort deals with issues that can be measured and defined thereby ignoring those aspects that cannot be measured:

_During the six years of my architectural education the subject of comfort was mentioned only once. It was by a mechanical engineer whose job it was to initiate my classmates and me into the mysteries of air conditioning and heating. He described something called the “comfort zone,” which, as far as I can remember, was a kidney-shaped, crosshatched area on a graph that showed the relationship between temperature and humidity. Comfort was inside the kidney, discomfort was everywhere else. This, apparently, was all that we needed to know about the subject. It was a curious omission from an otherwise rigorous curriculum; one would have thought that comfort was a crucial issue in preparing for the architectural profession, like justice in law, or health in medicine._ (Rybczynski 1986, p. ix).

Information for designers about indoor environmental conditions is still commonly presented in terms of a “comfort zone” (or psychrometric) diagram. (See for example, Ballinger et al. 1992; Hollo 1995; Yannos 1994.) Often design guides that include such information also specify a range of comfortable summer and winter temperatures and humidity levels (derived from the diagrams).

_The summer conditions in which most people feel comfortable range from approximately 20°C to 27°C, when the relative humidity is below 60 per cent._

_In winter, the conditions in which most people feel comfortable range from approximately 18°C to 24°C. Air movement in cool conditions reduces warmth._

_At night, during sleep, the comfortable range of temperatures is lower._ (Hollo 1995, p. 17).

Data for psychrometric diagrams are derived from studies of thermal comfort or thermal sensation based on climate chamber studies, field studies or mathematical models. (For overviews of such work see Humphreys 1975; McIntyre 1980; and Parsons 1993). Thermal comfort models are often used to derive the temperature at which a percentage of the population feels thermal neutrality (neither too warm or too cold). This information is then used where assumptions are made about desired comfort conditions because the future
The thermal comfort studies are directed towards establishing norms and averages. They are not concerned with the idiosyncratic differences that individuals exhibit towards thermal conditions or the strategies that these individuals adopt to deal with these conditions in the real-world. The image of the individual arising from thermal comfort studies is that of a generalised person with a body that exhibits thermostatic responses to his or her environment. The individual is assigned an essentially passive role and feeling 'neutral' is a desired state. The 'environment' in this image is narrowly defined in terms of thermal conditions. The rich interaction of factors that contribute to a sense of comfort in the real-world is reduced to a narrow consideration of thermal conditions. Images to do with aspects of built-form that influence notions of comfort, in the broader sense, are hard to discern.

### 7.5.2 Built-environment research: energy use

Another important source of images are studies that investigate people's attitudes and knowledge about energy use and/or environmental issues related to housing. Often these are conducted during the development of policy or to assess such policy. For example, during the development of the Victorian house energy rating scheme a survey was conducted to "identify and investigate the barriers to the increased market penetration of energy efficient homes in Victoria." (Energy Victoria 1991a, p. 2). One of the findings of this study was that energy-efficiency is not a high priority amongst people buying or building a home. Other issues such as cost, amenity, location, price and external appearance were rated higher, confirming the results of other studies (see for example, Hassell Planning Consultants, 1983; Giesbers & Scarfe quoted in Ballinger, Samuels et al. 1991). This is borne out by thermal insulation studies that highlight the fact that most people do not insulate their houses to reduce energy use but to improve comfort. For example, an Australian Bureau of Statistics survey of nearly 2,000 households that had installed insulation in their dwellings revealed that 76.4% had done so to achieve comfort whereas 16.3% wanted to save energy costs and 4.9% to reduce energy use (ABS 1994). In some cases researchers have found that energy use was higher in houses with insulation than in non-insulated houses (Kirby 1979) and that the installation of insulation was connected to increased energy use (Cloher 1981). These seemingly anomalous findings were related to factors such as the use of appliances, larger dwelling sizes and increased amenity. Even amongst potential home-buyers who are aware of the benefits of climatically-appropriate design or those people who live in 'low energy' homes, efficiency is often not highly valued (Ballinger, Samuels et al. 1991; Energy Victoria 1991a; Bennetts 1998c). In the Energy Victoria study (1991a, 1991b) a good proportion of the home buyer group understood aspects of solar-efficient design (the use of insulation, windows to the north etc.) but only talked of these things in the "context of comfort, lifestyle
or taking advantage of the sun (and not saving energy)”. Some of the second home buyers and renovators mentioned that they wanted more light, “but again it was not in an “energy efficient” context (but rather in an aesthetic sense)” (Energy Victoria 1991b, p. ii).

Trevor Lee (1994) conducted a pictorial survey of Australia’s first ‘passive solar’ public housing development approximately ten years after occupation to illustrate the problem of lack of knowledge or appreciation of the energy saving features of the designs. Many of the tenants had effectively diminished their solar access through planting or otherwise shading their north-facing windows.

*It is apparent that many occupants of the early solarised dwellings revisited are not getting the full measure of energy savings and enhanced comfort that the design allows. In several cases, occupant action in building out their own solar access indicates a low or possible even negative value is placed on their solar heating capabilities. Alternatively, it may indicate that the conceptual extension of living spaces onto a northerly patio, an integral part of many of the original designs, is so attractive as to tempt the owners into extending the roof in translucent material to protect the pleasurable times they have there (Lee 1994, p. 4).*

The image evident in studies such as those outlined above is that of the ‘problem’ of the future occupants’ attitudes and knowledge about energy use. Much of the research is directed towards understanding this problem and proposing solutions to it. The research image of the house is that of an energy-user while it appears that the occupants’ image of their house (or future house) is related to the way they want it to feel and look.

### 7.5.3 Psychological and sociological studies of energy use

Other important sources of images of the occupant that informs design advice are psychological and sociological studies concerned with the connection between energy use and people’s behaviour, attitudes and beliefs, and social and cultural concerns. Contributions from this field of research span more than two decades.

The investigation of energy-using behaviour as a topic of psychological study began in America in the 1970s with the oil embargo, waned during the 1980s and revived during the 1990s in response to issues such as acid rain, urban air pollution and the threat of global climate change. David Crossley published a number of papers in Australia during the 1970s (referred to in Williamson 1997) but most of the more recent work originates in America. Often research in this field aims to identify models of individual behaviour with the overall objective of influencing changes in energy consumption behaviour (Kempton et al. 1992). This often involves evaluating energy saving techniques (for example, Wilk & Wilhite 1985) and conservation programs (for example, Brown and Berry 1995) or conducting large scale attitudinal surveys (for example, Samuelson & Biek 1991). Recent work in this field links individual energy use to the environmental problem of global climate change and Kempton et al. (1992) maintain this association raises distinctive issues.
One thing that is profoundly new about the 1990s energy problems is the moral component. . . the case for solving energy problems in the 1970s could be easily made on other grounds as well, such as national security and personal economic motivations driven by high prices.

The situation is different now. Lower prices reduce the self-interest motivation, and equally important, many of the most serious effects of today’s environmental threats occur far in the future, to other nations or to other species (Kempton et al. 1992, p. 1220).

Samuelson and Biek (1991) refer to the importance of individuals’ beliefs and attitudes for conservation behaviour. They maintain that:

... when an individual perceives that his or her contribution to a public good (e.g., reducing US energy consumption) will not make a perceptible, significant difference to the group’s collective outcomes, then he or she will be less likely to make contributions ...[and that] individuals may be more likely to conserve common resources when they perceive the resource scarcity has been caused by genuine environmental causes (e.g., drought), rather than by others overconsumption (Samuelson and Biek 1991, p. 552).

