The Use of HyperCard as a Medium for Communicating Information to Design Professionals

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If the information generated through building simulations is to reach and influence building and design professionals it is necessary to present it in an accessible format. Most simulation programs are not sufficiently friendly for use by those who do not have specialised training. The processes involved in obtaining the information do not sufficiently reflect the usual methods of accessing information employed by designers. Many aspects of the Macintosh-based HyperCard make it well suited to the project-based contextual nature of the design process. An example of a stack being developed which provides information about window design, orientation and shading will be used to demonstrate and describe the potential of HyperCard.

Information transfer

The communication of information from researchers to designers about the energy implications of design has been a subject of some concern and research over the last decade. As Lewis et al (1988, p. 901) have pointed out,

> *Notwithstanding all the information and results generated in solar research during the past decade and a half, too often this knowledge is not finding adequate application in the . . . building industry.*

These comments were made in relation to the European situation however they apply equally to Australia. Not only are there problems with the methods of disseminating research (all too often only published in academic journals) but there has been a concomitant lack of evidence of any major changes in built form.

The communication of information to designers poses particular problems:

• The information needs to fit in with the design process; it must have an appropriate level of precision and allow rapid connections to be made.

• The information often needs to be translated from one format (eg words and figures) to another (drawings). The connections between the two must be obvious.

• Information usually needs to be presented at a number of different levels of generality.

• Any new information must reflect existing work practices, regulations, preconceptions.

> *[I]f design support is to have a significant impact, it must engage with the architectural design process. To do that it must be 'designed' for the purpose.* (Kealy 1990, p. 16).

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Design of buildings for optimum solar energy input

The example used in this paper is taken from work done during the Energy Research and Development Corporation funded project *Design of Buildings for Optimum Solar Energy Input* at the University of Adelaide. This project focussed on the design of window area, shading and orientation and its relation to solar energy input. The overall aim of the project was to interpret and present data on direct and diffuse solar radiation in ways which related directly to important aims in design of buildings, in order that such data could be directly applicable in design decision-making.

The project involved both generation of information and its presentation. It was considered important that the presentation of the information should;

• be appropriate for different target audiences and for different needs during the design process.

• consider energy-related design issues in the context of the many other issues to be taken into account during design.

• provide quantitative information which was easily understood and clearly related to building form.

The quantitative information

The quantitative information produced during the project resulted in of a series of shading energy charts (and the related computer program – SHADING) and tables of recommended solar gains for 12 locations in Australia.

The shading energy charts show the effects of different amounts of fixed external shading on the solar energy entering a space through the glass of a window. They were produced using measured solar radiation data from the Australian Climatic Data Bank which contains hourly global diffuse and direct solar radiation data recorded at a number of locations. For each chart many different combinations of window glass height and shading device height and extension were modelled using the computer program, SOLSHADH written by T J. Williamson (University of Adelaide). This program takes account of direct radiation, diffuse sky radiation and ground-reflected radiation.

The computer program, SHADING (written by T J. Williamson, University of Adelaide)complements the shading energy charts. This program enables the evaluation of shading devices other than the 'eaves-type' considered by the charts. SHADING uses the same computation technique as the program SOLSHADH but includes some modifications to improve the run time. These simplifications provide answers of sufficient accuracy to allow the comparison and choice of shading devices.

Tables of recommended gains for winter and recommended maximum gains for summer were produced for each of the 12 locations. The tables were produced using the computer program, TEMPAL*. The performance of various combinations of orientation, glass area and type, wall construction, floor construction and covering and ventilation rates was modelled using climatic data for each location.

Windows and energy

The design information was presented in two formats; written material and graphical methods presented in the book *Windows and Energy* (Williamson et al forthcoming), and computer methods.

The book *Windows and Energy*, is divided into three sections, beginning with general concepts concerning the functions of windows and their shading and orientation, and leading to specific and quantitative information.

Windows and Energy is organised in this way to allow for the great variety of aims that might matter in window design, the great range in resource availability for designing and for producing the windows and the great range of contexts for the windows. This variety and range in ends, means and contexts makes it difficult to generalise in design guides as any general advice may be bad advice in relation to some particular ends, means or contexts. So the book starts with the ends or (aims), helping the designer to decide on these in relation to what is normal for that type of building in its climatic and other context. Some guidance is also given for the less mainstream cases. From this starting point, the user is directed on one or more paths, depending partly on whether a quick approximate answer is required, or whether the design problem is one for which it is worth investing more effort.

