Gothic revival

Italianate

Boom

House drawings courtesy Robin Boyd from his book Australia's Home, Melbourne University 1961

Take ten average families and ask them to define a comfortable home, and you will receive ten different answers. People's opinions vary for many reasons, including where they were born or spent their formative years.

Our perceptions of climate differ. A person from South East Asia might find the winter in Perth to be quite uncomfortable and cold, yet someone from Scandinavia may say it really isn't winter at all.

Defining Comfort

The way we perceive comfort is a complex and subjective matter. However, it takes on a new importance when we talk about the amount of energy needed to maintain it.

A physical scientist might define human comfort as being the relationship between air temperature, mean radiant temperature (the averaged temperature of the walls and surfaces around us), air speed, humidity, activity level and clothing.

Another way of defining comfort is to measure the environmental conditions in which 70% of those surveyed say they are comfortable. This is often called the "comfort zone", and it is possible to draw charts that show the different comfort zones according to geographic

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*A modern and attractive energy efficient house. The **Northern Star** by Northpoint Homes, a division of Holl Corporation, was recently awarded a 5-star rating under the House Energy Rating Scheme. This project house incorporates all of the principles of energy efficient design such as orientation, window placement and shading and includes both ceiling and wall insulation.*

sign in Australia

location. Charts drawn for say Broome, will differ from Albany and Kalgoorlie. Generally, the comfort zone extends from about 18° to about 28°C, depending on humidity. Beyond these limits we tend to feel uncomfortable and respond by actions which make us warmer or cooler.

In a poorly designed house, this can involve the consumption of large amounts of purchased energy in the form of gas or electricity. In a well designed house, suited to the local climate, that energy cost is minimised.

The challenge that faces the home designer is to create designs which appeal to the market place, take account of our need to be comfortable and are cost effective. We are increasingly adding another dimension — the desire to be efficient with energy consumption at home.

This is by no means a new facet of home design, and throughout Australia's history there have been attempts at producing designs more suitable for our climates, often based on erroneous assumptions about climatic differences or similarities. Their success has been hit and miss in the absence of appropriate analytical tools. It is not adequate to say that Perth has a climate "like California" and leave it at that.

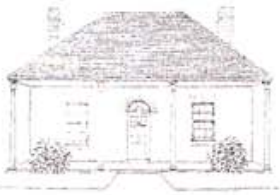
European Settlement to the 1970s

When the first English settlers in Australia started to build homes, they built in the Georgian style they were familiar with. That style came from a

Georgian (original settlers)

much colder climate with far less direct sunlight. In a maritime climate like Sydney (similar to Perth) the classic Georgian house was not unduly uncomfortable in summer, and with servants to keep fires burning in winter, it was comfortable in the context of early settlement.

As inland migration started and the moderating effects of the ocean diminished with distance, the response was to shade the walls with a device of Indian origin, the verandah. A "colonial" style had begun.



Georgian (verandah added)

Keeping the walls cool and the sun out, the verandah is still popular today, yet in terms of energy efficiency, it can have the shortcoming of preventing the sun's heat from entering a home in winter.

An early history of Australian domestic architecture can read like a series of experiments with the climate — which new design would give protection against the sun? Over the two centuries since settlement, we have also seen the influence of the state of the economy, the effect of world wars, the local availability of construction materials and fashion trends.

We have a strong legacy of different styles that evolved such as Federation, the Californian Bungalow, the 'L' shape design and more recently the popularity

Californian bungalow

of the Tuscan style. It has largely been a matter of chance that any one of the design or construction methods has been energy efficient.

At times serendipity has been at work.

L-shape open plan rather than with a corridor down the centre

The introduction of the concrete raft floor in the 1960s (which replaced wooden floor boards) is an example of a trend which has significant benefits in creating the basis of an energy efficient house. Built in the late 1940s, war service homes, particularly the brick and tile designs, can be comfortable, especially when roof insulation has been installed. However, they perform better still when correctly oriented to the sun, although this is

Post WWII austerity (war service homes etc)

largely dependent on street layouts and is generally unplanned.

A frequently heard complaint about older homes is that they are too dark and cold in winter, presumably the legacy of early design attempts to keep the sun out. During the 1970s, the use of glazing began to dominate design — in part because glass is cheaper than bricks. Whether or not the windows were shaded was not an important consideration.

Latterly, particularly with the advent of the so-called Tuscan style, the use of shading through overhanging eaves has often disappeared. In some instances, the external shutter has been retained as a design feature but it is usually non-functional. Such unshaded glazing can lead to overheating in summer. Unless windows are adequately curtained, significant heat is also lost in winter.

Impact of the Oil Crises

The oil crises of the early 1970s had another impact on home design. Dedicated groups of solar energy enthusiasts, armed with the basic tenets of solar design, set about to prove that we could minimise our dependence on fossil fuels in the home.

It was a very different approach to home design, driven not by fashion or the marketplace, but by the quest for deriving as much of the "comfort maintenance" energy from the sun as possible. There were two forms of designs, "passive" and "active". In the former, the house absorbs and loses

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heat passively purely as a result of its clever design, whereas the active solar home has mechanical devices in addition to optimise thermal transfer.
Looking at those designs today, some appear cumbersome and not aesthetically pleasing. "Solar" became yet another style and earned itself a reputation for ugliness and higher cost. The fact that many of these solar homes of the 1970s were elegant and looked no different from their energy consumptive neighbours has been forgotten.

New Directions

Twenty five years later, the way we approach home design is taking a new direction. This time not so much a stylistic one or an engineering solution to comfort, but a design analysis that will assist home designers achieve better thermal performance.
There are many constant values in the way houses respond to a particular climate. The physics of buildings materials and construction methods are well understood. We have established data for our various climatic regions (there are six major ones in Western Australia) and we can now match climate with the design of a house, its orientation to the sun's path and other factors.
Software packages are also available which manipulate all of this data to predict the thermal performance of a particular design in a given location, allowing design improvements to be incorporated before construction begins.
The House Energy Rating Scheme, launched in May 1996 (see ***Energy Matters*** issue 4), is one of the software packages which promote this design approach. Variables in home design can then be applied to a computer program and a rating derived. The effect of changing the type of construction material, and indeed any other parameter can be accommodated and rated accordingly.
Under the House Energy Rating Scheme, houses are rated from one to five stars – the more stars, the more energy efficient the home has the potential to be.
We have arrived at a point in the history of home construction where the guess work is taken out of design and we can build thermally adequate houses for any region we choose. The fact that elements of passive solar design will always be present is no accident, and there is no reason why the principles of passive solar design should conflict with good aesthetics or market appeal. It is a matter of replacing one source of comfort maintenance energy with another.
The benefits of doing so are clear. In addition to the pleasure of being bathed in winter sunshine, research has shown that it costs less to run a thermally well designed house, and for the life of the house the occupants are contributing to the reduction of greenhouse gases.
We now have the tools to determine how any design will respond to our many different climates, and from that, offer the homebuyer the opportunity to purchase a home in the style they want with the security of energy efficiency built in. That choice will undoubtedly extend in the future to include our ability to generate our own electricity and minimise the environmental impact of our homes by the selection of less energy intensive materials with the scope for recycling. Could we ask for more?

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