In a review of the contribution of psychological understanding of behaviour and attitudes to energy conservation, Paul Stern outlines the importance of a range of non-financial motives for energy conservation such as consumer preferences, group membership, personal values and attitudes, and problem avoidance (1992). He notes that energy conservation is often “perceived as a sacrifice” whereas adopting new technology can be seen as “an improvement in the quality of life” (Stern 1992, p. 1226). Seligman et al. (1979) find that while the connection between general attitudes (such as environmental concern) and specific behaviours (such as energy-conserving) is not strong, there is a correlation between energy use and specific beliefs (for example, that a warm internal environment is healthy). This point is confirmed in another study of residents’ attitudes and beliefs towards energy-use in south-western United States that finds “that the comfort and health factor was by far the best predictor of actual energy consumption behaviour” (Samuelson & Biek 1991, p.562).

The dominant value image evident in these works is that of the necessity to address global environmental problems related to the use of energy. People are seen in relation to these problems. Research is directed towards trying to understand why people don’t conserve energy and investigating what can be done about this. The ‘individuals’ at the centre of the research tend to be generalised as a consequence of the methodologies used (for example, large scale surveys) and the end-use to which much of the research is directed (often addressing policy issues, particularly energy conservation programs). There are few images of built-form or dwelling associated with these images.

While psychology concentrates largely on the behaviour of the individual, sociological and anthropological studies are concerned with the influence of social and cultural issues. Loren Lutzenhiser (1992a) provides an overview of the contribution (both existing and possible) of sociological analysis to the question of domestic energy use. She maintains that energy use is treated in sociological analysis as both a social problem and a theoretical problem.
In the case of the social problem perspective:

... a long social science research tradition has demonstrated that persons’ energy-consumption levels, their likelihood of pursuing conservation, and their understandings of energy and technology all vary systematically among groups identified on the basis of social class, ethnicity, life cycle stage, gender, education, occupation, geographic location and local culture. This variation can be traced to differences between groups in terms of their patterns of social activity, their housing and technology, although few social researchers have attempted to examine the physical-technical environments of various social groups (Lutzenhiser 1992a, p. 53).

Lutzenhiser and Hackett outline three social aspects of energy use often overlooked in policy stemming from economists’ assumptions:

(1) energy consumption not only varies with, but is a primary constituent of, social hierarchy; (2) a good deal of that consumption is built into the material culture of the communities, and is thus obligatory; and (3) demand for energy and other natural resources is not independent of supply (Lutzenhiser & Hackett 1993, p. 50).

In sociological literature, psychological approaches are criticised for ignoring the cultural and social aspects of energy use. It is maintained that individuals make culturally-sensible and collectively-sanctioned choices and there are unwritten norms, and in some cases even formal rules, governing ownership of such things as suburban houses, gas wall heaters and hot tubs. However, the level of analysis in this literature focuses on the group rather than the individual and also subsumes what Lutzenhiser calls lower levels of analysis of consumption such as the ‘engineering’ model (e.g. building-technology simulation models). Thus while it can illuminate certain aspects of the person-house-environment relationship it does not offer much in the way of information that can be interpreted for design advice. The dominant images are similar to those found in the psychological literature. The environment is considered in terms of ‘global’ environmental problems notably related to energy use. People (both in terms of individuals and groups) are generalised and viewed in terms of the ‘problems’ of their energy-use behaviour. There are few images related to housing or design issues.

There are a number of studies that investigate lay understanding of domestic energy use that use techniques developed in anthropology such as ethnographic interviews based around open-ended questions (Kempton & Montgomery 1982; Wilk & Wilhite 1985; and Kempton & Layne 1994). These studies are often cross-disciplinary and involve researchers from anthropology and energy research centres. Amongst the findings from these studies are that most householders have a distorted impression of how much energy appliances use, overestimating for those appliance that are easily visible and that they have to actuate (Kempton & Montgomery 1982). People have many goals for adopting energy conservation features in their homes apart from monetary savings including building a safe and secure haven for the family, self-reliance (or hatred of the utility company), and a desire to preserve the world’s resources (Wilk and Wilhite 1985, p. 628).
When considered in detail the research outlined above reveals the complexity of issues associated with the ‘problem’ of people’s energy-use behaviour. There is little indication of the design implications of these issues. Indeed, in terms of design advice, the detail of the research findings tends to be subsumed by the somewhat negative overall image that at the heart of the ‘problem’ are people and their beliefs, and their individual and cultural attitudes.

### 7.5.4 Summary: Dominant images of the occupants

The dominant images of the future occupants emerging from the research outlined above are of ‘typical’ people who can be a problematic aspect of the consideration of energy use in housing. The majority of the studies of energy use and the related concern of thermal comfort originate from building science; the issue is framed in terms of building physics with a particular emphasis on the performance of the building fabric. Often people are considered only in the assumptions made (about what is valued for example thermal comfort but not cost or design time) or as an input to computer thermal simulation programs (in terms of occupancy patterns and thermal comfort criteria). They are treated as a “physical entity occupying space, manipulating devices and contributing body heat to the indoor environment” (Lutzenhiser 1992a).

Research from other fields such as psychology and sociology does little to expand this view. While the detail of studies from these fields reveals a range of attitudes, beliefs, values and behaviours it is rare for research to be reported in terms of individual differences and their implications. It is rare for this research to make connections to aspects of built-form or design.

### 7.6 Examples of alternative images

The examples above outline the major sources of images of ‘what is’ that inform current sources of design advice. There are however, other sources of research that could inform alternative images of the nature of environmental issues associated with house design, appropriate solutions and the role of the future occupants. The following section briefly outlines some examples.

#### 7.6.1 Alternative images of the nature of environmental issues

Alternative images of the nature of environmental issues are evident in research that investigates people’s subjective understanding of these issues. For example, Kempton used ethnographic interviews to investigate lay understandings of global climate change (1991). He found that most of the people interviewed conceptualised global climate change differently from scientists and did not recognise the connection between energy consumption and global warming. Kempton identifies four pre-existing models that were used to explain the idea: ozone depletion, plant photosynthesis (explained by the interviewees in terms of oxygen depletion resulting from forests being cut down), air pollution and personally experienced
temperature variation. This study also canvassed the environmental values of the interviewees. The issue that emerged most strongly was the value given to future generations in general and to the interviewees’ descendants in particular.

British researchers Hinchcliffe (1996) and Myers and Macnaughton (1998) have analysed the way individuals receive and understand information about environmental issues. Hinchcliffe investigated responses to an energy conservation campaign, ‘Helping the earth begins at home’ conducted by the British government. This campaign, based on the concept popularised by the Brundtland Report (WECD 1987) of ‘thinking global, acting local’, was designed to explain the connection between energy use, CO₂ production and global warming and provide information about ways householders could reduce energy use. Hinchcliffe conducted a series of long interviews to investigate the way people ‘consumed’ the information. He claimed people found the message irrelevant to their daily lives and that:

... the focus upon a single, rather abstract, scientific hypothesis reproduced the notion that environmental problems were the responsibility of distant and equally abstract institutions (Hinchcliffe 1996 p. 61).