The HyperCard version of *Windows and Energy*

A version of *Windows and Energy* using the Macintosh-based HyperCard is being developed. The Hypercard format is ideally suited to the design approach adopted in the book.

HyperCard is best compared to a filing card system; but one where the sequence of 'cards' followed does not have the usual spatial constraints of a two or three dimensional physical medium. The card is a 'window'

* TEMPAL: original authors AB & EB Coldicutt, University of Melbourne. Version 2, TJ Williamson, University of Adelaide. See Coldicutt (1977) for further information.

of information and a collection of cards is called a stack. Individual cards are linked to each other by 'buttons' which, when clicked, allow the user to move from one card to another. Any card can be linked to any (or many) other card/s. The method of moving through a stack is known as 'browsing'; a term that reflects the informal, multi-sequential nature of the process.

In a book, the process of following one or more of a number of paths can be tedious, as it can involve much turning pages between (say) Part 2, Part 3b, Part 3c, a chart, one or more appendices. . . Hypercard offers a more flexible alternative in which paths through hierarchies or networks can be followed as the user develops a fuller understanding of the design problem.

The HyperCard version of *Windows and Energy* will consist of both general information about windows, orientation and shading plus a 'user friendly' front end for SHADING.

Establishing design aims

Many inter-related factors have to be considered in the design of a window. Figures 1 & 2 show how the user will be assisted in thinking through the design aims for a particular window in its context.

A simple procedure will be given to help establish one or two main aims regarding energy and the window. This method is based on the designer drawing upon his or her knowledge of existing buildings of the type being designed and then considering the performance of these buildings during hot and cold weather (see figure 3).