Myers and Macnaughton maintain “that the rhetoric of environmental organisations and the rhetoric of everyday talk about the environment are seriously out of joint” (1998, p. 351). They used rhetorical analysis to study people’s responses to terms used in environmental leaflets encouraging participatory action associated with sustainability. The leaflets came from twenty organisations ranging from Greenpeace to the British Nuclear Forum. Myers and Macnaughton identified general and recurring arguments used in these leaflets that they called commonplaces (for example, ‘think globally, act locally’, ‘We do not inherit the world from our ancestors, we borrow it from our children’) and these were discussed in a series of Focus Groups. One aspect of the discussions involved the participants comparing these commonplaces to a list of their own environmental concerns that they had compiled at the beginning of the session. These lists included examples such as rubbish, ‘dog mess in the local park’, ‘traffic’ and ‘sewer outlets’.

The statements from the organisations were perceived as more general summaries of the familiar and specific problems they themselves had introduced. But the two lists were not perceived as just another way of saying the same thing. Their own concern with specific local problems is seen as more practical, more authentic, and more likely to lead to action (Myers and Macnaughton 1998, p. 348).

Myers and Macnaughton contend that participation in initiatives to address environmental issues requires, in part, “an effective and common language” and that this will “ultimately be found in the way people talk, not in policy documents” (Myers and Macnaughton 1998, p. 352).

The research referred to above suggests that the everyday understanding of environmental issues is an important consideration in the formation of strategies and policies to address environmental problems. The image of environmental issues presented by these studies is not that of global problems identified and defined by science but rather of issues identified by
people about which they care and that they feel affect their lives. Although the examples referred to above do not deal specifically with the built environment they suggest the importance, for design advice, of exploring this alternative view of environmental issues.

7.6.2 Alternative images of ‘environmentally appropriate’ solutions

Alternative images of ‘environmentally appropriate’ solutions could be found by considering this issue from the point of view of the occupants. Current sources of design advice about the environmental aspects of house design tend to present the image of the house as a problem in relation to energy use. However, for people seeking their dream house such an image barely touches on all the environmental images that might be relevant. There is a vast body of literature that deals with ‘the meaning of home’. An overview of studies from psychology, social psychology and phenomenology (Després 1991) identifies the ten most common categories of the meaning of home in the literature as:

- home as security and control,
- home as a reflection of one’s ideas and values,
- home as acting upon and modifying one’s dwelling,
- home as permanence and continuity,
- home as relationships with family and friends,
- home as centre of activity,
- home as a refuge from the outside world,
- home as indicator of personal status,
- home as material structure, and
- home as a place to own.

Interpretation of these meanings in the psychological literature centres around issues of territory, personality, privacy and social status. An overview of sociological works dealing with the meaning of home (Somerville 1997) identifies similar categories, however interpretation of them centres around issues of social class, gender and tenure. In this literature explicit references to the connection between environmental issues and ‘the meaning of home’ are rare. And yet each of the aspects listed above has potential implications of relevance to the way environmental issues are considered in housing. For example, some people’s view of their home as a centre of control may extend to controlling their own power, water and waste; issues to do with permanence and personal status have implications for material choice; the public recognition of a house that is ‘good for the environment’ may be important for those who see their home as reflecting their environmental concerns; and the idea of one’s home being a refuge from the outside world could extend to the use of non-toxic or ‘natural-looking’ materials. These meanings could easily link into design images. Carole Després’ (1991) provides a powerful example that places current environmental concerns in a wider time frame and links concerns about identity and meaning with built-form concerns:
A major influence on the meaning of the North American home is the moralist type of discourse inspired by the Romantic philosophy which developed around the following themes: a desire to destroy the dichotomy between nature and culture; the association of country life with innocence and virtue; the perception of women and children as morally superior beings; and finally, the promotion of the home as a refuge from urban life where family and women were protected from the corruption of city life. In Anglo-Saxon countries the Romantic ideal of the home came to be associated with an isolated structure surrounded by nature (Després 1991, p. 104).

Another approach to research into ‘environmentally appropriate’ solutions is explored in a paper by Guy and Farmer (1999). This study reveals a range of images of solutions and links them to common environmental themes. Guy and Farmer “[reject] the notion of buildings as simply technical structures which can be more or less better design related to an external definition of accepted environmental standards” (Guy & Farmer 1999, p. 1). Instead they suggest that the concept of sustainable building is socially constructed and that ‘green’ buildings can be seen as “social representations of alternative ecological and ethical values, or material embodiments of the logics that make up the green buildings debate” (Guy & Farmer 1999, p.5). The use of the term ‘logic’ in this context is borrowed from Hajer who describes it as a:

...specific ensemble of ideas, concepts, and categorisations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities (Hajer 1995, p. 44).

Guy and Farmer maintain that:

...[r]ather than searching for a single ethical response to the diversity and variety of ecological and human settings in which building activity takes place, it would seem more appropriate to develop a pluralistic moral position that may guide us through the complexities of ‘real-life’ building situations (1999, p. 3-4).

They conducted an extensive review of books, articles and reports related to “ecological”, “environmental”, or “green” buildings and identified six logics and the strategies associated with them (see Table 7.2).

### Table 7.2: Six competing logics of green buildings

<table>
<thead>
<tr>
<th>Logic</th>
<th>Ecological</th>
<th>Smart</th>
<th>Aesthetic</th>
<th>Symbolic</th>
<th>Comfort</th>
<th>Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emblematic issue</td>
<td>sustainability</td>
<td>efficiency</td>
<td>new millennium</td>
<td>authenticity</td>
<td>sick buildings</td>
<td>democracy</td>
</tr>
<tr>
<td>Ethical concern</td>
<td>eco-centric</td>
<td>futurity</td>
<td>beauty</td>
<td>identity</td>
<td>wholeness</td>
<td>equity</td>
</tr>
<tr>
<td>Building image</td>
<td>polluter</td>
<td>asset</td>
<td>iconic</td>
<td>harmonious</td>
<td>healthy</td>
<td>home</td>
</tr>
<tr>
<td>Risk</td>
<td>planetary survival</td>
<td>market survival</td>
<td>identity</td>
<td>cultural life</td>
<td>individual</td>
<td>alienation</td>
</tr>
<tr>
<td>Rhetoric</td>
<td>holistic</td>
<td>commercial</td>
<td>architectural</td>
<td>experiential</td>
<td>medical</td>
<td>societal</td>
</tr>
<tr>
<td>Design strategy</td>
<td>reduce footprint</td>
<td>reduce energy</td>
<td>express nature</td>
<td>situational</td>
<td>living building</td>
<td>create identity</td>
</tr>
<tr>
<td>Evaluation</td>
<td>truth to nature</td>
<td>cost-benefit performance</td>
<td>transformative value</td>
<td>truth to place</td>
<td>productivity, homeliness</td>
<td>social cohesion</td>
</tr>
</tbody>
</table>

Source: Adapted from Guy & Farmer 1999

Guy and Farmer’s work suggests a way of linking specific environmental issues through building images and of connecting these to the values of the participants in the design.
process. It also illustrates the possibility of extending the range of current images of ‘environmentally appropriate’ houses.

7.6.3 Alternative images of the occupants

There are a number of examples of research into design issues related to comfort that present alternative images of the occupant. Japanese writer, Saturo Kuno (1995) proposes an alternative approach to the question of thermal comfort and thermal neutrality based on the idea of “pleasantness”. He maintains that feeling pleasantness (pleasantly warm or cool) is a more desirable state than that of thermal neutrality. Pleasantness occurs in a dynamic, responsive system that involves feeling some discomfort that, when alleviated, is experienced as pleasantness. Kuno suggests that not only are these fluctuations in thermal sensation pleasant but that they may be “healthy”. He proposes that design that incorporates dynamic and responsive features such as natural ventilation, solar gain for heating and operable shading will be more pleasant than mechanically conditioned thermally neutral environments.

The image of ‘people’ in Kuno’s approach to comfort is that they are likely to take an active role in alleviating discomfort, and that their responses to their environments are an important design consideration.

Another source of alternative images is research that investigates individuals’ environmental preferences and the consequent design implications. These imply an image of the occupant as an important determinant of the design process. The concept of thermal preferences has been suggested as a potentially useful approach for information for designers of housing (Williamson, Coldicutt et al. 1989).

Thermal preferences are defined as:

...the choice of physical factors influencing thermal sensation (air temperature, humidity, air movement, radiation, clothing and activity) which house occupants would make when constrained by the factors over which a designer usually has little or no influence (climate, energy costs, lifestyle, and societal expectations of housing and heating and cooling plant), but not constrained by factors particular to the occupants’ own house, such as characteristics of the house and plant which a designer could influence. (Williamson, Coldicutt et al. 1989, p. 7).

The authors suggest that thermal preference information that includes information about preferences for sun and breezes would be useful for designers of Australian housing.

Sun penetration can be described in terms of optimums and acceptable limits, and, for warm weather, breezes can be described similarly. Such information may be of much more direct use to a designer than information such as predicted mean votes: it relates more directly to building design, and to aspects of design which are important to building quality (Williamson, Coldicutt et al. 1989, p. 24).

A number of questions in the NEEHA study (see 7.2.2) investigated people’s preferences for sun in living rooms and bedrooms. These identified a general preference amongst the householders surveyed for sun in the living areas at all times of the year except in the case of Perth where the general preference was for the total exclusion of sun in summer.

156
Although a stronger preference appears for winter sun in living areas, the majority of people in each location agreed that there should be at least some sun entering bedrooms during winter (Williamson 1997, p. 73).

In the same study the householders were asked about the extent to which they agreed or disagreed with the statement “for healthy living, some windows should be open whenever there is someone at home”. Responses varied although more agreed than disagreed with the statement (Ballinger, Samuels et al. 1991, p. 81).

Studies in Australia and elsewhere have noted that the occupants of houses designed along solar-efficient principles, even if they do not necessarily appreciate the energy-saving capabilities of these designs, often cite the airiness and sunniness of the houses as major attractions (Case 1984; ECD Partnership 1991; Energy Victoria 1991b). A study of 200 passive solar homes in the USA found that one of the two greatest sources of satisfaction amongst the owners was an “emotive response i.e. increased mental health” (Saras quoted in Ballinger, Samuels et al. 1991, p. 55) and it is suggested that a contributing factor is the strong ‘indoor/outdoor connection’ of passive solar homes resulting from their large area of glazing. The desire for a connection with the wider environment through some sort of indoor/outdoor space such as a verandah, covered pergola, deck or courtyard was an important finding of a study exploring the house-buying public’s ideas about environmental issues in housing (Bennetts 1998b). Some suggestions for the value of this indoor/outdoor connection are that it provides “contact with seasonal weather variations; contact with daily weather changes; and connection to the time of day” (Ballinger, Samuels et al. 1990, p. 54). These ends are rarely addressed in current sources of design advice.

The preceding section presents a range of research examples that portray different images of the occupants than those currently evident in many sources of design advice. Here the image is of people who are likely to be active participants in the design process and whose attitudes and beliefs about a range of environmental issues have important design implications. These images are positive and constructive.

7.7 Discussion

Sections 7.3 - 7.5 of this chapter review the major images of ‘what is’ that inform current sources of design advice in Australia. A wealth of material is reviewed that, on close reading, reveals a complex picture. Nonetheless a narrow range of images emerges from the research and these images are reflected in current sources of design advice. In this research, concern about greenhouse gas production and energy use dominates images of the environmental impact of housing; images of the solar-efficient model (and to a lesser extent the tropical model) dominate images of appropriate solutions; and the major images of the occupant are that they are an essentially ‘unimportant’, passive or problematic aspect of the consideration of environmental issues in design.
The design advice images of 'what is' reflect the influence of the building science community that is responsible for the vast majority of research into these issues in Australia. This field is dominated by scientific and technical approaches to understanding the environmental aspects of house design. Many of the difficulties outlined in this chapter are connected to the research methodologies used to investigate these issues. Invariably these are designed to study an issue in depth (often energy use) and this process necessitates reducing, or ignoring, the role of many contextual issues. On the other hand thinking about and accommodating contextual issues is an inescapable aspect of design. 'Science-based' research is often directed towards establishing 'universal' or general truths whereas each design project is unique and specific to the particular time, place and people involved.

Another major difference between the architects' images of 'what is' and those that form the basis of design advice relates to how the images of environmental issues, appropriate solutions and people are integrated. Images of the key topics investigated in this chapter are largely disconnected. Research concerning the nature of environmental issues related to house design does not, in the main, incorporate images of houses or of people and their role in environmental or design issues. Typically, information about houses and house types does not incorporate images of people and their role in the design process, or of the importance of the future occupation of the house, and generally has limited images of 'the environment'. Research related to people largely centres on their role regarding energy-use and rarely encompasses images of house form, and again often has limited images of environmental issues. This is in contrast to the architects' images. These encompass images of environmental concerns, and of built-form, and the meaning and implications these have for the future occupants in an integrated way. The architects' images are subjective by nature. Therefore, their images of environmental issues and housing are imbued with a sense of why and how these issues are important for themselves and for other people. Affective, emotional and symbolic aspects of the consideration of environmental issues in house design are largely absent in research that forms the basis of the design advice.

The one area that is noticeably less straightforward is that of images of appropriate solutions. These are not only influenced by images arising from research but also by images from the 'real world' of actual houses (or associated with particular architects). Often the houses have been identified as 'environmentally appropriate' by the architectural profession or by public 'consensus' rather than by the research community. Consequently, the goals associated with these images may be more complex and less clear-cut than for the research images. The widespread recognition of these images demonstrates the power and importance of images of solutions.
7.8 Summary

This chapter reviews the major images of ‘what is’ that are reflected in design advice. These images are derived largely from research related to the nature of the environmental issues associated with house design, and to the identification of appropriate built-form solutions and studies of people and their role in relation to energy-use, housing and environmental issues. This material is drawn from a wide range of sources however the dominance of certain images is evident. Concern about greenhouse gas production and energy use dominates images of the environmental impact of housing; images of the solar-efficient model (and to a lesser extent the tropical model) dominate images of appropriate solutions; and the major images of the occupant are that they are an essentially ‘unimportant’, passive or problematic aspect of the consideration of environmental issues in design. These images reflect the influence of the building science community. Much of the research into these topics in Australia originates from this community.

Research that presents alternative images of these features is described. In this work, the image of the future occupants of the house is that they are an important design consideration and that they are active participants in the design process.
8. Summary, discussion and conclusions

8.1 Summary

The previous chapters review images of the environmental aspects of house design in Australia in the late 1990s.

Chapter 2 presents the idea of images as subjective knowledge and outlines the importance of images during the design process. It introduces the idea that architects link images together in a story-like way. This enables them to have an overall picture of a situation and to perceive where there might be gaps in their knowledge. This chapter outlines the importance of images for conversation and communication particularly regarding those areas that are vague and subjective such as are common during the design process. It suggests that images allow both client and architect to project what could or should happen in the future. Also highlighted are two images of the environment: the environment seen in terms of global problems and as fields of significance for the individual.