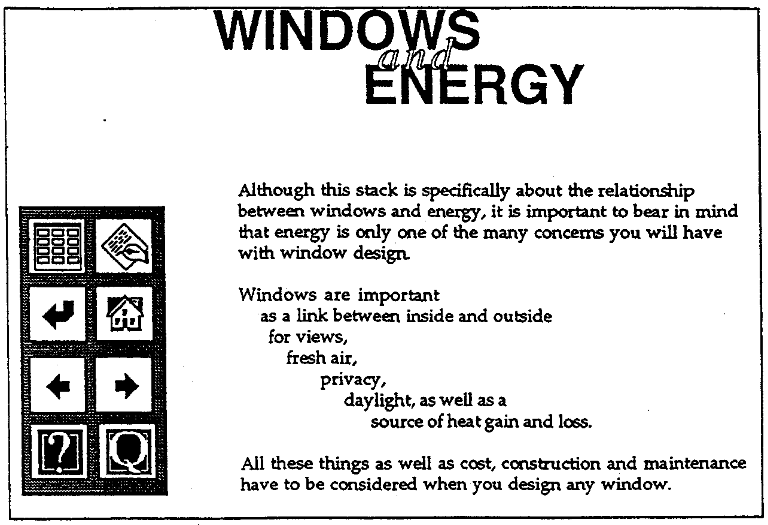

figure 1

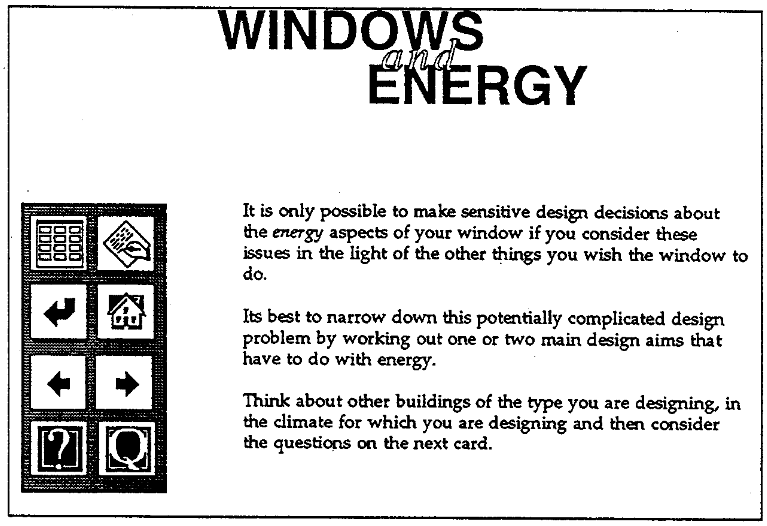

figure 2

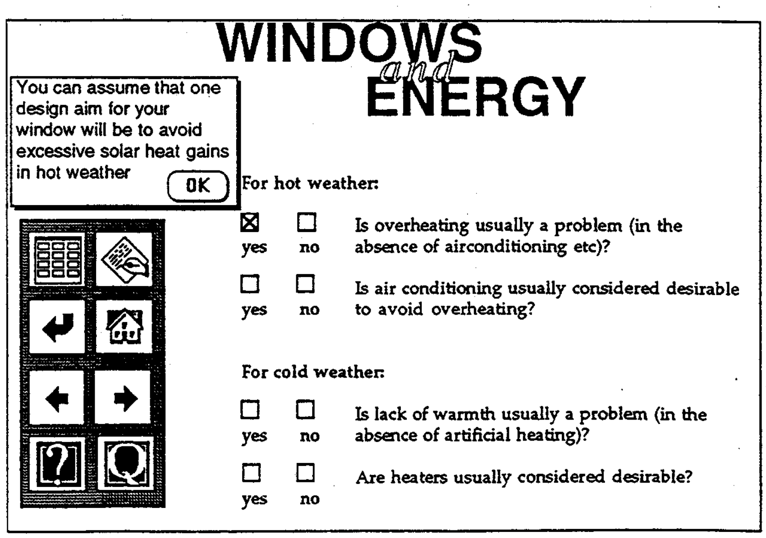

figure 3

General design information

General design information will be provided about a number of common aims and pairs of aims relating to windows and energy (see figure 4). The aims will include those to do with heat, light and ventilation.

This section will look at ways of addressing particular aims for windows in different orientations (see figure 5). It will include information about such things as appropriate types of shading devices, glass areas, building form and construction and how they relate to the specific aims.

In the example shown, where the aim is to keep solar gains in hot weather to a minimum whilst letting in lots of sun in cold weather, once all the orientations are considered it is clearly easier to achieve this aim with a window which faces north.

However, it is rare for a building to have windows facing only one direction, and so the information about other orientations is useful to allow designers to consider how the whole building can best meet their design aims.

This section will help the designer get a general understanding about which orientations and types of shading devices are most appropriate to achieve their design aim/s for a window.

Interface to SHADING

Many users would be familiar with this general information and would choose to go directly to the section where calculations