Chapter 3 describes a series of interviews conducted with ten South Australian architects where they described a house or other small building that they had designed. It presents long extracts from four of the interviews to illustrate the story-like way that the architects describe their designs. This chapter indicates the range of images that emerged from the interviews and illustrates the inter-relatedness of the issues considered. The importance for decision-making of the values of the architects and their clients is highlighted.

Chapters 4 to 7 investigate the images arising from the interviews and from current design advice about the environmental aspects of house design. Chapter 4 outlines the architects’ images of ‘what should be’ regarding the environmental aspects of house design. The transcripts of the interviews were analysed for references to goals, strategies and values related to the environmental aspects of house design. This chapter highlights the importance of the values of the architects and of their world views in determining appropriate goals and strategies.

Chapter 5 reviews the images of ‘what should be’ evident in three key sources of design advice. The narrowness of approach they present is highlighted as are the virtual absence of
images related to the future occupants of the house, and the tendency for environmental issues to be defined largely in terms of energy use.

Chapter 6 outlines the architects' images of 'what is'. The transcripts of the interviews were analysed for references to images of the nature of environmental issues, images of housing issues and images of the practice of design. These are presented using extracts from the interviews. The images are revealed to be broad, design-related and value-laden.

Chapter 7 reviews research that informs the design advice view of 'what is'. Studies of the nature of the environmental impact of housing, and of 'appropriate' house designs and of the future occupants of the house are investigated. These are revealed to present a narrow range of images: the problems of greenhouse gas emissions and energy use dominate images of environmental issues; the solar-efficient model dominates images of appropriate solutions; and the images of the occupants are dominated by the ideas that they are largely unimportant or problematic. These images are largely disconnected. Examples of research that present alternate images are also presented.

The previous chapters illustrate the approach to environmental issues in house design from two perspectives: a view represented by current design advice from a range of sources such as design guidelines, research, policy and regulations; and a view from practice represented by the ten architects interviewed. Although many of the issues evident in the 'design advice' view are reflected in the concerns of the architects, some important differences in approach can be identified. The following section will discuss these differences and their implications.

8.2 Discussion

The comparison of images embodied in current design advice with those arising from the interviews gives the impression that there are two different 'meta'-images operating. One of these can be thought of as the design advice or theoretical image, and the other as the practice or practical image.

8.2.1 The theoretical image

In the theoretical image 'the environment' is discussed in 'global' terms. The environment is referred to in ways that suggest that it represents everything 'natural' outside the house; that which surrounds it, is beneath it and above it. This environment is common to all people; an idea symbolised by the visual image of Earth as seen from space. Often this visual image is accompanied by warnings that the Earth is fragile and under threat. Buildings are considered to contribute to this threat as they require resources (land, energy and materials) and contribute to pollution (for example, land degradation, greenhouse gas emissions, ozone depletion). There is, however, a presumption that development is an inevitable and necessary corollary to an advanced society and that environmental issues essentially involve managing the problems arising from this development.
In this image the consideration of environmental issues to do with house design consists of dealing with the problems connected with resource use and environmental degradation. The production of greenhouse gas has been identified as a major environmental concern associated with residential construction in Australia. Science is seen as an important source of knowledge about the extent and nature of this (and other) environmental problems.

In the theoretical image, the design of a house is considered to be a linear process that involves the architect analysing the situation, gathering information and making informed decisions. It is believed that appropriate information can assist the architect to make good decisions. Therefore it is necessary to provide information about the nature of environmental issues associated with housing and to provide examples of ways of addressing these issues in house design. Advice about the environmental aspects of house design addresses these two ends: explaining the problems and revealing ways of addressing them.

It is presumed that technical and scientific techniques can be used to find solutions to environmental problems associated with house design. Research using techniques such as computer modelling, technical monitoring and gathering statistical information forms the basis of design advice. The approach to knowledge embodied by these techniques is that of the search for objective facts in a defined field. This reductionist approach ignores many contextual issues that affect design (such as cultural, social, historical, and aesthetic concerns) to concentrate on the issue being considered, often simply the impact of built-form on energy use. The image associated with information generated using ‘scientific’ techniques such as computer modelling is that they provide a ‘true’ picture of the world, or particular aspects of the world.

A strong aspect of the theoretical image is that it is possible to present information about how environmental issues should be addressed in house design in terms of ‘scientifically justified’ solutions that are not time, place or client specific. This creates the image that such information can be applied directly, or adapted, to a variety of design situations.

Design advice about the nature of environmental issues associated with house design focuses on the performance of buildings with explanations of how the components of the built-fabric contribute to the use of energy. Design advice about how environmental issues should be addressed in house design focuses on the presentation of information about houses and house types that have been identified as energy-efficient. Issues to do with energy use are presented in ways that suggest that they can be considered separately from other design concerns. Part of the image associated with design advice is that ‘good’ design can be achieved through following prescribed courses of action. Often, information about appropriate solutions is presented in prescriptive terms as a series of ‘rules’ to be followed.

The theoretical meta-image incorporates images of the potential environmental contribution to be made from appropriately designed houses. For example, information about solar-efficient
design often claims that reducing the energy used to heat and cool a house will contribute to reducing the greenhouse gas emissions in Australia and contribute to the abatement of global warming. It is often implied that appropriate solutions are 'measurably' better. This is demonstrated by determining how closely the house complies with a recognised image of an environmentally appropriate solution or by modelling its potential environmental impact.

People are strangely absent from the theoretical image. They are largely excluded from this view of the 'the environment' and their roles in the design process are rarely made explicit. Subjective understanding of, and the meaning attached to, the idea of the environment lies outside this image. The values and concerns of the future occupants of the house are seldom mentioned in relation to establishing goals and strategies. The future occupants are assumed either as keen participants whose aims are identical to those expressed in the design advice or they are 'designed' out of participation because they cannot be trusted. There is a strong image that it is the building itself that uses energy. Few visual images of 'environmentally appropriate' houses include people. Case studies and monitoring projects rarely present a picture of the occupants and their relationship with their house or their role in energy use. This contributes to the impression that issues to do with occupancy are not a major concern when considering the environmental aspects of design.

8.2.2 The practical image

By contrast, the ways the architects discuss issues related to 'the environment' suggest that they are considering not only 'problems' to be solved and situations to be managed but opportunities to be realised and taken advantage of. In this image, the environment is regarded both in relation to potential global problems and in terms of 'fields of significance'. Subjective issues to do with meanings and connections are important considerations. The environment is referred to in a variety of ways including by reference to the natural world (expressed through the wind, sun, land, sea and sky) and to built-form (in relation to the environments created for occupants). Energy use is not considered to be the major environmental problem associated with housing but one amongst many that include biodiversity loss, pollution, and loss of contact with the natural world. Causes and consequences of these problems are seen as complex and 'culture-related'. Environmental aspects of the design are seen as inextricably interwoven into, and affected by, all other considerations of the design rather than something that can be treated in an isolated way.

The image of the process of designing a house that emerges from the interviews is one of an essentially 'messy', non-linear process. The design evolves over time, in specific contexts and with a range of participants both active and passive. Each design project is unique, combining specific requirements arising from the particular clients, site, budget and the time at which it occurs. There is a gradual and continual working towards understanding and the desired outcome of a building. Compromise is seen as inevitable. The evolution of the design involves developing images of what the house and dwelling 'mean' to the future occupants.
and how they will live in it, heat and cool it, open and close it, and in some cases how they might change and adapt it. This longer term, occupant-focussed perspective of the house is noticeably absent in the design advice.

The architects refer to a wide range of sources of information including their education, various sources of design advice and their ideas about, and experience of, dwelling, design and environmental issues. The images arising from these sources appear to be important conceptual tools for linking built-form, human, and environmental issues in an integrated way. These images are by nature subjective and value-laden.

Part of the image that the architects have of addressing environmental issues in the design process relates to the difficulty of changing the status quo. Although the architects show an understanding that the impact, in societal or global environmental terms, of ‘good’ house design is limited, it is understood that the potential benefit for individuals can be significant. For the architects themselves this relates to the satisfaction they derive from incorporating such values into their work and the ‘meaning’ it contributes to their designs. For the clients there is the potential to express their values in built-form, and enhance the way they live. For both it is one way of exploring their relationship to the wider world. There is an understanding that perfect solutions are not possible but that each design contributes in some way to reframing the contexts and hopefully improving understanding and knowledge. The success of the building is evaluated in many terms including whether it is built, how it corresponds to the clients’ and architects’ aspirations, and whether it provides longer-term satisfaction for the occupants.

In the practical image issues to do with people, notably the concerns of the client and/or occupants, are a vital consideration for architects. The design process involves the development of a partnership between architect and clients that at times encompasses other participants. Goals, strategies and solutions are worked out together through the development of shared images of the house being designed. The relationship between architect and clients is an intimate one. The clients reveal aspects of their life, their values and the way they wish to relate to the outer world. The architects draw on their own experience and values as they engage in the creative process of translating the clients’ concerns and desires into built form.

### 8.3 The consideration of environmental issues in house design

These two meta-images outline the salient differences identified in this investigation of the images from design advice, and from practice, of the environmental aspects of house design in Australia. These differences have implications for understanding how environmental issues are currently addressed in house design in Australia, and for understanding the role of design advice in this process.
Chapter 1 referred to claims that, despite the availability of appropriate knowledge about environmental issues related to house design, there is little evidence that this has equated to changes in architectural practice in Australia. Many reasons are offered for this including; lack of accessible information (RAIA 1993), lack of commitment (Ballinger et al. 1995), and attitudinal or non-technical barriers (Deni Greene Consulting Services 1991; Ballinger et al. 1991). Following a survey of Australian architects’ perceptions of energy efficient/ecological architecture, Sabine Wittmann suggests that:

"Most architects do not perceive energy efficient/ecological design as important enough to place it high on the list of factors they consider most important in design" (Wittmann 1998, p. 92).

This thesis raises three considerations that need to be taken into account in relation to this question: the image of ‘the environment’ that is evident in theory and practice, the importance of the status quo for the practice of house design, and the nature of the available knowledge about how environmental issues should be addressed.

8.3.1 The image of ‘the environment’

The current perception that environmental issues are not adequately considered by architects arises partly because these issues are narrowly ‘defined’ in terms of global environmental problems. If this image is extended to encompass the view that ‘the environment’ can also be considered as a field of significance for the individual, then the practice of addressing environmental issues in house design in Australia is more widespread than has previously been acknowledged.

It was apparent from the interviews that the architects addressed broad and complex environmental concerns in the design projects they discussed. The architects did not always refer to, or recognise, these concerns in terms of ‘the environment’ or ‘environmental issues’. And yet they described an inherently environmental process of matching person to house to the wider setting that required the consideration of appropriate use of resources (such as time, money, energy and materials) for this end. This process is more closely aligned to the image of the environment as a field of significance for an individual, than to that of the ‘global environment’. The image of a field of significance is a more useful concept for design decision-making. In this view, meaning and affective issues are important. The environmental outcomes of particular decisions are evaluated by architect and clients against their images of what they are trying to achieve; how they want the house to look, to feel, and to ‘work’. An ‘objective’ evaluation of the ‘environmental appropriateness’ of the finished house, in these terms, would be difficult. On the other hand, if environmental issues are defined in terms of problems such as the need to reduce greenhouse gases, then evaluating the impact of particular decisions on this goal may be difficult. This evaluation is likely to be based upon images of ‘acceptable solutions’ but these provide little guidance if, for some reason, aspects of the image cannot be achieved.
The field of significance view of the environment does not negate the importance of wider environmental concerns. For many of the architects it was obvious that their understanding of ‘the environment’ encompassed both views: the environment as a field of significance for the individual forming part of a larger narrative of concern about global environmental problems. The architects’ recognition of these problems was apparent in the interviews. There were references to such issues as the connection between energy use and greenhouse gas emissions and to the environmental degradation associated with the use of tropical hardwoods. Cooper (1992) (see 2.3.4) maintains that understanding environmental issues in terms of their significance for the individual may form the basis for addressing larger environmental concerns. If individuals recognise their environments as important they will be conscious of threats to these environments whether it is local pollution, development that disrupts their life patterns or the loss of a valued tree. This recognition can also extend to an appreciation of the importance for other individuals (both existing and in the future) of their environments. Therefore, it can encompass concern about future (or geographically distant) environmental impacts of current practices.

This suggests the importance for design advice of highlighting the links between environmental issues of significance for the individual (such as those to do with lighting, ventilation, views, solar access, symbolic meanings and the image of the building) and design concerns such as siting, form, and materials. These are important design considerations, not only for the quality of life of the house’s occupants, but also for the occupants’ perceptions of wider environmental problems. Such an approach provides important opportunities for linking environmental concerns with design decision-making. It also provides a way of framing environmental issues in a positive way – emphasising the aspects that people value and the design opportunities these provide – rather than framing the issues in negative images of the house and the occupants as ‘problems’.

8.3.2 The impact of the status quo

The second point that emerged from the interviews was the architects’ understanding that they work within the status quo and that this restricts the options available to them.

Beach comments that one of the difficulties with changing the status quo is that;

...goals or plans usually address only a portion of the framed status quo. As a result, the degree of change brought about by [adopting goals or plans] is small relative to that frame and relative to the larger images that make up the decision maker’s entire knowledge store (Beach 1990, p. 54).

Current government policies at all levels supposedly designed to encourage environmentally appropriate house design do indeed only address a portion of the status quo. For example, policies that address the relationship between the built-fabric of a house and greenhouse gas production tend to concentrate on aspects of built-form and energy use. Questions arising from existing resource allocation, power supplies, trade agreements, transport systems,
development patterns, design methods, construction practices, lifestyles and modes of consumption are ignored. This is partially a consequence of the difficulty of encompassing the full scope of such issues in the format of policy designed to direct particular actions.

Beach goes on to say;

\ldots [t]his together with the requirements that the [changes being considered] be compatible with the principles, goals, and plans that define the frame means that there is a tendency for things to stay pretty much as they are, with only small accretions and deletions \ldots rather than revolutionary changes (Beach 1990, p. 54).

Much of the current approach to the consideration of how environmental issues should be addressed in house design originates from public representatives of the status quo: government organisations, academic institutions and professional organisations. The practices and policies of these organisations encompass the technocratic belief that environmental change is not incompatible with the status quo. Existing resource allocation, power supplies, transport systems, subdivision practices, lending policies of banks, building regulations, design methods, construction practices, lifestyles and modes of consumption are, in large part, accepted as inevitable. Therefore, the changes that are considered to be possible and appropriate are restricted and tend to fall within the domain of material choices.