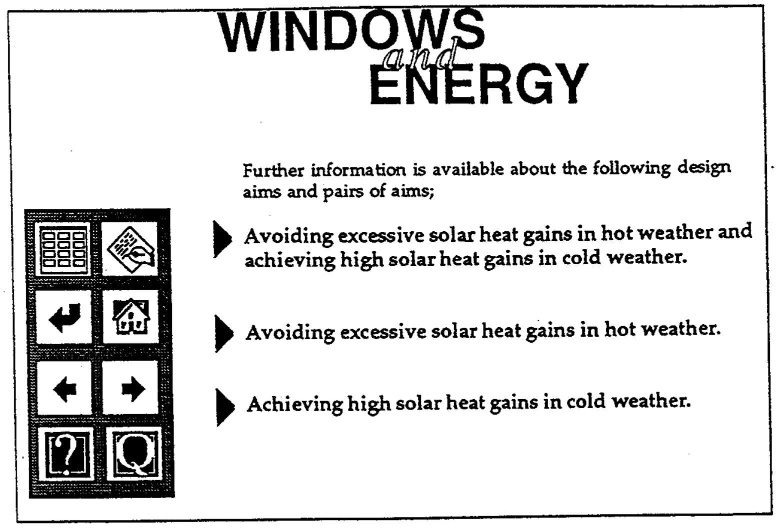

figure 4

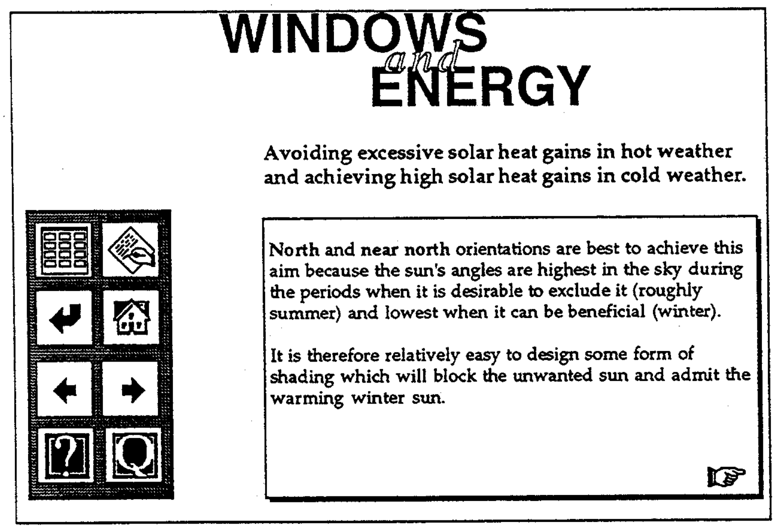

figure 5

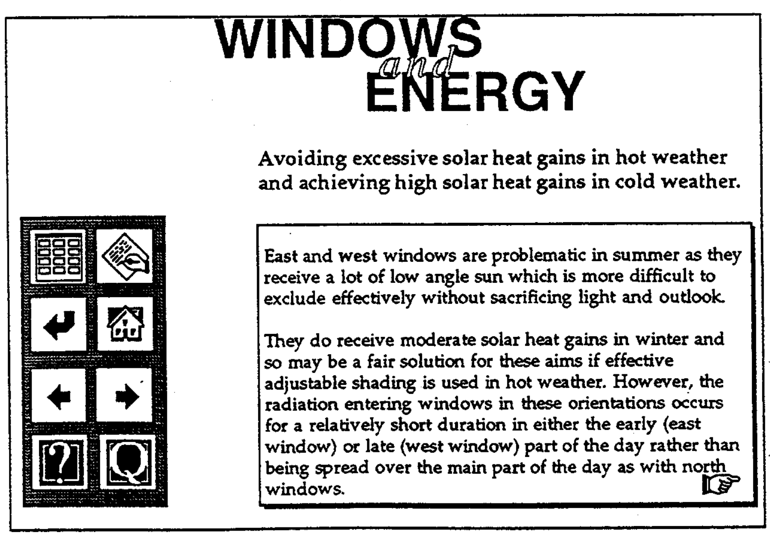

figure 6

using SHADING can be done.

This section will give an easy-to-use method of finding quantitative information about the heat gains through a particular window with any type of shading device. Horizontal and/or vertical shading devices can be considered along with site obstructions such as trees or other buildings.

Two cards of information will be required to provide the input for SHADING; one about location and construction options and the other about window and shading details. The information will be 'selected' by clicking on one of a list of options (see figure 7). The information required will be very familiar – the most technical being the R value for insulation – and changing any selection will be quite straightforward.

The output from SHADING is in the form of a total solar heat gain for a nominated period. To apply this in design, it is necessary to have some idea about the gains that should be achieved for the particular building. This information is given in the box at the bottom of figure 9. The recommended maximum gains are derived from the Tables of Recommended Solar Gains which were described in the section above on **The Quantitative Information.**

In the example shown the predicted gains are below the recommended maximum and so no changes are needed in the design, but if the gains are outside the recommended limits the user is directed to the Design Modifications part of the stack, to examine possible changes.