This thesis has suggested that a more ‘environmental’ approach to addressing environmental issues in house design is possible through design than through policy. The design approach encompasses the occupant, the house and its wider settings in an integrated way. It takes account of the passage of time. Policies embody the values, and reflect the knowledge, of the time when they were written. They can be difficult to modify. Design is better able to respond to the here-and-now and to envisage the future. Unlike policy strategies, architects’ images can encompass the many contextual issues that affect a particular situation, and the interactions between these issues. Policy approaches are based on what has been done before or has previously been identified as ‘appropriate’. Design is a creative activity. It involves the capacity to visualise new and different ways of doing things.

8.3.3 The nature of design advice

The third issue emerging from this thesis that has a bearing on the current consideration of environmental issues in house design in Australia relates to the proposition that there is adequate information available to inform this process.

This thesis has demonstrated that it is difficult to support this proposition. On the one hand existing design advice concentrates on the relationship between energy use and built form. The ways that occupancy affects energy use, and the design implications of this issue, are still little understood. Similarly, the way energy use relates to other environmental aims and the many other contextual issues affecting design, such as cultural, social, economic and political concerns, is still little understood.
The ways that existing sources of design advice are used for decision-making in the practice of house design are little understood. This thesis has demonstrated the complex but inherently interdependent relationship between the architects' images of environmental issues associated with house design and design advice about these issues. Design advice is a way of promoting and explaining to individuals those issues of concern to the wider society. The architects indicated that they were aware of 'the problems' and 'the solutions' promoted by current sources of design advice. The interviews revealed extensive use by the architects of concepts that form the basis of such design advice. There were references to images of sunpaths, weather patterns, material properties, global warming, biodiversity, ecology and solar-efficiency. These images were integrated with building-specific information about clients' thermal preferences, the availability of materials, typical patterns of use of heaters and coolers, and acceptable notions of style.

There was little evidence, however, that the architects used existing design advice in an instrumental way to assist decision-making during the process of designing a house. The one example explicitly mentioned by several architects was the use of sun-angle charts to help determine the size of windows, roof overhangs or other shading to windows. In these cases there was a narrowly defined problem with non-contentious goals. No assumption needed to be made on behalf of passive participants of the design process. There was an obvious and clear question to be asked and the design advice could provide the answer in the terms needed. This problem is not typical of the decisions made during design. Typically, goals are contentious (for example, designing an environmentally responsible house may suggest different things to different people) and the means of achieving the goals are various (for example, minimising operational energy use, minimising floor area or maximising the use of renewable energy may all address the end of reducing fossil-fuel based energy sources). Various participants are likely to be involved in the design process and the values of all of them will be an important determinant in design decision-making.

Many sources of design advice present the image that there are 'correct solutions' to the question of how environmental issues should be addressed in house design. This is essentially misleading. In practice, there are many ways to address any design problem. The outcome – a house – can be judged as 'good' or 'bad' and judgements may vary according to the specific circumstances of the project and the values of those judging. The house should not, however, be considered in the same light as the answer to a mathematical problem or to a problem such as the width of eaves needed to shade a window at a particular time, in a particular location.

It is not that current sources of design advice are necessarily 'wrong' but that they tend to present simplistic and often misleading images. Architects designing a house deal with complex situations of inter-related issues where the particularities of design are vital. The issues are not straightforward and it is often difficult to interpret the relevance of generalised
design advice to a specific site, time and occupancy pattern. This thesis has suggested that, in practice, the framing of design problems, design decision-making, and design evaluation, are far more likely to be influenced by the subjective knowledge, or images, held by the participants than to follow a 'scientific' or rational approach suggested by existing sources of design advice. Sources of design advice play an important part in forming these images. They are not in themselves, however, an adequate source of information about either the nature of environmental issues associated with housing or how to address these issues during the design of a house.

8.4 Conclusions

This thesis set out to improve the understanding of the current consideration of environmental issues in house design in Australia. It has done so by identifying and comparing the images used by a group of architects to describe the environmental aspects of design, and the images embodied in key sources of existing design advice about these issues. The sources of these images, their characteristics and their differences have been outlined. The implications of these differences have been discussed both for the practice of house design and for public images of how these issues are considered. It has shown that the differences between the architects' images and those in the design advice can contribute to design advice being misleading, inappropriate or irrelevant in practice. The narrow range of images presented by current sources of design advice perpetuate a restrictive understanding of the nature of environmental issues associated with house design. They also limit ideas about appropriate ways of addressing these issues.

This thesis suggests that architects and building designers should be made aware of the consequences of the way questions regarding environmental aspects of house design are framed. This framing is rarely made explicit. Nonetheless, it determines the issues that are considered important and therefore to be addressed during design. It also influences whether participants of the design process are considered to have an active role in the process, and the processes and outcomes that are deemed to be acceptable. A consideration of the images of these issues inherent in the design advice can indicate the relevance of such information to the design problem at hand.

Designers of design advice that seeks to support the consideration of environmental aspects of house design should acknowledge the contextual nature of design, make aims and assumptions clear, and ensure that strategies and aims are matched. They should not be determining solutions – that is the domain of design – but should support the development of those solutions.

This thesis suggests the importance, for architectural design, of further research into the connection between individual architect's ideas and cultural information about issues to do with the environment and with design. Further work could investigate links between
environmental concerns, building image and the concerns of the future occupants of the house. Chapter 7 highlighted some examples of research along these lines (notably that of Guy & Farmer 1999; Kuno 1995; and aspects of Després 1991). This thesis also highlights the importance of expanding and developing the current range of images of ‘environmentally appropriate’ solutions. A number of images of other solutions emerged from the interviews. These include a house that enhances the occupants’ connection to the wider environment; one that is cleverly designed to accommodate all the occupants’ wants and needs within a restricted size; and one that visually ‘expresses’ the occupants’ environmental concerns.

This thesis demonstrates the value of studying images. The approach adopted in this thesis has enabled the consideration of many issues that would be difficult to encompass using other research techniques. These include the interconnections and differences between theory and practice, and between scientific and design-centred approaches to how environmental issues should be addressed in house design, and between the ideas and values of the individual and of the wider society.

Beach’s image theory (1990) provides a basis for understanding decision-making that takes account of the myriad real-world contextual issues that are difficult to encompass using other methodologies. The use of image theory could be applied to other situations where theoretical, practical and ethical questions intertwine. For example, it could be used to study aspects of policy-making, medical diagnosis, or legal practice as well as other design situations such as urban or regional planning.

Another avenue for future work suggested by this thesis is the exploration of methods of presenting design advice that encourage active imagination, for example:

- illustrated story-like formats that encompass emotional, symbolic and affective issues and can present a world-view and values, and

- supporting individual, reflective, self-monitoring of buildings as a valuable source of knowledge about the integration of occupants, building and environmental concerns.

Computer methods that, rather than representing the design process in a linear fashion, offer the possibility of establishing multi-path (hyperlink) connections could also be a fruitful avenue to explore. These could allow interconnections between issues to be explored. They could accommodate a range of goals and they could allow individual users to determine the issues that they see as important for particular design situations.
At a time when the impact humans can have on the world as we know it is more profound than ever there is a need to consider how we can go about things in a better way. This thesis has indicated the power of imagery in relation to this process. It suggests that the consideration of environmental issues is a way to affirm what we value and to give meaning to our lives. Architectural design, along with other creative processes, is a vehicle that allows us to project into the future and to imagine what should be and how things could work. The interviews with the architects underscored their ability to think about and deal with complex issues ranging over the global and the local, the individual and the public, the scientific and the artistic. This process should be nurtured and taken advantage of.
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Appendices

Appendix A: Extracts from BDP Environment Design Guide

Gen 1: RAIA Environment Policy A 17-22
Cas 12: Armstrong-Mobbs Sustainable House A 23-28
Cas 13: Capricorn 151 A 29-34
Cas 15 Homebush Newington Village A 35-46

Appendix B: Extracts from AMCORD

Sustainability and Residential Development B 1
Site Planning and Building Design: Element 5.10 Design for Climate B 2-11
PNP 3: Sustainable Residential Development B 12-17
PNP 18: Design for Temperate Climates B 18-25
PNP 19: Design for Hot Humid Climates B 26-31
PNP 20: Design for Hot Arid Climates B 32-37

Appendix C: RAIA Environment Awards

Award Criteria C 1-3
Award Winners 1998-99 C 4-6
Appendix A: Extracts from BDP Environment Design Guide

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Cas 15 Homebush Newington Village A 35-46
NOTE:
This appendix is included on pages A1-A46 of the print copy of the thesis held in the University of Adelaide Library.
Appendix B: Extracts from AMCORD

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability and Residential Development</td>
<td>B 1</td>
</tr>
<tr>
<td>Site Planning and Building Design: Element 5.10 Design for Climate</td>
<td>B 2-11</td>
</tr>
<tr>
<td>PNP 3: Sustainable Residential Development</td>
<td>B 12-17</td>
</tr>
<tr>
<td>PNP 18: Design for Temperate Climates</td>
<td>B 18-25</td>
</tr>
<tr>
<td>PNP 19: Design for Hot Humid Climates</td>
<td>B 26-31</td>
</tr>
<tr>
<td>PNP 20: Design for Hot Arid Climates</td>
<td>B 32-37</td>
</tr>
</tbody>
</table>
NOTE:
This appendix is included on pages B1-B37 of the print copy of the thesis held in the University of Adelaide Library.
Appendix C: RAIA Environment Awards

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Award Criteria

Award Winners 1999, 1998
AWARD CRITERIA

ESD AWARD CHECKLIST
Issue No 1 – 25 February 1998

The following is a draft prepared by the RAIA National Environment Sub-Committee to detail the criteria that can be used to assess a project with respect to Ecological Sustainable Development (ESD).

The goal of ESD is to achieve development that improves the total quality of life, both now and in the future, in a way that maintains the processes on which life depends. The objectives of ESD are to:
• enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
• provide for equity within and between generations; and
• protect biological diversity and maintain essential ecological processes and life support systems.

ASSESSMENT CRITERIA FOR ESD AWARD
Provide information on each relevant issue below by writing, diagrams, etc. Self assessment should be fair, good, or excellent and recorded by progressively ticking the three ‘assess boxes’ on the right.

SITING AND URBAN ISSUES
In general: Was site planning demonstrably appropriate with regard to the opportunities and constraints of the natural and built environment?
1. Appropriateness of siting & design with regard to microclimate (eg sun, wind, humidity, etc)
2. Appropriateness of siting & design with regard to natural and man-made elements (both + & - effect)
3. Utilisation of existing buildings, facilities, infrastructure, etc.
4. Maintenance and enhancement of natural ecological features and systems (eg habitat corridors)
5. Facilitation of pedestrian and non-motorised transport eg

ENERGY EFFICIENCY AND CONSUMPTION
In general: How has ingenuity of design enabled the building’s operational energy to be reduced across the seasons compared to other similar buildings?
6. Evidence of energy audits, benchmarks, targets or thermal modelling where undertaken
7. Measures to ensure minimal energy use for cooling in summer
8. Measures to ensure minimal energy use for heating in winter
9. Measures to ensure minimal energy use for lighting and ventilation
10. Use of energy efficient equipment, appliances and processes
11. Maximisation of use of renewable and low-impact energy sources

SELECTION OF BUILDING MATERIALS AND PROCESS
In general: Has selection of materials and processes considered wide-ranging environmental impacts?
12. Life cycle assessment of selected materials and processes, incl embodied energy & maintenance
13. Minimisation of use of non-renewable resources
14. Maximisation of use of renewable and/or recyclable materials and components
15. Considerations regarding toxicity, off-gassing and indoor air quality

CONSTRUCTION
In general: How have ingenious building systems been employed to reduce the energy consumption and waste during construction in the future?
16. Minimisation of energy used in construction
17. Minimisation of waste during construction
18. Ability to re-use and recycle materials and components

PROTECTION OF AIR, EARTH AND WATER
In general: How has the design acknowledged opportunities to harvest, use, re-use or recycle on-site

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resources during the life of the building?
19 Minimisation of pollution of air, earth and water eg, acid sulphate soils, salinity
20 Maximisation of conservation, collection, recycling, etc of water
21 Application of environmental sewage systems
22 Strategies for minimisation and recycling of operational waste, eg paper, glass, compostibles

SOCIAL ISSUES
In general: Does the design represent excellence and has it enhanced the "user's" understanding and integration with the natural and social environments?
24 Response, support and/or recognition of local social context
25 Contribution to user's understanding of the environment
26 Appropriate level of resource consumption (cost efficiency)
27 Exemplary design

ENERGY AWARD CHECKLIST
Issue No 1 – 25 February 1998

ASSESSMENT CRITERIA FOR ENERGY AWARD
Provide information as detailed below

RESIDENTIAL CATEGORY
Provide accredited or recognised Home Energy Rating Scheme rating, eg VicHERS, NatHERS

NON-RESIDENTIAL CATEGORY
Provide comparison of 12 months documented operational energy use against appropriate energy targets

DESCRIBE HOW THE FOLLOWING ISSUES WERE CONSIDERED (BOTH CATEGORIES)

Assess boxes

- Appropriate climatic strategies
- Appropriate planning for solar orientation
- Appropriate zoning for thermal control
- Measures to exclude summer sun (where appropriate)
- Measures to include winter sun (where appropriate)
- Appropriate use of insulation
- Appropriate use of thermal mass
- Design for controllable natural ventilation
- Design for inclusion of natural daylighting plus sunlight glare control
- Design for minimal use of equipment and appliances
- Use of energy efficient equipment and appliances
PROVIDE THE FOLLOWING INFORMATION TO ASSIST JUDGING (BOTH CATEGORIES)
Issue No 1 – 25 February 1998

The Site

1. North point
2. Climatic data for area
3. Direction and strength of prevailing winds
4. Site dimensions
5. Land contours
6. Location of services
7. Existing vegetation on and around site
8. Existing buildings on and around site
9. Views to and from site
10. Pedestrian and vehicular access

The Design

11. Location of new building on the site and percentage of site coverage
12. Describe nature of structure and materials
13. Demonstrate 3D thermal zoning of building design
14. Explain strategies for reducing energy used for cooling in summer
15. Explain strategies for reducing energy used for heating in winter
16. Explain strategies for reducing energy used for lighting throughout the year
17. Explain strategies for natural ventilation
18. Nominate appliances used and their energy ratings including hot water, heating and cooling systems
19. Nominate sources of energy used
20. Indicate energy consumption and compare to recognised standard
21. Describe energy management system
22. Types, levels and locations of all insulation (in chart form)
NOTE:
This appendix is included on pages C4-C6 of the print copy of the thesis held in the University of Adelaide Library.