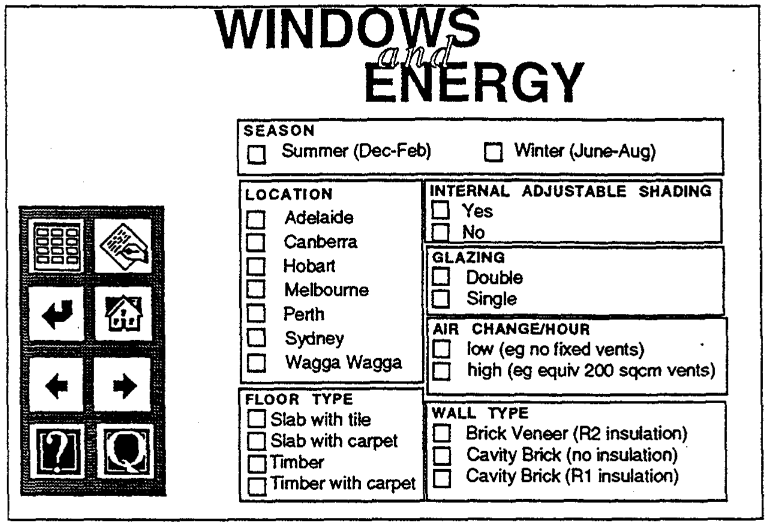

figure 7

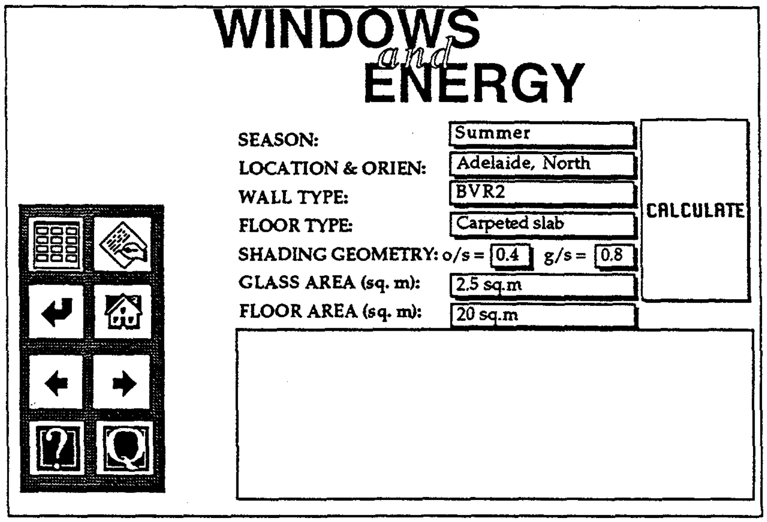

figure 8

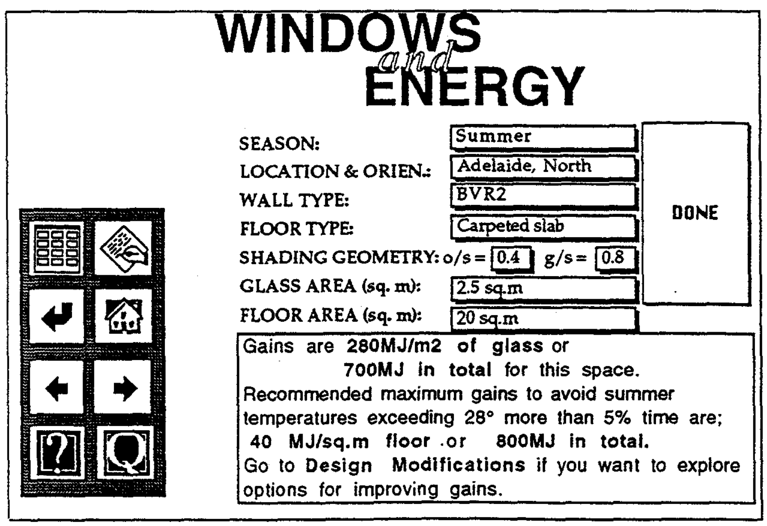

figure 9

Conclusion

As indicated in the example above HyperCard lends itself well to the design approach adopted during this project. It allows various strands of information to be interwoven and the inter-relationships between these strands can be made explicit. Information can be presented at various levels and the user can choose the depth to which he or she explores a topic. The level of depth or precision required by the user may vary according to the stage of the design process, the amount of time available for design or the perceived importance of energy-related design aims.

HyperCard is easy to master and does not require great programming skill on the part of the person constructing the stack. Thus it is a good tool for people who are primarily interested in presenting information rather than the mechanics of computing. Yet it also has the ability to 'call' other programs (in this case SHADING) thereby tapping into functions it is not directly capable of performing.

The nature of HyperCard imposes certain restrictions. One of the most important ones is that the amount of information easily presented on any one card is quite limited. Therefore many of the assumptions which are made explicit in the text and appendices of the book would remain 'hidden' in the HyperCard version of *Windows and energy.*

Despite this, the HyperCard version offers great possibilities in presenting the results of some very valuable research in a direct and interesting manner that could be easily accessed by designers with virtually no computing skills beyond basic office word processing. Repeated use could build up a picture of the way different elements interact thus making decisions involving windows and energy easier to resolve and making it easier to consider energy implications in the overall picture.

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